Anishinaabe Bimaadizwin Research Program

A joint initiative of Sioux Lookout Meno Ya Win Health Centre and Sioux Lookout First Nations Health Authority

Research Compilation

2016-2017
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Anishnaabe Bimaadiziwin Research Program continues to advance community-based research in Northwest Ontario. The program is a partnership of the Sioux Lookout Meno Ya Win Health Centre and the Sioux Lookout First Nations Health Authority. This is the fourth Research Compilation of regional research based in Sioux Lookout. Each encompasses several years of peer reviewed literature, reproduced with permission of the authors. We thank the clinicians, fellow researchers, administrators, organizations and study participants for contributing to the knowledge of medical and social realities in our region. Over the past decade, research has become an integral part of the fabric of our healthcare provision.

Community-based research receives its mandate from the issues affecting the population we serve. Research can facilitate health program planning, evaluation, and advocacy as well as documenting system deficits and clinical areas needing attention.

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Rural Medicine


The Occasional regional nerve blocks of the hand, Kelly L. CJRM 2016;21(3):80-83.

Addiction Medicine


Infectious Diseases


Cross cultural medicine


A 5 year retrospective study of emergency department use in Northwest Ontario: a measure of mental health and addictions needs

Cai-lei Matsumoto, MPH†; Terry O’Driscoll, MD‡; Jennifer Lawrence §; Andre Jakubow, MD‡; Sharen Maddsen, MD; Len Kelly, MD

ABSTRACT
Objective: The main objective of this study was to understand the five-year trend in total emergency department (ED) visits, frequency of use, and diagnoses and disposition of patients. Since the region has experienced a profound increase in opioid use disorder since 2009, we were particularly interested in changes in the volume of mental health and addiction (MHA) ED presentations.

Methods: Retrospective aggregate data analysis of ED visits to the Sioux Lookout Meno Ya Win Health Centre 2010-2014.

Results: ED visit volume increased 29% over the five-year study period, while MHA ED visits increased 73%. The admission rate remained stable at 6.9% of ED visits. Five-year trends in clinically grouped diagnostic categories identified respiratory, MHA, and abdominal/pelvic complaints as the three most common ED presentations. In 2014, MHA presentations accounted for 10.3% of ED visits, 8.7% of admissions, and 20.0% of inter-hospital transfers.

Conclusion: The dramatic increase in MHA ED visits mirrors the opioid epidemic the region is experiencing. MHA may soon become the commonest ED presentation. If reasons for ED visits serve as a proxy for unmet outpatient needs, increased efforts at developing community MHA services and addressing the related social determinants of health are required.

INTRODUCTION
Studies characterizing emergency department (ED) use have been largely confined to large urban centers. Rural ED use analysis is underrepresented in the literature, yet offers an interesting look at the fabric of medical services and the service needs in rural communities.

Keywords: emergency, utilization, mental health, addiction

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In this study we examine the ED in a unique rural hospital setting in northwest Ontario which services a 385,000 km² region, where patients are often triaged from remote First Nations community nursing stations before transfer to the hospital ED by air ambulance. The Sioux Lookout Meno Ya Win Health Centre (SLMHC) is a 60 bed hospital serving 29,000 primarily First Nations patients across 31 remote communities.1,2 In 2009, regional First Nations leaders identified an “epidemic” of opioid abuse in their communities.2,3 In 2016, a state of emergency was declared concerning health status of the population, identifying health inequities and wide gaps in services.2,3 Social determinants of health, such as housing and access to clean water, are common deficiencies in the First Nations communities of NW Ontario.4 Commentators describe underlying determinants of “colonialization, racist, social exclusion and lack of self-determination” as negatively affecting disparities in the health of Aboriginal peoples.5,6 In the context of these disparities, mental health and addiction (MHA) issues are significant concerns for the First Nations population in the SLMHC catchment area. First Nation youth experience significantly higher rates of mental health problems and have suicide rates six times the general population.6,7 The main objective of this study was to understand the five-year trend in total ED visits, and diagnoses and disposition of patients. Since the region has experienced a profound increase in opioid use disorder since 2009, we were particularly interested in the volume of MHA patients.8,9

METHODS

Sioux Lookout Meno Ya Win Health Centre obtained anonymized data for a five-year period (2010-2014) from the Northwest Health Alliance, a health care data collection organization which accessed hospital utilization information from National Ambulatory Care Registration System (NACRS). Ethics approval was granted by Sioux Lookout Meno Ya Win Health Centre Research and Ethics Committee. Data analysis was completed using SPSS (Version 21, IBM, Armonk, NY). Descriptive statistics were completed for sex, age, ED volume, disposition, and primary diagnosis. Diagnosis was completed using ICD-10 codes and grouped into relevant clinical categories. Mental health ICD-10 coded visits were combined with codes for substance abuse, addictions and self-harm ED visits.

RESULTS

From 2010-2014 there were 80,212 ED visits to SLMHC resulting in an annual average of 53 (95% CI 50.2, 56.0) per 100 population. Fifty-four percent of visits were from Sioux Lookout while 41% were from Northern Communities and 5% were from areas outside of the catchment area. People aged 20-40 years made up the majority of visits with those aged 76 and older visiting the least. Women visited the ED more frequently than men: 55% versus 45% of visits.

The annual number of ED visits increased 29% from 2010-2014, for a total of 17,911 visits in 2014 (Figure 1). The annual visit rate per capita in 2014 was 62 per 100 population and averaged 55 per 100 over 5 years. Admission rates were stable at 6.9% (95% CI 6.3, 7.5) (Figure 1) and less than 1% of ED patients were transferred on to tertiary care centers.

The three commonest diagnostic ED visit categories were respiratory, MHA, and abdominal/pelvic complaints. Our most dramatic finding was the increasing trend in ED visits for MHA, which increased 73% in the 5-year study period (Figure 2).

The ED workload of MHAs incurred significant inpatient service needs, constituting 8.2% of admissions (458/5,552) and 14.7% of transfers (111/755) from 2010-2014.

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DISCUSSION

Ontario-wide ED visits per capita increased 27% between 1998-2008, when it was measured at 42 per 100 population.8,10 This provincial utilization rate is slightly lower than the Canadian average ED utilization of 49 per 100 population.11 The SLMHC ED visit volume increased a similar rate (29%) in just a 5-year period, without related population increases.

Rural utilization rates are typically higher than urban, given that rural EDs provide both emergency and urgent primary care service.12,13 Our 2014 visit rate of 62 per 100 population (five-year average of 53), was lower than expected for such a large and remote region, and was lower than other rural estimates found in the literature12,13 (see Table 2). This likely reflects the geographic barrier of distance and access, as 80% of the catchment 20-40 age group and demonstrated a slight preponderance of females (51.5%). This same age group also experienced the highest increase (96%) in MHA ED visits during the study period.


ductibility for an ED visit, but MHAs are not in the national top ten common reasons for an ED visit.14 Our hospital encountered a twelve-fold higher rate of MHA ED visits in 2012 when compared to Ontario-wide numbers and the gap is widening (Table 3). The leading reason for transfer from our facility was for orthopedic care (21.0% of transfers). This was similar

Table 1. ED visits, admissions and transfers for SLMHC for 2014

<table>
<thead>
<tr>
<th>Diagnostic category</th>
<th>ED Visits (%)</th>
<th>Admissions (%)</th>
<th>Transfers (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory</td>
<td>2117 (11.8)</td>
<td>182 (15.3)</td>
<td>3 (2.6)</td>
</tr>
<tr>
<td>Abdominal/pelvic complaints</td>
<td>1594 (8.9)</td>
<td>241 (20.3)</td>
<td>4 (3.5)</td>
</tr>
<tr>
<td>MHA</td>
<td>1852 (10.3)</td>
<td>103 (8.7)</td>
<td>23 (20.3)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>17,911</td>
<td>1175</td>
<td>155</td>
</tr>
</tbody>
</table>

Table 2. Mental health and addiction (MHA) ED visits per 100,000 population

<table>
<thead>
<tr>
<th>Location, year</th>
<th>ED visits per 100 population</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Bay, ON, 1997</td>
<td>53</td>
</tr>
<tr>
<td>Huron Country ON, 1998</td>
<td>43</td>
</tr>
<tr>
<td>Sault Ste. Marie, ON, 2004</td>
<td>84</td>
</tr>
<tr>
<td>Sioux Lookout Meno Ya Win Health Centre, ON, 2010-2014</td>
<td>55</td>
</tr>
</tbody>
</table>

Table 3. Estimated ED visits per capita in rural and general populations
to a southern Ontario rural emergency department study, where 23% of transfers were orthopedic. However, our second leading reason for patient transfer (20.0%) in 2014 was MHA, while it accounted for only 4.5% of transfers in the southern Ontario study. Our ED visits for MHA diagnoses increased 73% in the 5-year study period (Figure 2). This increase was consistent with the growing epidemic of opioid abuse described by regional First Nations leaders in 2009. Opioid use disorder is addictive to a preexisting burden of mental health challenges in the First Nations population. In 2013, the regional mortality program documented 28% of pregnancies experiencing some narcotic exposure during gestation. One regional First Nation community documented an adult age-adjusted rate of treatment for opioid use disorder of 41%. Many communities have begun to address addictions.

New community-based addiction treatment programs have been initiated in 22 of the 31 remote communities in the region and hospital-based services have developed to address the burden of widespread opioid use in the region and hospital-based services have developed to address the burden of widespread opioid use disorder. The community-based programs play an important role in dealing with the burden of widespread opioid use in the region and hospital-based services have developed to address the burden of widespread opioid use disorder. The community-based programs play an important role in dealing with the burden of widespread opioid use disorder. The community-based programs play an important role in dealing with the burden of widespread opioid use disorder. The community-based programs play an important role in dealing with the burden of widespread opioid use disorder.

Community nurse provides a substantial amount of primary and urgent care in the remote communities of our ED catchment area and this information is not captured in our study. The remote nursing stations and community MHA workers also locally manage a heavy workload related to MHAS, limiting transfers to the ED.

Conclusion

The Sioux Lookout ED provides rural hospital services in a unique hospital and community environment. The dramatic increase in MHA ED visits mirrors the opioid use disorder epidemic the region is presently experiencing. MHA may soon become the most common medical presentation. If reasons for ED visits serve as a proxy for unmet outpatient needs, increased efforts at developing community MHA services and addressing the underlying social determinants of health are required.

Competing Interests: None declared.

References

Defining “high-frequency” emergency department use

Does one size fit all for urban and rural areas?

Cai lei Matsumoto MPH Teresa O’Driscoll MD FCFP Sharen Madden MD MSc FCFP

Main outcome measures

Participants

Literature review

Methods

Setting

Participants

The total catchment population is 30,000, for a visit per capita rate of 59.7 per 100 population. The region served encompasses 300,000 km², and half of those in the 30,000 catchment population require air transportation to access the ED for emergencies and further triaged care. Applying the common high-frequency definition of 4 or more annual visits to 2014 ED visitors, 1188 (16.7%) ED patients were identified as high-frequency users (Figure 1). Using a standard of 6 or more ED visits a year identified a smaller number of patients (n=566 (7.9%) as the high-frequency subset and “normalized” ED use for the remaining 92.1% of patients (Table 2). We analyzed further subsets of visit pattern categories of very high-frequency use (12 to 19 visits annually) and super users (≥20 visits annually). This identified sequentially smaller numbers of patients responsible for disproportionate ED workloads (Table 2).

We used anonymized annual ED visit information from 2014 for the Sioux Lookout Meno Ya Win Health Centre, a rural 60-bed facility in northwestern Ontario. Data were accessed from regional and national data sets (from the National Ambulatory Care Reporting System) through Northwest Health Alliance, regional health analysts. The data were analyzed to identify high-frequency use using SPSS, version 21. Descriptive statistics, frequencies, and means were obtained to define and characterize high-frequency, very high-frequency, and super users. Ethics approval was granted by the Meno Ya Win Health Centre Research Review and Ethics Committee.

In 2014, 7121 patients made a total of 17,911 visits to the ED at the Sioux Lookout Meno Ya Win Health Centre. The total catchment population is 30,000, for a visit per capita rate of 59.7 per 100 population. The region served encompasses 300,000 km², and half of those in the 30,000 catchment population require air transportation to access the ED for emergencies and further triaged care. 11 Applying the common high-frequency definition of 4 or more annual visits to 2014 ED visitors, 1188 (16.7%) ED patients were identified as high-frequency users (Figure 1). Using a standard of 6 or more ED visits a year identified a smaller number of patients (n=566 (7.9%) as the high-frequency subset and “normalized” ED use for the remaining 92.1% of patients (Table 2). We analyzed further subsets of visit pattern categories of very high-frequency use (12 to 19 visits annually) and super users (≥20 visits annually). This identified sequentially smaller numbers of patients responsible for disproportionate ED workloads (Table 2).
rather than reuse this definition, we propose a rural definition to that described by applying the standard of 4 or more in larger urban settings.

Using this high-frequency definition in our study, we document that 7.9% of patients (with ≥ 6 annual ED visits) are high-frequency users and account for 31.3% of visit workload and 24.1% of admisions. Applying Insurance Plan data, they are all identified with the same patient identifier number and the number of visits by a specific patient is not available.

Table 1. Number of visits and admissions for average and high-frequency ED users in 2014

<table>
<thead>
<tr>
<th>NO. OF ANNUAL VISITS</th>
<th>PATIENTS, N (%)</th>
<th>VISITS, N (%)</th>
<th>ADMISSIONS, N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5</td>
<td>6554 (92.1)</td>
<td>11702 (65.3)</td>
<td>855 (72.8)</td>
</tr>
<tr>
<td>≥ 6</td>
<td>566 (7.9)</td>
<td>5607 (31.3)</td>
<td>284 (24.1)</td>
</tr>
</tbody>
</table>

Average user (0-5) 6554 (92.1) 11702 (65.3) 855 (72.8)

High-frequency user (≥ 6-11) 446 (6.3) 3381 (18.9) 205 (17.4)

Very high-frequency (≥ 12-19) 85 (1.2) 1235 (6.9) 48 (4.1)

Super user (≥ 20) 35 (0.5) 991 (5.5) 31 (2.6)

Other 1 (0.01*) 602 (3.4) 36 (3.1)

Table 2. Subanalysis of ED user frequency by number of visits with admission data

<table>
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<tr>
<th>NO. OF ANNUAL VISITS</th>
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Ed—emergency department.

Non-insured visits were removed from our analysis. In Ontario Health Insurance Plan data, they are all identified with the same patient identifier number and the number of visits by a specific patient is not available.

If the objective of identifying high-frequency ED users is to design programs and interventions that better meet the needs of these patients, we need a more manageable sized cohort.

Such interventions typically include a form of interdisciplinary case management for identified high-frequency patients and can decrease ED visits by up to 30%.13-15

Our initial high frequency category (≥ 6) identified 566 patients. This is a rather large number of patients for a small rural hospital to attempt a case management style of intervention.

By further breaking down our visit volume to smaller categories of high-frequency users (≥ 6 to 11 visits), very high-frequency users (12 to 19 visits), and super users (≥ 20 visits), we identify increasingly smaller numbers of patients, with increasingly higher associated per patient visit workloads. This allows for a graded series of interventions, perhaps with greater attention to the super users who are responsible for almost 5.8% of annual ED visits (Table 2). Less intensive interventions can be designed for the 85 patients who are very high-frequency users (12 to 19 visits) and account for almost 7% of the ED visits (Table 2).

Table 3. Subanalysis of ED user frequency by number of visits with admission data

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Non-insured visits were removed from our analysis. In Ontario Health Insurance Plan data, they are all identified with the same patient identifier number and the number of visits by a specific patient is not available.

We suggest the definition of high-frequency rural ED use be ≥ 6 or more annual visits. It makes sense to differentiate the definition from that used in large urban ED centres, both because of the different service context and the size of the subset of ED patients subsequently identified. Further identifying intense users of ED services can be achieved with subset categories of very high-frequency users (12 to 19) and super users (≥ 20).

These smaller categories of users allow a graded set of interventions to be considered in a manageable number of patients.
**ORIGINAL ARTICLE**

**ARTICLE ORIGINAL**

**Rates of diabetes-related lower-limb amputation in northwestern Ontario: an incidence study and introduction of a standardized diabetic foot ulcer management protocol**

**Introduction:** First Nations populations in Canada have higher incidence rates of type 2 diabetes mellitus than the general population and also incur more frequent complications, including lower-limb amputation. Patients with diabetes who present with a foot ulcer are at high risk for macrovascular events, with a 5-year mortality rate of up to 60%.

**Methods:** Using census and health administrative data, we reviewed the incidence of diabetes and rates of diabetes-related lower-limb amputation in 2010–2015 in the catchment area of the Sioux Lookout Meno Ya Win Health Centre in northwestern Ontario, which serves a largely First Nations population. We also describe a novel protocol for the management of diabetic foot ulcers.

**Results:** The rate of lower-limb amputation was 7 times the Ontario average and was 5 times higher than in other areas of the province. The Sioux Lookout Diabetic Foot Ulcer Protocol supports timely vascular assessment for concurrent peripheral vascular disease in patients with diabetic foot ulcers.

**Conclusion:** Patients with diabetes in the Sioux Lookout Meno Ya Win Health Centre catchment area appear to undergo below-knee amputation at a rate 5 times greater than in other Ontario regions. Patients with diabetic foot ulcers should be identified as being at high risk for other atherosclerotic events (e.g., myocardial infarctions, cerebrovascular accident) and require aggressive risk-management strategies.

**Introduction:** Au Canada, les peuples des Premières Nations présentent des taux d’incidence de diabète de type 2 plus élevés que la population générale et en suscitant également davantage les comorbidités, notamment les amputations des membres inférieurs. Les patients diabétiques qui souffrent d’ulcères pédieux sont exposés à un risque élevé de complications macrovasculaires, et à un taux de mortalité à 5 ans pouvant atteindre 50%.

**Méthodes:** À partir des données du recensement et des données administratives sur la santé, nous avons étudié l’incidence du diabète et les taux d’amputation des membres inférieurs liée au diabète de 2010 à 2015 dans la zone desservie par le Centre de santé Meno Ya Win de Sioux Lookout, dans le nord-ouest de l’Ontario, qui répond aux besoins d’une population en majorité autochtone. Nous décrivons aussi un nouveau protocole de prise en charge d’ulcères pédieux diabétiques.

**Résultats:** Le taux d’amputation des membres inférieurs a été 7 fois plus élevé que la moyenne ontarienne et 5 fois plus élevé que dans d’autres régions de la province. Le protocole de Sioux Lookout pour l’ulcère pédieux diabétique permet une évaluation rapide de possibles maladies vasculaires périphériques concomitantes chez les patients présentant des ulcères pédieux diabétiques.

**INTRODUCTION**

A diabetic foot ulcer may at first glance appear to be a limited foot issue, but it may herald a more serious vascular problem and identify patients with diabetes at higher risk for mortality.

**Methods:** Aggregate data for diabetes and lower limb amputations in patients with type 2 diabetes were retrospectively accessed for a 4-year period (2010–2013) for the catchment area of the SLMHC. Data were collected from the Decision Support Office at the Northwest Health Alliance, a shared health care data service organization. We used data from the

**Conclusion:** Les patients diabétiques de la région desservie par le Centre de santé Meno Ya Win de Sioux Lookout semblent nécessiter une amputation sous le genou 5 fois plus souvent que les patients d’autres régions de l’Ontario. Les patients qui présentent des ulcères pédieux diabétiques devraient être reconnus comme exposés à un risque élevé à l’égard d’autres complications athéroscléreuses (p.-ex., infarctus du myocarde, accident vasculaire cérébral) et ont besoin de stratégies dynamiques de gestion des risques.
Statistics Canada population census, the Ontario Health Insurance Program database and provincial hospital surgical codes to identify catchment population, numbers of adult patients with type 2 diabetes and incidence of below-knee amputation. Provincial statistics record all lower-limb amputations (both minor and major). Trauma- and cancer-related amputations were excluded.

We estimated the adult diabetic population from a 10-year analysis of province-wide physician billing for diabetes or related complications for the population of Sioux Lookout and the 31 northern First Nations communities served by the SLMHC. Rates of diabetes and amputation were also calculated for 5 relevant provincial Local Health Integration Networks: Central Toronto, North West and North East.

We focused on patients with type 2 diabetes who had undergone below-knee amputation as they are the most common major amputation patient. It seemed more clinically relevant to focus on this major amputation than assessing the provincially tabulated rates of all lower-limb amputations, which include patients who might have required toe surgery, eventually leading to a major amputation.

We were able to access data for this single procedure in our catchment area and various Local Health Integration Networks in the province.

RESULTS

The population of the identified catchment area for the SLMHC from the 2015 census data was 22,276, 85% of which was First Nations. The adult (age ≥ 18 yr) population with a diagnosis of diabetes was estimated to be 1885, 11% of the adult population.

The average rate of lower-limb amputation in the adult diabetic population in Ontario over the study period (2010–2015) was 146.5 per 100,000, compared to 1078.5 per 100,000 for the Sioux Lookout diabetic population.

The rate of diabetes-related below-knee amputation was 5.68 per 1000 adult patients, 3 times greater than the rates for other Local Health Integration Networks (Table 2).

The average age at below-knee amputation in the Sioux Lookout diabetic population was 50.2 (standard deviation [SD] 8.7) years, compared to 64.0 (SD 2.3) years in the Central Toronto, North West and North East Local Health Integration Networks. The sex distribution was predominantly male (75.0%), as in other provincial regions.

DISCUSSION

The rate of lower-limb amputation in the adult diabetic population in the SLMHC catchment area in 2010–15 was 7 times the provincial rate and was 5 times that in other areas of the province.

This high rate does not appear to be an anomaly. A 2012 Institute for Clinical Evaluative Sciences study also showed that northwestern Ontario had the highest regional rate of diabetes-related total lower-limb amputations (major and minor) in the province between 2006 and 2010.

Lower-limb amputation occurred at an earlier average age in our studied population than in the general Canadian population (50.2 [SD 8.7] yr vs. 67 [SD 15] yr). Multiple factors may be at play: potentially more aggressive disease (peripheral vascular disease, type 2 diabetes), late presentation of diabetic foot ulcer, limited access to foot care services including inadequate monitoring, and variable investigation and treatment plans owing to limited resources and/or lack of clear clinical guidelines. Host susceptibility (e.g., cardiovascular risk factors, including smoking, and nutritional status) and broader social determinants of health are all relevant, potentially contributing factors.

Interestingly, geography may be protective. In a 2007 study of Manitoba First Nations, Martens and colleagues identified a rate of type 2 diabetes 4 times that among the general population. They described population-based amputation rates 18 times those of the rest of the province. They also found that the more remote First Nations communities fared better, with lower amputation rates and more medical referrals. Those authors postulated that the system of integrated community-based and visiting health care providers (i.e., J.A. Hildes Northern Medical Unit) lowered barriers to accessing care and improved care for patients with diabetes.

Most of the Canadian literature on diabetic foot ulcers in Canadian Aboriginal populations comes from Manitoba. Two retrospective reviews showed that Aboriginal Manitobans experienced higher rates of type 2 diabetes and a higher mean number of foot ulcers per patient and of diabetes-associated lower-extremity amputations than their non-Aboriginal counterparts. A cross-sectional study of patients with diabetes from 1 First Nations community showed a disproportionately high rate of emergency department visits for complications of foot ulcers and relatively low availability of preventive foot and wound care services.

Reid and colleagues 2006 study of 169 northern Manitoba Aboriginal patients showed an incidence of diabetic foot ulcers of 5% and the startling fact that 64% of the patients they studied were unable to perform their own foot surveillance. The patients received an average of 0.7 foot examinations annually over a 7-year period. In 2008, Rose and colleagues concluded that the absence of home care services on reserve, inadequate footwear and limited access to foot care services contributed to foot ulcer development.

Similar trends are seen internationally. A 10-year retrospective study of diabetes-associated major amputations at a hospital in northern Queensland, Australia, showed disproportionately high amputation rates among Indigenous
Sioux Lookout Diabetic Foot Ulcer Protocol

In response to such high amputation rates, we examined guidelines for management of diabetic foot ulcers, the common precursor to a diabetes-related lower-limb amputation. The International Working Group on the Diabetic Foot (http://iowg.org/guidelines/guidance-on-pad-2015/) guidelines were the most evidence-based and recommend early vascular assessment in patients with foot ulcers, especially patients whose ulcers fail to heal over 6 weeks. Unfortunately, most of the working group’s strong recommendations were supported by weak evidence.

We searched MEDLINE and Embase (January 2005–May 2016) for the MeSH search term “diabetic foot” combined with “arterial occlusive diseases” or “peripheral vascular disease.” We found 63 citations but none that described evidence that aggressive management of foot ulcers prevented amputation or conclusive evidence that any specific diabetic foot ulcer protocol improved outcomes. On discussion with clinicians, we were struck by the variety of approaches taken with patients with foot ulcers. Even in focused tertiary care centre “diabetic foot clinics,” clinicians had different thresholds for ordering imaging investigations for concomitant peripheral arterial disease. We felt that describing a reasonable approach that organized investigations for concomitant peripheral vascular disease and coronary artery disease would at least standardize management of diabetic foot ulcers.

The purpose of the Sioux Lookout Diabetic Foot Ulcer Protocol (Fig. 2) is 2-fold. The first is to identify a time frame for conservative wound management (6 wk), after which vascular assessment is suggested. The second is to identify the patient with a foot ulcer as being at high risk for other, extensive arterial disease. Patients who have comorbid peripheral, coronary, or cerebral arterial disease would likely benefit from a risk-management approach. The protocol includes clinical history-taking, physical examination and risk-management components as well as vascular imaging, treatment of peripheral vascular disease and referral suggestions.

A history of claudication or pain at rest may indicate vascular compromise, whereas an easily palpable pedal pulse likely excludes serious arterial disease. Many authors, however, recommend that all patients with diabetic foot ulcers receive an ankle–brachial index test at presentation. This easy bedside Doppler examination uses the ratio of arm and leg pressures measured with a blood pressure cuff (Fig. 3). A small cuff may also be attached to a toe to perform a toe–brachial index test, which can correct for a false-negative result of an ankle–brachial index test (e.g., an ankle–brachial index > 1.4 suggests incompressible ankle arteries). Any ankle–brachial index outside the normal range (0.9–1.4) necessitates further assessment (toe–brachial index test and/or computed tomography angiography). A low ankle–brachial index value identifies vascular compromise, and a value above the normal range denotes a calcified and incompressible vessel; both necessitate further vascular assessment.

Patients with abnormal clinical findings or ankle–brachial index, or delayed foot ulcer healing require anatomic imaging. Computed tomography angiography may be the most readily available in some rural Canadian locations. Other angiographic imaging includes digital subtraction angiography or magnetic resonance angiography, both of which require contrast medium and may be nephrotoxic. The sooner poor vascularization is identified, the better, as nutrient-deprived ulcers heal poorly (Fig. 4).

Macrovascular risk management is also suggested for all patients with diabetic foot ulcers. In a recent Ontario study, 791 patients with peripheral arterial disease were enrolled, and 26% of patients had a diabetic foot ulcer. Among patients who received foot ulcer care, 22% had an amputation within 1 year. The traditional approach to diabetes care included regular foot examinations and patient education, with consultation for vascular surgery reserved for patients with severe PAD.

The protocol includes a clear recommendation to order imaging studies earlier for patients with lower ankle–brachial indices. The most commonly used imaging investigations for concomitant peripheral arterial disease are ultrasonography and computed tomography angiography. Other investigations include magnetic resonance angiography, intra-arterial digital subtraction angiography, and duplex ultrasound. Documentation of imaging is crucial, as vascular surgery is the preferred treatment for diabetic foot ulcers with concomitant peripheral arterial disease. Appropriate imaging investigations are more likely to influence clinician decisions regarding revascularization and amputation management.

Weinstein monofilament or 128-Hz tuning fork

Non-compressible ABI

Non-healing ulcer

Diabetic foot ulcer

Completed wound care x6/52

Healed ulcer

Ongoing care

CT angiography

Revascularization

Amputation

Non-healing ulcer

Likely exclusion of PAD

Mild-to-moderate PAD

Severe PAD

ABI < 0.5

ABI 0.5–0.9

ABI > 1.4

TBI ≥ 0.7

TBI < 0.35

Topical infection p.r.n.

• Treatment with pressure

• Debridement tissue and calloused

• Offload pressure (casts, shoes, etc.)

Conservative wound care x6/52

1. Toe-brachial index (TBI), if ABI > 1.4 (incompressible, unreliable ABI result). If ABI results remain unclear, proceed to CTA. Many authors suggest ABIs for all diabetic foot ulcer patients; additional testing may include transcutaneous oxygen pressure (TcP02).


3. Angioplasty or bypass surgery.

ABI = ankle brachial index, ACE = angiotensin-converting enzyme, BP = blood pressure, CTA = computed tomographic angiography, CVD = cardiovascular disease, MRI = magnetic resonance imaging, PAD = peripheral arterial disease.

1. Two-brachial index (TBI), ABI > 1.4 (incompressible, unreliable ABI result). If ABI results remain unclear, proceed to CTA. Many authors suggest ABIs for all diabetic foot ulcer patients; additional testing may include transcutaneous oxygen pressure (TcP02).


3. Ulceration of a major amputation.
vascular disease (25% of whom were diabetic) were followed for 38 years. The authors focused on 8 management categories: use of statins, angiotensin-converting-enzyme inhibitors and antiplatelet medications, and attention to smoking, weight, blood pressure, and lipid and glycemic control. They showed a 40% relative reduction in death, myocardial infarction and cerebrovascular accidents (adjusted hazard ratio 0.63, 95% confidence interval 0.53–0.74) and a 53% relative reduction for major amputations (adjusted hazard ratio 0.47, 95% confidence interval 0.13–0.54) and a 53% relative reduction for major myocardial infarction and cerebrovascular accidents.

They showed a 40% relative reduction in death, myocardial infarction and cerebrovascular accidents (adjusted hazard ratio 0.63, 95% confidence interval 0.53–0.74) and a 53% relative reduction for major amputations (adjusted hazard ratio 0.47, 95% confidence interval 0.13–0.54). Since there is such an abundance of literature on this topic, we will focus on one area that appears to be understudied and has the potential to significantly impact the care of patients with diabetes.

Census data are not always accurate, particularly when enumerating numerous remote communities. Although other estimates of the population exist, we used census data in this study as it allowed us to make reliable comparisons to other regions of Ontario. We believe the population estimate may be underestimated, owing to occasional community nonparticipation in census activity and remoteness. This would overestimate amputation rates to some degree but would not alter the underlying message that the rate of major amputation is very high in adult patients with diabetes in our catchment area.

CONCLUSION
Patients with diabetes in the SLMHC catchment area appear to undergo major below-knee amputation at a rate 3 times greater than in other Ontario regions. Patients with diabetic foot ulcers are at high risk for arterial disease in the affected limb as well as for cardiac and cerebral events and deaths.

Poorly healing diabetic foot ulcers may be the first indication that a patient needs vascular assessment and aggressive management of cardiovascular disease risk.

We have developed a protocol that we hope will increase early detection of vascular compromise and assist in healing of diabetic foot ulcers and limit amputation. A prospective study to evaluate the application and outcomes of the protocol is planned.

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**CONCLUSION**

Patients with diabetes in the SLMHC catchment area are more likely to undergo major below-knee amputation at a rate 3 times greater than in other Ontario regions. Patients with diabetic foot ulcers are at high risk for arterial disease in the affected limb as well as for cardiac and cerebral events and deaths.

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**REFERENCES**

Honey of a Wound: The Use of Medical Honey to Heal Diabetic Foot Ulcers in a Low-resource Environment

By Katherine Kivi, BScN RN, CDE, CFCN; Cynthia Dwyer, BN RN, CFCN and Bradley Lance, RN

The following is a case report of two First Nations clients from remote, fly-in communities in northwest Ontario that illustrates the efficiency of medical honey and simple dressing methods in healing diabetic foot ulcers. Remote communities face significant health challenges, including limited access to specialty wound care and dressing supplies. In this case, the dressing choice, which can be administered at home or at a remote nursing station, resulted in complete closure of two serious foot ulcers.

Diabetes care can be accessed at Sioux Lookout Meno Ya Win Health Centre (SLMHC) in Sioux Lookout, Ontario. The hospital provides primary and preventative health care for a region that extends from Hudson Bay to Lake Superior. This vast area encompasses approximately 360,000 square kilometres of land and has the lowest population density in Ontario. More than two-thirds of the residents (77.8%) identify as First Nations people.1 Most of the communities are accessible only by airplane or winter road. Type 2 diabetes has reached epidemic levels in First Nation populations, in which adults are three times more likely to have type 2 diabetes than non-indigenous Canadians.1,2 Two registered nurses at SLMHC provide wound care for the population of 29,000. Many of our clients arrive by plane from more than 300 kilometres north of SLMHC.

Clinical methods need to be practical and easily managed in our environment, where, due to transportation limitations, we can only follow up with most patients every two weeks. Nursing station nurses and/or family members perform dressing changes and treatment in the interim. We have achieved success using medical honey as a diabetic foot ulcer (DFU) healing agent. Natural honey is a viscous, supersaturated sugar solution derived from nectar gathered and modified by the honeybee.4 Medical honey is natural honey gamma-irradiated to eliminate any Clostridium botulinum contamination. Honey is acidic (pH of 3.2 – 4.5), and its antimicrobial properties have resolved MRSA and Staphylococcus aureus infection in wounds.5,6 The anti-inflammatory effect of honey results in reduced wound exudate, edema and scarring.7 Our methods promote ease of dressing changes, wound closure and client satisfaction.

Adding Honey to the Mix
The key features of our wound care method are the use of medical honey, conservative sharp wound debridement (CSWD) and simple wound coverings. The dressing components are inexpensive, and the nurses in the diabetes programs are qualified to perform CSWD. The use of medical honey at SLMHC was initially promoted in 2008 and implemented hospital-wide in 2010.

Two Cases
Two First Nations clients were asked to participate, and signed consents were obtained. Ethical approval was received by SLMHC Research Review and Ethics Committee. Names have been altered for confidentiality.

Lydia
“Lydia” is a 55-year-old First Nations woman with a right planter DFU complicated by Charcot foot. She lives in a fly-in-only community north of SLMHC. Lydia has type 2 diabetes, hypertension and hyperlipidemia. She was experiencing pain and edema in her right foot with increased symptoms on ambulation. The doctor’s examination at the remote nursing station found a large mid-planter callus, mild diffuse erythema of the forefoot and back pain. Oral clindamycin was prescribed.

Wound management began at SLMHC in November 2015. The callus was reduced with CSWD, revealing a diabetic foot ulcer 1.9 cm (length) x 0.9 cm (width) x 0.3 cm (depth). Local wound care included cleansing with normal saline, applying a small amount of honey and covering with an absorbent pad dressing (9 cm x 10 cm) secured with tape. A high, post-op, closed-toe offloading shoe was provided. Lydia returned home with orders for dressing changes every two days at the nursing station. With each return trip to SLMHC, CSWD was performed if required. Dressing supplies were sent home with Lydia each time. The wound on Lydia’s right Charcot foot was healed in March 2016. Successful resolution of her DFU was achieved through early detection of a serious wound, timely retrieval of the client from a remote community, specialized wound care in a rural hospital and consistent follow-up. Lydia’s attendance at regular dressing changes and diligent offloading of the foot were significant contributions (see Figures 1 and 2).
How Honey Works in Wounds

The knowledge that *Klebsiella* and *Enterobacter* bacteria have been shown to be resistant to silver-impregnated dressings may indicate a need to return to natural antibacterial products that promote wound healing.6-10 Honey is a traditional medicine used since ancient times, and its place in the history of human healing practices is readily accepted by our clients.6,12 The antimicrobial properties of honey include high sugar concentration, low pH, the presence of hydrogen peroxide, methylglyoxal, antimicrobial peptide bee defensin-1 along with oxidase, and other compounds such as polyphenols and flavonoids from plant nectar.6,12,13

The high sugar/low moisture content of honey causes osmotic stress to microbial cells. Low pH is unfavourable for the growth of many microorganisms. No bacteria are known to be completely resistant to the effects of honey.6,12,13 Research by Camplin and Maddock’s did identify some honey resistance by *Pseudomonas aeruginosa* in biofilm.13 This illustrates the importance of periodic wound culturing to appropriately identify any pathogens in a wound. The authors’ advise, “where recalcitrant or chronic, infected wounds are present it remains vital to ensure that topical treatments such as manuka honey are appropriately applied for a suitable length of time in combination with other antimicrobials where necessary to ensure that infection is resolved and the likelihood for resistance is minimised.”13

Bowling et al. state that “the risk of MRSA infection and bacteremia in patients with colonized ulcers is recognized.”34 Topical honey use has no known systemic effects.

Conclusion

Our clients often welcome the possibility of returning home with a dressing routine using simple, effective supplies. Sood et al. observe that “there is an overwhelming amount of wound dressings available in the market [which] implies the lack of full understanding of wound care and management … honey can inhibit biofilms of various species, is non-cytotoxic [and] a non-irritant with very low risk of client sensitization.”10 Complex and/or expensive dressings are not readily available in northern nursing stations. A 10 g tube of medical honey costs about $4. The absorptive adherent dressing we use costs less than $3, and our most basic dressings are only 12 cents each. These items are of practical use in a low-resource environment.

The ability to effect wound closure in clients with a diabetic foot ulcer living in remote communities, relying on inexpensive supplies that are easy for the clients to use when away from professional care, is an important outcome in wound care provision.10

Katherine Kivi, *works in the Sioux Lookout Diabetes Program at Sioux Lookout Meno Ya Win Hospital*. She is Diabetes Educator, Wound/Foot Care. Kathy has recently accepted a nursing position in Nunavut.

Cynthia Dwyer, *works in the Centre for Complex Diabetes Care at Sioux Lookout Meno Ya Win Hospital, Advanced Wound/Foot Care*. 

Bradley Lance, *is a Patient Care Manager, Manager of OR, Chronic Disease, ER, Day Medicine at Sioux Lookout Meno Ya Win Hospital*.

References

dachievements/IntegratedHealthServicesPlan.aspx.

2. Public Health Agency of Canada. Diabetes in Canada Facts and Figures from a Public Health Perspective. Report high-
faits-chiffres-2011/index-eng.php.

cle/11763-eng.htm.


10. Sood A, Grancock M, Tomaszewski N. Wound dressings and com-
parative effectiveness data. Advanced Wound Care. 2014;3(8).


Self-care at Home

Each client and/or escort/family member is shown how to apply the dressing during the initial visit. Then the client is asked to demonstrate to the nurse how to apply the material to the wound. The client is given the time to reapply the dressing until comfortable with the process. Due to the simplicity of the dressing, most clients only require a one-time demonstration.
Exercise-dependent anaphylaxis (EIA) is a rare disorder in which individuals develop immunoglobulin E (IgE)-mediated hypersensitivity in conjunction with exercise, causing anaphylaxis. The lifetime prevalence of EIA is about 0.05%. About 30% to 50% of EIA is food dependent, only occurring with the combination of a specific food and exercise.1-4 In these patients exercise or food on their own do not cause anaphylaxis, only in combination do they trigger the reaction. The case presented here describes a rare life-threatening diagnosis in a previously well 22-year-old female jogger. Results of standard allergy testing were noncontributory. This case is unique because there are likely multiple triggers that in combination with exercise contribute to the patient developing the anaphylactic reactions. Diagnosis is made by a careful history and an awareness of the combination of food triggers and EIA. Prevention includes avoidance of the combined potential triggers and carrying an epinephrine autoinjector.

Case
A female patient presented after anaphylactic reactions at the ages of 19 and 22 years with undifferentiated triggers while jogging. The first event occurred in the spring after eating a salad with scallops and shrimp. She reported abdominal cramping within 5 minutes of starting her jog, then within 30 minutes she developed nausea, facial swelling, diffuse pruritus, and difficulty breathing. A passer-by called an ambulance and the patient lost consciousness. On presentation at the emergency department she had profound hypotension and bradycardia. Emergency treatment included epinephrine, intravenous fluids, steroids, antihistamines, and H₂ antagonists. Euspatch testing several weeks later revealed a positive reaction to dust mites and mild reactions to spring tree pollen, banana, avocado, and tomato; she did not react to any shellfish, including shrimp and scallops.

The second event occurred while exercising, again in the spring season, after eating curvy with vegetables, shrimp, and white fish. She had been jogging for 45 minutes when she developed facial swelling and hives. In the emergency department she also had an episode of emesis and again was profoundly hypotensive. Subsequent repeat allergy testing showed positive reactions to dust mites, cats, birch, maple, rats, oak, elm, and grass. The foods she was tested for that resulted in negative reactions included the most common food triggers: egg, wheat, fish, shrimp, and peanuts. Also, at this time she had a pet rat in her house.

Discussion
To assess the literature MEDLINE was searched from 2000 to 2015 using the MeSH terms exercise and food hypersensitivity and anaphylaxis, identifying 134 articles. Many different types of foods have been shown to cause food-dependent exercise-induced anaphylaxis (FDEIA), including wheat, shellfish, nuts, tomatoes, peanuts, fish, pork, beef, mushrooms, hazelnuts, eggs, peaches, apples, milk, and alcohol.1-4 There are also reports in which the ingestion of 2 foods together along with exercise are required to trigger a reaction.1 Nonfood combination triggers reported include medication (monosodium anti-inflammatory drugs), cold or warm temperatures, menstrual cycle, pollens, and ingestion of dust mites.1-4 Interestingly, these nonfood triggers are usually cofactors that appear to enhance the anaphylactic reaction but that do not cause the reaction on their own.

EDITOR’S KEY POINTS
• Food-dependent exercise-induced anaphylaxis is rare, and findings of allergy testing might be negative. Particular food triggers are benign unless combined with exercise.
• Prevention involves avoiding the combination of the trigger food and exercise, allowing 4 to 6 hours for digestion of the known trigger food before exercise, and carrying an epinephrine autoinjector during exercise.
• Treatment includes immediate intramuscular epinephrine injection and emergency department assessment.

POINTS DE REPÈRE DU RÉDACTEUR
• L’anaphylaxie de source alimentaire déclenchée par l’exercice est rare, et les résultats des tests d’allergie pourraient être négatifs. Certains aliments alimentaires sont bénins, à moins d’être combinés à des activités physiques.
• Pour la prévenir, il s’agit d’éviter la combinaison de l’aliment inducteur et de l’exercice, d’attendre 4 à 6 heures pour que soit digéré l’aliment déciderait avant de faire de l’exercice et de se munir d’un auto-injecteur d’épinéphrine pendant l’activité physique. Le traitement comporte une injection intramusculaire immédiate d’épinéphrine, suivie d’une évaluation à l’issue.

This article has been peer reviewed. Cet article a fait l’objet d’une révision par des pairs.

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There is no definite evidence for what mechanisms trigger the allergic reaction, but several proposed mechanisms might help to explain FDEIA. One of the proposed theories is that IgE cross-links with a specific food allergen and, when combined with exercise, it lowers the threshold for mast cell degranulation, histamine and vasoactive mediators are released, and this in turn leads to anaphylaxis.1-4 Two other proposed mechanisms include changes in pH that might be a trigger for FDEIA1 and that exercise increases blood flow to muscle, while decreasing circulation to gut mucosa, thus exposing more muscle tissue mast cells to the allergen.1-4 The reaction usually occurs within the first 30 minutes of starting physical activity.3 Symptoms include pruritus, cough, chest tightness, angioedema, urticaria, wheezing, and gastrointestinal complaints.3

Treatment of FDEIA involves the same emergency care for other causes of anaphylaxis (epinephrine, antihistamines, H₁ and H₂ blockers, inhaled bronchodilators, and steroids as needed). Any patient who has self-administered epinephrine should still seek immediate medical care for further monitoring and treatment, as the anaphylactic reaction might have ongoing life-threatening effects.3 Further preventive treatment of FDEIA involves avoidance of exercise for 4 to 6 hours after ingesting the known food trigger, carrying an epinephrine autoinjector during exercise, lowering the intensity of exercise, and avoiding exercise in extreme weather conditions such as hot and humid or cold temperatures.4 Taking medications such as antihistamines or H₂ blockers before exercise is still a controversial topic, as there is currently inadequate evidence to support prophylactic treatment.2,5 A case study described a successful trial of prophylactic omalizumab in a 14-year-old boy with refractory FDEIA. This relatively new recombinant DNA monoclonal antibody, which binds to IgE and mutates its activity in type 1 allergic reactions, was taken before exercise and reduced this patient’s anaphylactic reactions.6 Another case study in a 47-year-old Japanese man showed administration of misoprostol (a prostaglandin E₁ analogue) before exercise decreased his wheat-dependent anaphylactic reactions, perhaps owing to upregulation of gastrointestinal breakdown of allergenic particles.7

Conclusion
The patient in this case is a young woman with FDEIA with an unknown trigger. Treating physicians presumed a combination of spring pollen, seafood, and exercise to be the trigger. She has since avoided any exercise for a minimum of 4 to 6 hours after consuming any fish or seafood. As the reactions occurred with both finned fish and shellfish, she was advised to avoid both possible triggers before exercise. She has not had any further anaphylactic reactions and she carries an epinephrine autoinjector while exercising. If she develops recurrent reactions, it might be reasonable to consider prophylactic exercise treatments such as omalizumab or misoprostol for this rare condition.4

De Minto is a staff physician at the St. Louis Outlook Stowe Yo Wu Health Centre and undertook this report while a resident in family medicine at the Northern Ontario School of Medicine in St. Louis, ON.

Competing interests None Declared

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References
Interlaminar epidural steroid injections for low back pain in rural Ontario

Introduction: We sought to document the efficacy of interlaminar epidural steroid injections (ESIs) for the relief of low back pain in a rural population.

Methods: We conducted a prospective observational cohort study with brief follow-up telephone interviews at 1, 3 and 6 months after interlaminar ESI.

Results: A total of 47 ESIs were administered to the 24 participants. In an intention-to-treat analysis, pain relief was achieved in 78.7%, 55.3% and 27.7% of participants at 1, 3 and 6 months.

Conclusion: Interlaminar ESIs, without fluoroscopic guidance, were effective for up to 3 months of symptom relief.

INTRODUCTION

Radicular low back pain (lumbar pain with neurologic signs and symptoms) constitutes 4%–5% of cases of back pain seen by general practitioners.1 Because this subgroup of patients with low back pain includes those who may need surgical referral or intervention, they merit a particular focus.

Clinical findings and radiographic imaging allow us to categorize these patients into those with lumbar disc herniation (LDH) and/or lumbar spinal stenosis (LSS). Degree of pain does not consistently correlate with severity of imaging-detected spinal pathologies, and most initial episodes resolve with conservative treatment.2–4 The frequency of spontaneous resolution varies according to diagnosis, with symptoms improving without operative intervention in 80% of patients with LDH and up to 45% of patients with LSS.5 Lumbar disc herniation involves mechanical compression from herniated disc material, whereas LSS encompasses the degenerative narrowing of the central canal, lateral recess or neural foramina.4 In both cases, inflammation is widely believed to play a causal role in instigating radiculopathy.2,5,6 Epidural steroid injections (ESIs) may therefore have a role in the treatment of radicular low back pain, after the failure of conservative management.2,4–8

There are 3 primary methods for the injection of corticosteroids into the epidural space: caudal, transforaminal and interlaminar. ESIs.7,10–12 Caudal ESI involves the injection of medication through the sacral hiatus, transforaminal ESI uses the neural foramen to target a specific nerve root and interlaminar ESIs target the epidural space between the laminae.6,7,10–12 Although transformaminal ESI is generally considered the most effective, its safety profile mandates the use of fluoroscopic guidance, which may not be feasible in a rural setting.6,7,10–14 Interlaminar ESI, on the other hand, is also considered effective and can be administered without real-time imaging guidance,1,4,11,12,16–22 The technique is similar to that used by rural generalists performing lumbar punctures and by rural general practitioners and anesthesiologists for epidural analgesia during labour.1,4,11

Although widely considered safe,4,11,12,23,24 the value of ESI as a clinical practice remains a subject of debate. Some literature supports the efficacy of ESI for short-term pain reduction,23,24 other publications point out important flaws, such as a lack of cost-effectiveness, the absence of substantial improvement and — in 1 case — the worsening of outcomes.16–18 Most research findings fall in between these 2 conclusions.20–23

This prospective study investigates the efficacy of interlaminar ESIs in treating low back pain in rural population. It is a follow-up to a previous 5-year retrospective study that demonstrated substantial improvement of symptoms following interlaminar ESIs.15

METHODS

Setting
The Sioux Lookout Meno Ya Win Health Centre serves a population of 30,000 in northwestern Ontario.

Data collection and analysis
This research was approved by the Sioux Lookout Meno Ya Win Research and Ethics Committee.

Patients who presented for ESI at an outpatient clinic at the Sioux Lookout Meno Ya Win Health Centre between October 2011 and December 2014 were invited to participate in this study. Exclusion criteria were local infection or full anticoagulation therapy with warfarin. After informed consent, key demographic characteristics for each participant, as well as the number of previous injections, analgesic usage, history of back surgery and current level of pain using numeric pain scale measures were recorded. Patients were contacted by telephone, 1, 3 and 6 months postinjection and asked to rate their current level of pain as less, greater or the same as it had been prior to treatment and whether they received subsequent injections if medically indicated.

Data were collected in Microsoft Excel, and analysis was completed with Excel and IBM SPSS (version 20.0 for Windows). Means and frequencies were calculated as appropriate.

Method of injection
Epidural steroid injections were performed by 2 experienced general practitioners/anesthesiologists. Before injection, patients were briefed on the potential risks and benefits associated with the procedure. The interlaminar approach was used without real-time imaging guidance. The skin was injected in lumbar flexion, and the correct level was identified using the iliac crest as indicative of the L5–L4 level. In the case of patients with a history of back surgery, the location of injection was raised or lowered a level accordingly. The subcutaneous injection of 4 mL of 1% lidocaine was followed by the interlaminar advancement of a 17-gauge Tuohy needle and the identification of the epidural space using the loss-of-resistance technique. Then, 1 mL of 80 mg/mL methylprednisolone acetate with 4 mL of normal saline was injected. Instructions for postinjection care were provided.

RESULTS

Study population
Twenty-four patients gave informed consent and were enrolled in the study. Patient characteristics are provided in Table 1. Thirteen (54.2%) were women, and the mean age was 50.4 (standard deviation [SD] 13.5) years. Lumbar disc herniation was the most common diagnosis, occurring in 17 (70.8%) participants, followed by LSS, which affected 16 (66.7%). Eleven (45.8%) patients were diagnosed with both LDH and LSS. On average, each participant had received about 1 ESI before the commencement of the study (mean 0.9, range 0–6 injections). All patients used some form of analgesics for low back pain at the beginning of the study. Fourteen (58.3%) used narcotics, 10 (41.7%) used acetaminophen and 9 (37.5%) used NSAIDs, with 8 (33.3%) using a combination therapy. Hypertension and diabetes were the most common comorbidities, with each affecting 9 (37.5%) participants. Other observed comorbidities included psychosocial factors (16.7%), coronary artery disease (8.3%) and peripheral vascular disease (4.2%) (Table 1).

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RESULTS

Study population
Twenty-four patients gave informed consent and were enrolled in the study. Patient characteristics are provided in Table 1. Thirteen (54.2%) were women, and the mean age was 50.4 (standard deviation [SD] 13.5) years. Lumbar disc herniation was the most common diagnosis, occurring in 17 (70.8%) participants, followed by LSS, which affected 16 (66.7%). Eleven (45.8%) patients were diagnosed with both LDH and LSS. On average, each participant had received about 1 ESI before the commencement of the study (mean 0.9, range 0–6 injections). All patients used some form of analgesics for low back pain at the beginning of the study. Fourteen (58.3%) used narcotics, 10 (41.7%) used acetaminophen and 9 (37.5%) used NSAIDs, with 8 (33.3%) using a combination therapy. Hypertension and diabetes were the most common comorbidities, with each affecting 9 (37.5%) participants. Other observed comorbidities included psychosocial factors (16.7%), coronary artery disease (8.3%) and peripheral vascular disease (4.2%) (Table 1).
Pain relief

A total of 47 ESIs were administered to the 24 participants, with 17 (70.8%) receiving a single injection and 3 (12.5%) receiving 4 or more injections (Fig. 1). The mean score on the numeric pain rating scale before interlaminar ESI was 6.48 (SD 1.94) out of 10. Adverse reactions to treatment were reported after 5 injections; 2 were headaches and 1 was new bilateral radicular pain.

Of those who received a single injection, 3 were lost to follow-up within a month and were excluded from further analysis. Two patients receiving multiple injections were lost to follow-up within a month of receiving a subsequent injection. Of the 42 injections with follow-up data, 37 (88.1%) were associated with reduced pain from baseline after 1 month, and the remainder were associated with no change in level of pain. The number of injections associated with pain relief fell to 26 (68.4%) of the 38 injections with follow-up data after 3 months; again, all remaining injections were associated with no change in pain level. After 6 months, of the 28 injections with follow-up data, 15 (46.4%) were associated with continued pain relief and 2 (7.1%) with increased pain relative to baseline.

In an intention-to-treat analysis (including those lost to follow-up), pain relief occurred in 78.7%, 55.3% and 27.7% at 1, 3, and 6 months (Fig. 2).

**DISCUSSION**

Our results show that interlaminar ESI, without fluoroscopic guidance, can effectively decrease low back pain for up to 3 months.

Although the analgesic effects of interlaminar ESI are of short-term duration, there is a lack of consensus in the literature on exactly how short this term is. At one end of the spectrum, Brown found that only 35.3% of patients who received a standard interlaminar ESI experienced effective pain relief after 6 weeks, and Ghai and colleagues reported this percentage to be 16.7% after 6 months. Other researchers have found that the effects of interlaminar ESI last at least 6 months; 105.5 months; 135 days; or 6 weeks. In a previous retrospective study at our hospital, Mashari and colleagues found that 80% of the 88 patients with follow-up data experienced improvement after receiving an interlaminar ESI. The present study reports a reduction of symptoms for up to 3 months after injection in 55% of patients.

Of the prospective studies found in our literature search, only Riveit and colleagues explicitly described administering interlaminar ESIs in the absence of real-time imaging guidance, making this study of particular interest to the present study.14,22 The rates of pain relief reported by Riveit and colleagues17 — with 61% of patients with LDH reporting improvement after 2 weeks compared with only 38% of patients with LSS — are lower than the rates found in both of the studies carried out at our institution.14,17 This difference could be due to the exclusion of patients who had experienced low back pain for less than 6 months in the study by Riveit and colleagues,17 given that the effectiveness of ESI diminishes with increasing duration of symptoms.4,17

Two patients in this study experienced headaches after receiving an interlaminar ESI. This is noteworthy because new-onset, severe headache, which is associated with post–dural puncture headache, is estimated to occur in 8%–40% of interlaminar ESIs administered without real-time imaging guidance.27,28

**CONCLUSION**

Interlaminar ESI was associated with pain reduction for up to 3 months for most patients. Interlaminar ESI can be administered in a context where fluoroscopic guidance is not available, such as in remote and rural communities.

**REFERENCES**


**Table 1: Characteristics of participants receiving interlaminar epidural steroid injections, n = 24**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No. (%)</th>
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<tbody>
<tr>
<td>Age, yr, mean ± SD</td>
<td>50.4 ± 13.3</td>
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<tr>
<td>Sex</td>
<td>Male 11 (45.8)</td>
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<tr>
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<td>Female 13 (54.2)</td>
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<td>Radiographic diagnosis</td>
<td>LDH 17 (70.8)</td>
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<td></td>
<td>LSS 16 (66.7)</td>
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<td></td>
<td>LDDD and LSS 11 (45.8)</td>
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**Fig. 1. Number of epidural steroid injections (ESIs) administered per patient during the course of the study (47 ESIs in 24 patients).**

**Fig. 2. Outcomes at 1, 3 and 6 months after epidural steroid injection as a proportion of the number of injections (n = 47).**

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Competing interests: None declared.

None declared.

Competing interests: None declared.

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Len Kelly MD MDcSc, Rajiv Gandhi MD, Anukul Panu MD

A 55-year-old postmenopausal woman experiences intermittent anterior clicking and locking of her hip while walking. The clicking is painful and comes on without warning, causing her to stop walking for several minutes. The patient has no history of trauma and no night pain.

She enjoys golf, but now has to ride in a golf cart to complete the round. Initial examination shows a normal range of motion without pain. There is no evidence of femoral or inguinal hernia or localized tenderness consistent with a trochanteric bursitis. Radiographs of her hip appear normal.

What causes of pain should be considered?

The patient’s history of intermittent symptoms indicates a mechanical origin of pain. That the patient had normal range of motion without pain on examination is a pertinent negative finding for osteoarthritis. Because there was no evidence of osteoarthrosis or metastatic disease on the plain radiographs, nor evidence of hemia (femoral or inguinal), trochanteric bursitis or local inflammation or infection on examination, a labral tear of the cartilage of the acetabulum should be considered.

A labral tear occurs at the relatively avascular proximal portion of the cartilaginous labrum where it attaches to the articular cartilage of the hip joint. It typically presents as anterior mechanical hip pain.

The labrum acts as a seal of the synovial fluid and extends the depth of the joint by as much as 25%. Involving activities such as golf, hockey, soccer and ballet may cause tears. Common types of tears are described: traumatic tears (young athletes) and degenerative tears (early osteoarthrosis in older patients). Labral tears may be asymptomatic. In a study involving 70 asymptomatic individuals (mean age 26 yr), a surprising 27 (39%) cases of labral tear seen on high-resolution magnetic resonance (MR) imaging were reported.

What investigations are required if a labral tear is suspected?

An MR arthrogram involving injection of contrast medium into the joint is typically used to identify labral tears (Figure 1). Because a labral tear dis-
Practise

rupts the seal of the synovial fluid within the joint, extravasation of the contrast medium shows the location and extent of the tear. For patients averse to intra-articular injection, high-resolution MR imaging may be a good substitute.6

If imaging shows a labral tear, what are the treatment options for this patient?

In this older patient, damage of the adjacent articular cartilage in her hip joint is likely, and labral dislocation may not give definitive symptom relief.

Uncontrolled studies have shown that discrete sports-related labral tears may respond to arthroscopic hip surgery in younger athletic patients.7 However, a Canadian study involving 41 older patients (> 45 yr; mean age 53.7 yr) showed poor results of surgery, with relatively high re-operation rates and minimal improvement in joint-specific and overall quality-of-life measures.8 The authors of a similar American study involving 30 patients (mean age 63.9 yr) also recommended caution in advising surgery in older patients because of poor two-year overall survival (70%) and a reoperation rate of 37%, most often requiring total hip arthroplasty.9

In this patient’s age group, a labral tear may be a sign of a deteriorating joint rather than an isolated reparable lesion. Watchful waiting and non-load-bearing exercise may be a good option. Physiotherapy techniques currently include active and deep-tissue release in addition to progressive resisted stretching and strengthening activities.10 Poor response to conservative treatment and increasing disability may require revisiting surgery as a treatment option.

Case revisited

On further examination, rotational testing of the patient’s flexed hip reproduced a painful click. The patient decided not to consider conservative treatment at this point and will seek conservative treatment with physiotherapy to maximize her overall flexibility and strength.

References


decision is a series that focuses on practical evidence-based approaches to common presentations in primary care. The articles address key decisions that a clinician may encounter during initial assessment. The information presented can usually be covered in a typical primary care appointment. Articles should be no longer than 650 words, may include one figure, box or table and should begin with a very brief description (75 words or less) of the clinical situation. The decisions addressed should be presented in the form of questions. A box providing helpful resources for the patient or physician is encouraged.

The Practitioner Le praticien

The occasional digital nerve block

In performing regional anesthesia of the fingers and hand, there are several general principles that need to be identified. The first is to relax. Successful blocks get easier with repetition. Most rural physicians do not perform them weekly or monthly, so it may take a while to get comfortable with them, and repeat blocks may be required for any given procedure.

PRELIMINARY PRECAUTIONS

1. Ensure that you have performed and documented any neurologic and vascular assessment before injection. Most injections will be performed with a 25-gauge needle. Because the needle will often be adjacent to an artery, aspiration before injection is needed. Parasthesia on initial needle placement indicates that the needle is in the nerve, and withdrawing slowly until it is absent identifies a safe injection site. Parasthesia is a sign of neurovascular impingement. It is preferable to aspirate adjacent to the nerve insertion and injection.

2. Epinephrine containing anesthetic agents should not be used. There has been some debate about this in the fields of orthopedic and plastic hand surgery, a changing practice in which epinephrine is being used along with a local anesthetic.1,2 This change in practice does not necessarily extend medially to the rural practitioner, when most textbooks still clearly admonish the use of epinephrine, particularly in finger anesthesia.3,4

3. The traditional ring block for digital nerve anesthesia is no longer a preferred technique owing to its lower safety profile from the tourniquet effect of anesthetic volume used.5

4. Use of lidocaine is common. If multiple injections are used, the toxicity range of 4 mg/kg needs to be considered (e.g., 20 mL of 1% lidocaine may be toxic for a 50-kg patient if it rapidly becomes intravascular; 10 mL for a 2% solution). Toxicity is less of a concern when instilled into soft tissue, where it will be slowly absorbed and metabolized. Toxicity is more likely to be an issue with a hematoma block, which typically involves use of larger volumes and may function as a rapidly absorbed intraosseous infusion. This toxicity presents with a metallic taste in the mouth and may be followed by a seizure. Bupivacaine is a common, longer-acting equivalent choice for finger and hand anesthesia. Digital nerve block is not synonymous with ring block.6

5. Remember that there is a variable dorsal digital nerve on each digit. They bifurcate just proximal to the metacarpophalangeal joint, the visible knuckle. Finger anesthesia can be performed in 3 ways: web-space block, metacarpophalangeal block and ring block.

EQUIPMENT

• 25-gauge 3/4-inch needle
• Lidocaine

WEB-Space BLOCK

This block is the easiest to perform and has been found to be the most effective digital block.7 Simply insert a 25-gauge, 3/4-inch needle with the bevel pointing away from the phalangeal crease. Advance the needle subcutaneously to the web space, then advance across the bone, trying to remain superficial. The needle should pass beneath flexor tendon sheaths. An initial digital paresthesia will confirm the needle tip in the web space. Native tissue block will be effective at the distal interphalangeal joint and is an excellent choice if cohesive properties are desired.8

...
3½-inch needle completely into the web space. Insert to a depth of about 1 inch and inject 3 mL of lidocaine (Fig. 1). This will likely reach both aspects of the digital nerve at or near their bifurcation.

**METACARPOPHALANGEAL BLOCK**

Metacarpophalangeal block is performed on the dorsal surface of the hand just proximal to the visible knuckle joint.10 The needle is entered perpendicular to the skin, behind the visible knuckle, and advanced until the palmar aponeurosis is felt or the palmar skin is tented there and then inject a similar volume.7 Some lidocaine can be kept and used when the needle is almost out of the skin to tunnel subcutaneously across the metacarpophalangeal area and deposit a subcutaneous wheal, so that the entry point of the second injection is anesthetized in advance. The other side of the metacarpophalangeal area is entered in the same fashion with another 3 mL of lidocaine instilled.

**RING BLOCK**

Because there is no place for fluid to expand as in the previous approaches, this commonly employed method may leave the patient exposed to a potential compartment syndrome.2,3 Use it cautiously and not at all in patients with poor vascular health. The classic approach is 1–1.5 mL of lidocaine on each side of the digit.11 The needle enters the dorsal finger skin just distal to the web space and the 1-mL volume is injected, partly at the dorsal branch and then further advanced to the volar branch of the digital nerve. The needle basically slides along the side of the finger as each nerve receives an injection. The total volume in the finger should total 5 mL or less (Fig. 5).

**REFERENCES**

bone, to string the tendon out. The ulnar nerve can be reached by injecting just on the thumb side of this tendon to reach the ulnar nerve by this volar approach (Fig. 4). The injection for the nerve essentially lies between the tendon and the nearby ulnar artery. A 2004 cadaveric study found damage to this artery almost 40% of the time.7

A medial approach to the nerve has demonstrated less risk of arterial damage.3,7 Place the needle parallel to the wrist crease and slip it under the tendon, which is usually very easy to palpate (Fig. 5)

Advance the needle beneath the tendon to its far side where the nerve lies, and then inject 3–5 mL (Fig. 6).

Consider an alternative, less commonly described approach that is done more proximally, before the palmar and dorsal branch of the ulnar nerve bifurcate.2,8 Find the spot 3 fingerbreadths (5–7 cm) proximal to the wrist crease, slide the needle under the flexor carpi ulnaris tendon and inject 3–5 mL of lidocaine. The artery is not so closely applied to the nerve, and this approach is safer and simpler (Figs. 7 and 8).

**Fig. 3.** Traditional distal approach to the ulnar nerve.

**Fig. 4.** Entering just lateral (thumb side) to the flexor carpi ulnaris muscle, located by flexing the wrist and abducting the little finger.

**Fig. 5.** The medial approach to the ulnar nerve.

**Fig. 6.** Slipping the needle under the flexor carpi ulnaris tendon from the medial aspect is more protective of the ulnar artery.

**Fig. 7.** Both branches of the ulnar nerve can be blocked 5 fingerbreadths (5–7 cm) proximal to the wrist crease.

**Fig. 8.** Needle enters just under the flexor carpi ulnaris tendon and travels to the other side of it.

**Fig. 9.** Anatomical snuff-box formed by the extensor pollicis brevis and longus muscles.

**Fig. 10.** Place 5 mL of lidocaine subcutaneously in the anatomical snuff-box.

**Fig. 11.** Follow that with 2 subcutaneous wheals as shown.

**Fig. 12.** The dorsal subcutaneous wheal should travel several inches around the back of the hand above the tendons.

**Fig. 13.** A volar subcutaneous wheal is shorter and also stays above the tendon.

**Fig. 14.** Nerve regions to the hand.

**RADIAL NERVE BLOCK**

The radial nerve innervates the dorsum of the hand and the first 5 fingers — but only up to the proximal interphalangeal joint, then the median nerve takes over. Remember this distinction for fingertip work.9

This nerve block is considered a field block because anesthesia is obtained by diffusion of a generous amount of solution rather than accurate placement of the needle beside a nerve, given that the nerve has multiple and varying bifurcations. The first step is to place 3–5 mL of lidocaine subcutaneously in the anatomical snuff-box. Identify it by extending the thumb in typical hitchhiker style (Figs. 9 and 10). Other authors describe forming a subcutaneous wheal extending along one-half of the back of the wrist using another 3–5 mL of lidocaine5,9 (Figs. 11 and 12). Some also extend a shorter subcutaneous wheal around the volar aspect of the wrist to cover the radial styloid2,11 (Fig. 13). These additional subcutaneous wheals can be accomplished via a single needle puncture by withdrawing and re-angling the needle under the skin.22

The regions of sensation to the hand are shown in Figure 14. The ultrasound-guided method allows direct visualization of the needle, artery and the
nerve. With this approach, a smaller volume of anesthetic may be used, and there is less potential for trauma to the nerve.12 Although such training is rapidly percolating throughout rural emergency departments, knowledge of the relevant anatomical landmarks and the ability to deliver regional hand anesthesia without technical aids will always be an asset. Epinephrine is sometimes used for prolonged surgeries by hand surgeons: the use of 5 mL of 2% lidocaine with 1:100 000 epinephrine can provide up to 9 hours of anesthesia.14

Competing interests: None declared.

REFERENCES

Evaluation of 6 remote First Nations community-based buprenorphine programs in northwestern Ontario

Retrospective study

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Sharon Crane MD  CCFP  H	Sara Rea CCFP  Pierre Parsons CCFP  H
Lyle Kelly MD  MCI  FCFP  FRRM

Abstract

Objective To evaluate established opioid addiction treatment programs that use traditional healing in combination with buprenorphine-naloxone maintenance treatment in 6 First Nations communities in the Sioux Lookout region of northwestern Ontario.

Design Retrospective cohort study

Setting Six First Nations communities in northwestern Ontario.

Participants A total of 526 First Nations participants in opioid-dependence treatment programs.

Intervention Buprenorphine-naloxone substitution therapy and First Nations healing programming.

Main outcomes Retention rates and urine drug screening (UDS) results.

Results Treatment retention rates at 6, 12, and 18 months were 84%, 76%, and 72%, respectively. We estimate that the rate at 24 months will also be more than 70%. The UDS programming varied and was implemented in only 1 community. Initially urine testing was voluntary and it then became mandatory. Screening with either method found the proportion of urine samples with negative results for illicit opioids ranged between 84% and 95%.

Conclusion The program’s treatment retention rates and negative UDS results were higher than those reported for most methadone and buprenorphine-naloxone programs, despite a patient population where severe posttraumatic stress disorder is endemic, and despite the programs’ lack of resources and addiction expertise. Community-based programs like these overcome the initial challenge of cultural competence. First Nations communities in other provinces should establish their own buprenorphine-naloxone programs, using local primary care physicians as prescribers. Sustainable core funding is needed for programming, long-term aftercare, and trauma recovery for such initiatives.

This article has been peer reviewed.
Can Fam Physician 2017;63:137-45

EDITORS’ KEY POINTS

• Remote First Nations communities in northwestern Ontario have a high prevalence of opioid addiction and its consequences, such as crime, violence, and overdose. Communities in the Sioux Lookout region have established treatment programs using traditional healing in combination with buprenorphine-naloxone maintenance treatment. The authors were invited by 6 communities to evaluate their programs.

• The 6-month treatment retention rate of 84% for these programs is higher than that reported for most methadone and buprenorphine-naloxone programs in the United States and Canada, despite these programs lacking the expertise and resources other such programs typically have. In 1 community, the high rates of negative urine drug screening results when screening was voluntary were also demonstrated when screening became mandatory after the study data collection period.

• Despite many obstacles, these community-driven initiatives have creatively begun to address crippling levels of addiction. Although a causal relationship could not be determined, the 6 communities studied experienced a dramatic decline in suicides (P = .025) after the initiation of these programs. Culturally embedded, community-based programs can provide an important starting point for long-term healing.

Research

Evaluation of 6 remote First Nations community-based buprenorphine programs in northwestern Ontario

Since the opioid crisis began in the late 1990s, remote northwestern Ontario First Nations communities have experienced a massive surge in the prevalence of opioid addiction. The Nishnawbe Aski Nation, in a news release in 2012, estimated that 41% of the adults aged 20 to 50 years were opioid dependent. First Nations band councils and addicted workers report that opioid-related overdoses, crime, social dysfunction, and addiction are common in their communities.

Until recently, treatment options have been limited. Abstinence-based programs have high relapse rates and have involved traveling out of the community to an urban treatment centre. Methadone treatment is not feasible in many isolated First Nations communities, as they lack a methadone prescriber from the pharmacy, and the physician-based electronic medical records (EMRs), which recorded buprenorphine-naloxone prescriptions. Population estimates were based on all patients covered by Ontario Health Insurance within each community, as listed in the EMR.

Program description

Administration and staffing. All 6 communities began providing buprenorphine-naloxone substitution in the summer or fall of 2012 and into 2013. Each community designed its own program and unique complement of staff and consultants. Communities provide a facility for the program, often in an unused or refurbished building. The programs are overseen by the board chair and council, the Health Director, and community leaders. The service delivery team consists of the local program coordinator, medication dispensers, consultant counselors, nurses, and physicians. Community nurses initiate bloodwork on admission to the program. Participants are self-referred. The local capacity to provide direct, observed therapy was often a limiting factor for inductions. Patients were admitted to the program on a first-come, first-served basis if they met the diagnostic criteria for opioid use disorder.

Buprenorphine-naloxone prescriptions. Patients were often started on buprenorphine-naloxone in group inductions of 10 to 25 patients at a time, depending on funding and the availability of clinical personnel. Often inductions were initiated by visiting community physicians, if available, addiction physicians from urban centres assisted during group inductions. The physician continues treatment, including dose changes, weaning, and other addiction and general medical needs.

A recent study documented remarkable results from a buprenorphine-naloxone program in one regional community, with dramatically reduced rates of crime and increased rates of school attendance. The study measured only community outcomes. This current study is the first to report on treatment retention rates and urine drug screening (UDS) results for buprenorphine-naloxone maintenance programs in the Sioux Lookout region.

METHODS

Treatment setting

We conducted a retrospective cohort study. Six First Nations communities who requested program evaluation (with a total population of 4388) participated in the study. All are located north of the town of Sioux Lookout, where the Sioux Lookout Meno Ya Win Health Centre serves as their regional medical hub for primary and hospital care. The population, medication use, and laboratory values were calculated from the physician-based electronic medical records (EMRs), which recorded buprenorphine-naloxone prescriptions. Population estimates were based on all patients covered by Ontario Health Insurance within each community, as listed in the EMR.

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they have provided informed consent. Community physicians, who visit each community for 1-week periods each month, prescribe follow-up buprenorphine-naloxone doses. The drug is dispensed daily under the supervision of a community nurse or community addictions worker. Take-home doses are prescribed by the addiction physician or the community physician in consultation with other members of the treatment team. A locally developed physician prescribing guideline was developed to assist induction prescribing and maintenance dosing.

Counseling. After induction, the group attends 4 weeks of intensive daily treatment and aftercare. Some programs provide daily, supervised dispensing of buprenorphine-naloxone. A “Land” aftercare program has been developed in some of the communities, with organized days of fishing, hunting, traditional walks for memorialization, and other community gardening programs. Elders and experienced First Nations counselors provide individual and group healing sessions where possible. Some communities hire counselors from outside of the community if resources permit. In many programs, the community physician provides the core clinical support.

Data collection

The 6 programs started buprenorphine-naloxone substitution in the summer or fall of 2012 and into 2013. Data were collected from the start of each program until July 2015. Because UDS was only randomly available for that time period, we also included initial UDS results from early 2016, when it became mandatory in 1 community.

Information on buprenorphine-naloxone prescribing was collected for patients in the last year of observation. Patients were considered retained in treatment from the date of their first buprenorphine-naloxone prescription until their last prescription ended. Twelve-month retention rates were calculated for patients who started buprenorphine-naloxone 12 months before July 2015. Buprenorphine-naloxone dosing data were available from 1 of the 6 communities and were analyzed for induction dose and the dose at every 6-month follow-up.

Urine drug screening was performed systematically in only 1 of the 6 communities. To evaluate their treatment programs, community physicians to their clients. The study was launched in response to a request from the Canadian National Health Research and Ethics Committee. The evaluation received partial funding from the Northern Ontario Academic Medicine Association. Most of the investigators on this study are also clinicians working in Sioux Lookout or community leaders.

Table 1. Age distribution of community members

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<th>Age, y</th>
<th>Participants, N (%)</th>
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<td>3 (1)</td>
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<td>Total</td>
<td>526 (100)</td>
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Table 2. Dose and retention rates at 6-month intervals since induction

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<tr>
<th>TIME SINCE INDUCTION, mo</th>
<th>NO. OF PARTICIPANTS, N (%)</th>
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<td>277 (72)</td>
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<tr>
<td>18-24</td>
<td>202</td>
<td>95 (estimated &gt; 70)*</td>
<td>107</td>
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*Six months had not yet elapsed since induction for 5 of the 526 total participants at the time of data collection; 43 participants had not yet completed 12 months of treatment, 48 had not yet completed 18 months, and 181 had not yet completed 24 months. We expect that most of the 181 participants who had not yet completed 24 months of treatment will be retained.

This study confirms the extraordinarily high prevalence of opioid dependence in First Nations communities. Among adults aged 20 to 60 years, 28% were taking buprenorphine-naloxone, double the prevalence of adults in these communities with type 2 diabetes (14%). This paper is the first, to our knowledge, to report on the effectiveness of buprenorphine-naloxone maintenance programs in rural, aboriginal communities, in Canada or elsewhere. A recent study of an inpatient detoxification program in Sioux Lookout, using a rapid taper of buprenorphine-naloxone, reported relapse rates of 52% after 2 weeks and 70% after 6 months, confirming that tapering and detoxification are of limited usefulness in the treatment of opioid addiction.

The 6-month treatment retention rate of 84% is higher than rates reported for most methadone and buprenorphine-naloxone programs in the United States, Canada or elsewhere. A recent study of an inpatient detoxification program in Sioux Lookout, using a rapid taper of buprenorphine-naloxone, reported relapse rates of 52% after 2 weeks and 70% after 6 months, confirming that tapering and detoxification are of limited usefulness in the treatment of opioid addiction.

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In these community-based programs, the high reten - tion rates and low rates of illicit opioid use are con - sistent with the positive community-wide results of an earlier study in 1 of the 6 communities. 

Suicides

Suicides in these 6 communities declined significantly (P < 0.05) from 9 cases in the 3-year period of 2009 to 2012 to 1 cases in the subsequent 3-year period during which buprenorphine-naloxone programming began (2012 to 2014).
Evaluation of 6 remote First Nations community-based buprenorphine programs in northwestern Ontario

statistic be included in the program evaluation, but our mandate did not extend to examining associated individual factors, such as concurrent opioid use or demographic information. We cannot therefore attribute a causal relationship between the reduction in suicides and addiction treatment programming. The success of the programs runs counter to current knowledge about medication, patient, and treatment factors that affect treatment retention. Systematic reviews have demonstrated that buprenorphine has lower treatment retention rates than methadone does. Yet Sioux Lookout patients required rather low buprenorphine-naloxone doses of 6.0 mg at 18 months (the usual therapeutic range is 8 to 16 mg) and have retention rates of 78% at the 1-year mark. In some communities, this could be because participants were not daily users and therefore had a lower degree of physical dependence. Despite this, we know anecdotally that in several of the communities included in this study, there were histories of daily intravenous opioid use for greater than 5 years. Further, many Sioux Lookout region patients have characteristics that have been associated with poor outcomes. Our clinical impression is that community members use illicit opioids often purchased from drug dealers, rather than oral opioids acquired from physicians’ prescriptions; illicit opioid users have higher rates of treatment dropout than oral prescription opioid users do. 19,20

Figure 1. Distribution of participants over time and at each 6-month retention evaluation point

Figure 2. Retained participants and dropouts in the buprenorphine-naloxone program at 6-month intervals: Because participants entered the program at different times, not all retained participants had completed more than 6 months of treatment at the time of data collection. Most dropouts occurred in the first 6 months.

Figure 3. Timing of dropouts from the buprenorphine-naloxone programs
20 patients start taking buprenorphine-naloxone on the inductees. Psychosocial treatment programs lack formal training in opioid substitution therapy. A typical program, the primary relationship is between the patient’s family and community.

Other considerations

Despite these limitations, the results are most likely valid because they are consistent with other clinical observations and the observations of other communities. Currently, the primary care physician who prescribes buprenorphine-naloxone patients on top of community-wide “welcoming back” of addicted patients are on the World Health Organization list of essential medications. This is very disturbing given that the opioid crisis is entering its 20th year, First Nations communities have been devastated by the crisis, and buprenorphine-naloxone is an inexpensive and highly effective intervention.

Our findings have presented the successful outcomes of community-based opioid dependence treatment programs in 6 remote First Nations communities. Despite many obstacles, these community-driven initiatives have creatively begun to address crippling levels of addiction. The addiction rates of First Nations youth are on the World Health Organization list of essential medications. The addiction rates of First Nations youth are on the World Health Organization list of essential medications.

Conclusion

We have presented the successful outcomes of community-based opioid dependence treatment programs in 6 remote First Nations communities. Despite many obstacles, these community-driven initiatives have creatively begun to address crippling levels of addiction. The addiction rates of First Nations youth are on the World Health Organization list of essential medications.

Of note, the buprenorphine-naloxone program:

- allows other First Nations communities to establish their own programs, perhaps with long-distance training, and mentorship from Sioux Lookout community physicians and community leaders.

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Systematic Literature Review on Buprenorphine/naloxone Use in Outpatient Opioid Dependence Treatment

Fiona Main, MD, CCFP, Len Kelly, MD, M Clin Sci, CCFP FRCPC

ABSTRACT

Objective: Summarize the literature on buprenorphine/naloxone for outpatient treatment of opioid dependence disorder. Methods: a literature of EMBASE and Medline 2000-2014 using the terms “naloxone + buprenorphine” and “opioid-related disorders”. Results: Over two hundred articles were retrieved. Seventeen studies were ultimately selected and reviewed for study quality, using Downs and Black’s 1998 checklist, the Canadian Task Force on Preventive Health Care levels of evidence and study outcome analysis. Conclusion: Buprenorphine/naloxone appears to be a safe, effective treatment modality for treatment of opioid dependence. As a recently introduced medication in North America, clinicians are slow to fully embrace its use. It provides an opportunity to more widely provide opioid substitution therapy in primary care settings. Key words: addiction, opioid substitution therapy, buprenorphine/naloxone, outpatient.

INTRODUCTION

The introduction in the last decade of buprenorphine/naloxone to the choice of treatment for opioid dependence is reflected in new types of treatment options and research opportunities. With a recognized safety profile, less monitoring and even ‘home starts’, it allows for outpatient management of substitution therapy where indicated. A relevant research base is developing. In this literature review, we explore the outpatient use of the combination medication buprenorphine/naloxone.

METHOD

A search of the literature from Jan 2000- July 2014 was conducted on EMBASE and Medline databases using the terms “naloxone + buprenorphine” and “opioid-related disorders”. This yielded a total of 234 studies. Reference lists of review papers were also reviewed for relevant articles. The abstracts of all studies were reviewed and studies selected for original research on the outpatient use of buprenorphine/naloxone maintenance treatment for addiction. Studies looking at pregnant or HIV-positive populations, and those dealing with buprenorphine/naloxone induction or inpatient treatment were excluded. Seventeen studies were ultimately selected and reviewed for study quality, using Downs and Black’s 1998 checklist, the Canadian Task Force on Preventive Health Care levels of evidence and study outcome analysis.

RESULTS

STUDY CHARACTERISTICS

The characteristics in the studies included are summarized in Table 1. The vast majority of studies had a predominance of male participants. Eleven/17 data sets specified type of opioid used (heroin vs. prescription opioids). Of these, three studies included only heroin users, four included a majority of heroin users, and four included a majority of prescription opioid users. Eleven/17 studies specified the race of their participants. In these 11 studies, 25-54% of participants were white, with the most common other races being African American and Hispanic. No studies identified Aboriginal participants. Fifteen/17 studies were conducted in the United States, and none in Canada. All studies were primarily conducted in urban settings.

Many studies had exclusion criteria for those suffering from serious medical and psychiatric illness, including comorbid addiction with alcohol.

TREATMENT

Treatment in these studies was administered by a variety of medical specialties including family medicine. A combination of buprenorphine/naloxone, as opposed to buprenorphine alone, was used in all 17 of the studies.

RETENTION RATES

Major outcomes are summarized in Table 2. The most common length of time reported for retention was six months. At six months, from 36-98% of patients were retained in treatment with buprenorphine/naloxone.1-5 A study reported sobriety rather than retention as primary outcome, and 53% were sober at six months.8 At 12 months, between 23-77% of patients were retained in treatment.9-13

ABSTINENCE FROM OPIOIDS

In general, studies did not require abstinence from opioids in patients in order to continue treatment. The percentage of opioid negative urines was reported either as an average of the entire study period, or at the end point of the study. Between 40-85% of urine samples were free of opioids at six month end points.13-14 There appeared to be positive correlation between observer rated abstinence and urine results.13

QUALITY OF LIFE MEASUREMENTS

Several studies showed significant improvement in quality of life and addiction related behavior during and after buprenorphine/naloxone treatment.15-19 No studies which examined these outcomes found negative results.

EFFECTS DURING FOLLOW-UP

Relatively few follow up results suggesting long term efficacy of treatment are available. Several studies examined different durations of treatment followed by tapering, meaning that patient were all off buprenorphine/naloxone when followed up. One study found that patients treated with buprenorphine/naloxone and tapered off during the study were more likely to be in addiction treatment when followed up, compared to those treated and tapered off methadone.15 This may be secondary to a shorter retention duration compared to methadone and/or a high satisfaction with buprenorphine/naloxone treatment. One high qualityRCT comparing a two-week maintenance and taper to a 12-week maintenance and taper found that overall only 8.6% of tapered individuals maintained abstinence at follow up.16 Two studies of longer maintenance treatments have shown varied retention rates demonstrated that of individuals who successfully completed six months of treatment with buprenorphine/naloxone, 3% were retained in treatment two years later.10-12 An observational study found that of individuals who successfully completed 12 months of treatment, 77% were still in treatment a minimum of 18 months later.13

FACTORS PREDICTING SUCCESS

Several pre-existing patient factors were found to predict successful retention and abstinence during the studies. These factors are summarized in Table 3. The most common variable found to positively predict success was older age, both at time of treatment and at time of opioid dependence onset.1-5,13 Drug of choice was also a significant variable, with four studies finding that prescription drug users, rather than heroin users, had more successful outcomes.1-5,13,19 Prescription drug users on average may be younger, have fewer years of opioid dependence, and less addiction treatment in their past.1,3 Specifically, use of illicit buprenorphine and methadone may be a positive variable predicting success.15 One study found that comorbid alcohol abuse may predict failure with buprenorphine/naloxone treatment.9

Race may be a variable affecting outcome, as two studies found that African American or Hispanic race negatively affected treatment success, while controlling for other variables.13,14 Route of drug abuse was also a significant variable in three studies, with two finding that non-intravenous (IV) drug users had more positive outcomes, and a third finding that recent IV drug user predicted success.15,16 The latter study was conducted with youth aged 15-21, and intravenous drug use was thought to correlate with more self perceived severity of illness and willingness to comply with treatment.16

Although sufferers of severe mental or physical illness were often excluded from these studies, several times patients with chronic mental or physical conditions were noted to have superior outcomes.1-5,19 It may be that these benefits benefit more from analogic properties of buprenorphine/naloxone and mental stabilization secondary to treatment. As expected, variables suggesting stability such as employment, marriage or long term relationship, and not being homeless are also predictors of treatment success.15 In one study, history of incarceration was found to not significantly influence outcomes.10
In-treatment variables, which have been thoroughly studied, involve degree and type of psychosocial support provided. A Cochrane Review of 27 studies showed that there was no benefit of additional psychosocial intervention over standard maintenance treatment, in any outcome measured.56 The control maintenance treatment in the studies in this Cochrane review all included some degree of counseling service. There does not seem to be any additional benefit offered by more intensive therapy, when retention, abstinence and success at follow-up are measured.48 Warden (2012) also found that youth who successfully abstained from illicit drugs during the first two weeks of treatment were much more likely to be retained for the study duration.49 Particularly given the safety of buprenorphine/naloxone induction, these findings recommend higher doses during the induction period.60

**ADVERSE EFFECTS/MORTALITY**

Adverse effects secondary to treatment were reported in the majority of studies reviewed, although not compared statistically. No significant or fatal increase in adverse events with buprenorphine/naloxone compared to other treatments was reported.

Although community-level harms such as crime related to opioid dependence are well documented, no studies were found which examined the impact of maintenance treatment on these outcomes.47

**DISCUSSION**

The documentation of the safety of the combination of buprenorphine/naloxone is developing. It can also be assumed from the literature on single agent buprenorphine. A review of buprenorphine from France revealed over a four year period, the risk of overdose attributable to buprenorphine was 10 times less than that attributable to methadone.55 Overall, opioid dependence studies have found much lower risk of death for those in maintenance treatment with buprenorphine or methadone, compared to those not in treatment.49 One buprenorphine study revealed that a shocking 4 of 20 patients in placebo control group died over the one year study period, compared to no deaths in the treatment group.66 Buprenorphine/naloxone seems well suited to substitution therapy with prescription drug use,54 particularly with patients who have not progressed to intravenous drug use.55-57

**CONCLUSION**

Since approval in the USA in 2002 and Canada in 2007, buprenorphine/naloxone is safely meeting a need for outpatient management of opioid dependence. Research in its first decade of use has rendered a useful picture of its use in community-based programs. While impatient programs will always be needed for complex cases and treatment. Primary care and outpatient treatment of opioid dependence is facilitated by the safety and efficacy of buprenorphine/naloxone. Primary care settings allow for easy access for co-morbid conditions and even other accompanying family members.

Research capacity, prescribing and treatment continuing medical education pose the next challenges in primary care leadership in treatment of opioid dependence in the community.

The literature demonstrates the safety and efficacy of buprenorphine/naloxone. This evidence supports the increased use of this treatment modality for treatment of opioid dependence in the outpatient setting.

**TABLE 1: STUDY CHARACTERISTICS**

<table>
<thead>
<tr>
<th>STUDY</th>
<th>DOWNS &amp; BLACK QUALITY SCORE</th>
<th>NUMBER/Trial TYPE</th>
<th>LEVEL OF EVIDENCE</th>
<th>PARTICIPANTS</th>
<th>TYPE OF USERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amato 2000</td>
<td>17</td>
<td>78, prospective, non-interventional</td>
<td>II</td>
<td>no race, Italy, urban</td>
<td>heroin</td>
</tr>
<tr>
<td>Apelt 2013</td>
<td>19</td>
<td>34, prospective, non-interventional</td>
<td>II</td>
<td>no race specified, Germany, likely urban</td>
<td>all were in maintenance tx already, type of opioid use not distinguished</td>
</tr>
<tr>
<td>Bell 2017</td>
<td>20</td>
<td>119, RCT</td>
<td>I</td>
<td>no race specified, Australia, likely urban</td>
<td>heroin only</td>
</tr>
<tr>
<td>Cunningham 2008</td>
<td>14</td>
<td>41, retrospective</td>
<td>II</td>
<td>90% non-white, urban, US</td>
<td>70% heroin</td>
</tr>
<tr>
<td>Curciro 2013</td>
<td>15</td>
<td>707 BP and 3105 MT, cohort</td>
<td>II</td>
<td>no race, urban, Italy</td>
<td></td>
</tr>
<tr>
<td>Dreifuss 2013/Weiss 2011</td>
<td>19/21</td>
<td>310, RCT</td>
<td>I</td>
<td>90% white, urban, US</td>
<td>less than 1% were heroin users</td>
</tr>
</tbody>
</table>

**TABLE 2: STUDY OUTCOMES**

<table>
<thead>
<tr>
<th>STUDY</th>
<th>RETENTION AT END OF STUDY</th>
<th>ABSTINENCE</th>
<th>RESULTS AT FOLLOW UP</th>
<th>OTHER OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apelt 2013</td>
<td>57.1% at 12 mos</td>
<td>98% negative urine for opioid at final assessment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bell 2007</td>
<td>59% at 3 mos</td>
<td>self-reported, 52% reported no use in past 3 mos</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cunningham 2008</td>
<td>71% at 3 mos</td>
<td>76% negative urines overall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curciro 2011</td>
<td>71%</td>
<td>79% negative urines overall</td>
<td>Those on BP had significantly lower risk of death during induction; but treatment risk and post-treatment risk was similar</td>
<td></td>
</tr>
<tr>
<td>Dreifuss 2013/Weiss 2011</td>
<td>49% at 3 mos</td>
<td>61% negative urines overall</td>
<td>8 weeks after taper; 8% continued abstinence</td>
<td></td>
</tr>
<tr>
<td>Fiellin 2006 and 2008/Moore 2007/Wang 2011</td>
<td>70% at 6 mos</td>
<td>40% negative urines overall</td>
<td>38% of those retained at 6 mos were retained at 2 years, with 96% opioid free urines</td>
<td></td>
</tr>
<tr>
<td>Fiellin 2006 and 2008/Moore 2007/Wang 2011</td>
<td>53% at 6 mos</td>
<td>54% neg urine at six mos</td>
<td>Serum transaminases were followed with no significant adverse effects</td>
<td></td>
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<thead>
<tr>
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<th>ABSTINENCE</th>
<th>RESULTS AT FOLLOW UP</th>
<th>OTHER OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kakko 2003</td>
<td>75% at 12 mos</td>
<td>75% neg urine at 12 mos</td>
<td>self reported/observer reported health outcomes improved significantly</td>
<td></td>
</tr>
<tr>
<td>Kakko 2007</td>
<td>78% at 6 mos</td>
<td>80% neg urine at six mos</td>
<td>4/10 died in control group. Tx group showed sig improvement in addiction severity index</td>
<td></td>
</tr>
<tr>
<td>Mintzer 2007</td>
<td>54% ‘ sober’ at 6 mos- urine free of opioids</td>
<td>Presence of psychiatric illness not a significant predictor of tx outcome.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miotto 2012</td>
<td>35% at 5 mos, 25% at 12 mos</td>
<td>opioid use ‘ decreased’ but no numbers given</td>
<td>85% of completers had no opioid neg urines</td>
<td></td>
</tr>
<tr>
<td>Neumann 2013</td>
<td>37.7% at 6 mos</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nielsen 2013/Ling 2009</td>
<td>42% were urine opioid neg after taper, with no benefit to longer taper</td>
<td>12% negative urines after 3 mos post taper</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parran 2010</td>
<td></td>
<td>77% of those retained at 12 mos remained on tx 18-42 mos later</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Woody 2008/Polsky 2010/Subramaniam 2011/Warden 2012</td>
<td>70% at 12 weeks</td>
<td>all tapered, 66% nega- tive urines at 12 mos</td>
<td>Those who remained on bup had less substance use, fewer psychosocial complications of addiction, more AA affiliation activities, and increased employment at follow-up</td>
<td></td>
</tr>
<tr>
<td>Potter 2013</td>
<td>46% at 6 mos</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stancill 2012</td>
<td>42% at 6 mos</td>
<td></td>
<td></td>
<td></td>
</tr>
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</table>

### TABLE 3: PREDICTORS OF OUTCOMES

<table>
<thead>
<tr>
<th>STUDY</th>
<th>Predictor</th>
<th>Success</th>
<th>Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woody 2008/Polsky 2010/Subramaniam 2011/Warden 2012</td>
<td>Recent DX, active medical or psychiatric condition, use of medications, early abstinence during study, non-heroin drug use</td>
<td>Older age, African American</td>
<td></td>
</tr>
<tr>
<td>Potter 2013</td>
<td>Opioid analgesic users as opposed to heroin or combined users. Non-injectors compared to injectees.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stancill 2012</td>
<td>African American race, not influenced by BZP drug of choice</td>
<td></td>
<td></td>
</tr>
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</table>

### REFERENCES

Buprenorphine-naloxone use in pregnancy for treatment of opioid dependence

Retrospective cohort study of 30 patients

Joe Dooley MD CCFP FCFP  Lianne Gerber-Finn MD CCFP  Irwin Antone MD CCFP FCFP  John Guilfoyle MD MClSc FCFP FRRM  Brittany Blakelock  Jazmyn Balfour-Boehm  Wilma M. Hopman MAB  Naana Jumah MD DMJ Palmc  Len Kelly MD MCI CS FCP FRCP

Research

Abstract

Objective To examine the maternal course and neonatal outcomes for women using buprenorphine-naloxone for opioid dependence in pregnancy.

Design Retrospective cohort study comparing outcomes for the group of pregnant patients exposed to buprenorphine-naloxone with outcomes for those exposed to other narcotics and those not exposed to narcotics.

Setting Northwestern Ontario obstetric program.

Participants A total of 640 births in an 18-month period from July 1, 2013, to January 1, 2015.

Main outcome measures Maternal outcomes included route of delivery, medical and surgical complications, out-of-hospital deliveries, change in illicit drug use, and length of stay. Neonatal outcomes included stillbirths, incidence and severity of neonatal abstinence syndrome, birth weight, gestational age, Apgar scores, and incidence of congenital abnormalities.

Results Thirty pregnant women used buprenorphine-naloxone for a mean (SD) of 18.8 (11.2) weeks; an additional 134 patients were exposed to other opioids and those not exposed to opioids. Maternal and neonatal outcomes were generally similar to those of pregnancies exposed to buprenorphine-naloxone. Switching to another agonist maintenance treatments versus conventional methadone maintenance in heroin dependence: A randomized controlled trial. Am J Psychiatry. 2007;164(5):797-803.


Buprenorphine-naloxone is a commonly used maintenance medication for nonpregnant women with opioid dependence. It has been demonstrated to be effective and safe, and opioid agonists in outpatient and primary care settings. Recent evidence shows that buprenorphine is equivalent or superior to methadone in managing opioid dependence in women, and the use of the combination of buprenorphine-naloxone and naloxone in pregnancy is limited by concern about fetal exposure and possible withdrawal from the naloxone component of this medication.

Changing a pregnant woman’s opioid to single-agent buprenorphine requires sending written requests to Health Canada and the manufacturer, and it is usually necessary to provide a full account of the medication before the request is approved. Because buprenorphine is not approved by Health Canada, the physician must receive and store the medication, rather than use commercial pharmacies. The alternative is a long-acting model of preparation, which has been commonly used in our integrated pregnancy program (IPP). If the patient and physician decide to change from the prepregnancy maintenance use of buprenorphine-naloxone to another agent, there might be a prolonged delay for administrative reasons, or the patient might decide to continue taking buprenorphine-naloxone. The IPP is a multidisciplinary program supporting pregnant women, their partners, and their family members, with or without additions. It is a hospital outpatient clinic with nurses, counselors, physicians, and lactation consultants.

The program has women from remote communities come to Sioux Lookout, Ont, for consultations during pregnancy and confinement for delivery. The program strives to provide comprehensive care to the family as a unit, including opioid-dependence treatment if needed. Opioid exposure during pregnancy occurs in up to 28% of pregnancies in our region. Harm reduction strategies include narcotic weaning in pregnancy to reduce the incidence of neonatal abstinence syndrome (NAS), as well as opioid-substitution therapy. The IPP program coordinates opioid-substitution therapy and aftercare with remote community-based addiction programs, which often involve use of buprenorphine-naloxone. This study documents a cohort of women using buprenorphine-naloxone during pregnancy and describes the course and outcomes of their pregnancies.

METHODS

In this retrospective cohort study, maternal and neonatal outcomes were collected from the Sioux Lookout Meno Ya Win Health Centre IPP program and from obstetric program and hospital records between July 1, 2013, and January 1, 2015, on all births beyond 20 weeks. Primary neonatal outcomes were incidence of congenital anomalies, stillbirths, birth weight, gestational age, Apgar scores, and incidence of NAS. Primary maternal outcomes included out-of-hospital deliveries, medical and surgical complications, route and time of delivery, change in illicit drug use, and length of stay.

Data were analyzed using Excel and SPSS, and analyses included paired t-tests for continuous data and Pearson χ² or Fisher exact tests, as appropriate, for categorical data. The study group was women exposed to buprenorphine-naloxone during pregnancy. Two comparison groups included pregnant women exposed to other narcotics during the same period and pregnant women not exposed to opioids. We used the nonexposed group as a normal control group and the group exposed to other narcotics to observe any outcomes in narcotic-exposed pregnancies that might vary as a result of exposure to buprenorphine-naloxone in particular. Ethics approval was granted by the Sioux Lookout Meno Ya Win Health Centre Research Review and Ethics Committee.

RESULTS

We collected data from all 640 deliveries from July 1, 2013, to January 1, 2015. There was a total of 164 narcotic-exposed pregnancies (25.6%), including 30 patients taking buprenorphine-naloxone at the commencement of their pregnancy (Table 1). The 164 patients in the narcotic-exposed group includes 34 patients who were taking opioid-replacement therapy at the time of conception (30 taking buprenorphine-naloxone and 4 taking other opioid agents) and 130 patients who were solely using illicit narcotics. Of the total group of narcotic-exposed (prescribed and illicit) pregnancies, all were offered opioid maintenance therapy and tapering during their pregnancy. Of the combined 164 narcotic-exposed pregnancies, 56 (34.1%) decreased their dose of illicit narcotics and 73 (44.5%) had quit by the time of delivery. For those women who reported taking illicit drugs at the time of delivery, our study did not provide evidence of care testing and confirmatory chromatography urine drug screening. The group-specific rates of illicit narcotic use at delivery are listed in Table 2. All women took buprenorphine-naloxone throughout their pregnancies and they had results similar to the nonexposed pregnancies, but also included 1 mild case of NAS and 1 postpartum hemorrhage. Three of these 5 had quit using any additional illicit drugs at the time of delivery, and opioid maintenance for all 5 was managed with an average of 4 mg (range 1 to 6 mg) of buprenorphine-naloxone at delivery. There were no cases of congenital anomalies or stillbirths among these 5 patients.

The larger group of women exposed to buprenorphine-naloxone (n = 40) were compared to the pregnant women (n = 614), with the results described above, excluded the medication for a mean (SD) of 18.8 (11.2) weeks (Table 2). The mean (SD) exposure time was lower at 15.9 (8.58) weeks if the 5 women who remained on the medication throughout their pregnancies were excluded. The comparison group exposed to other opioids (n = 134) was composed primarily of 130 patients not taking pregabarrapine substitution therapy, including 65 patients who managed their dependence during pregnancy.

Table 1. Maternal characteristics and outcomes

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>BUPRENORPHINE-NALOXONE</th>
<th>OTHER OPIODS</th>
<th>p VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (SD) age, y</td>
<td>26.1 (4.03)</td>
<td>25.4 (5.65)</td>
<td>.442</td>
</tr>
<tr>
<td>Mean (SD) gravidity</td>
<td>4.4 (2.50)</td>
<td>3.9 (2.03)</td>
<td>.240</td>
</tr>
<tr>
<td>Mean (SD) time taking buprenorphine-naloxone, wk</td>
<td>18.8 (11.20)</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Initial mean (SD) dose of buprenorphine-naloxone, mg</td>
<td>5.2 (6.20)</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Smoker, n (%)</td>
<td>25 (83.3)</td>
<td>113 (83.4%)</td>
<td>.893</td>
</tr>
<tr>
<td>Alcohol use, n (%)</td>
<td>6 (20.0)</td>
<td>32 (23.9)</td>
<td>.649</td>
</tr>
<tr>
<td>Type 2 diabetes, n (%)</td>
<td>2 (6.7)</td>
<td>3 (2.2)</td>
<td>.227</td>
</tr>
<tr>
<td>Hypertension, n (%)</td>
<td>3 (10.0)</td>
<td>8 (6.0)</td>
<td>.424</td>
</tr>
<tr>
<td>Hepatitis C, n (%)</td>
<td>1 (3.3)</td>
<td>7 (5.2)</td>
<td>.517</td>
</tr>
<tr>
<td>History of depression, n (%)</td>
<td>6 (20.0)</td>
<td>69 (55.0)</td>
<td>.014</td>
</tr>
<tr>
<td>Urine positive for THC, n (%)</td>
<td>4 (13.3)</td>
<td>35 (26.1)</td>
<td>.137</td>
</tr>
<tr>
<td>Gestational diabetes, n (%)</td>
<td>3 (10.0)</td>
<td>13 (9.7)</td>
<td>.960</td>
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<tr>
<td>Mean (SD) gestational age, wk</td>
<td>38.9 (1.48)</td>
<td>38.6 (1.60)</td>
<td>.348</td>
</tr>
<tr>
<td>Cesarean section, n (%)</td>
<td>5 (16.7)</td>
<td>35 (26.1)</td>
<td>.276</td>
</tr>
<tr>
<td>Postpartum hemorrhage, n (%)</td>
<td>3 (10.0)</td>
<td>10 (7.5)</td>
<td>.708</td>
</tr>
<tr>
<td>Mean (SD) LOS, d</td>
<td>3.0 (1.63)</td>
<td>2.7 (1.71)</td>
<td>.382</td>
</tr>
<tr>
<td>Out-of-hospital delivery, n (%)</td>
<td>1 (3.3)</td>
<td>3 (2.2)</td>
<td>.558</td>
</tr>
</tbody>
</table>

LOS—length of stay, THC—tetrahydrocannabinol.
Buprenorphine-naloxone use in pregnancy for treatment of opioid dependence | Research

Illicit sources and declined ongoing offers of prescribed medication.

Neonatal outcomes were similar between the 3 groups with the exception of the expected clinically insignificant lower birth weights among the pregnancies exposed to other opioids (Table 3).

Our study found that, within the context of an established prenatal program that values opioid tapering to decrease NAS, buprenorphine-naloxone is safely used in pregnancy. We also found that pregnancies exposed to buprenorphine-naloxone had significantly longer (normal) birth weights than pregnancies exposed to other narcotics and methadone, and medical patients taking buprenorphine-naloxone were able to cease illicit opioid use in pregnancy. We demonstrated very few differences among our neonatal outcomes in term of route and time of delivery and medical and con genital anomalies. It also did not record the length of time or initiation point for maintenance in the pregnancy. The taper in the group was a result of patient and doctor decision. In the non exposed group a clear signal that buprenorphine-naloxone therapy is about to find its place in opioid-dependence treatment in pregnancy.

Our comparison groups were not chosen to systematically show the effect of outcomes of buprenorphine-naloxone exposure in pregnancy, but to demonstrate its place in an obstetric program dealing with a heavy load of opioid dependent women. The buprenorphine-naloxone cohort in our study was heterogeneous, as its members underwent medication switching and tapering as clinically indicated or preferred by the patient throughout pregnancy. Despite this limitation, we did believe it was useful to describe this reasonably sized prospective cohort who took buprenorphine-naloxone during the first trimester of their pregnancies, even without an ideal comparison group.

We demonstrated very few differences among our comparison groups in this study. Because the group exposed to methadone had other narcotic co-users with diverse reasons for opting out of opioid-maintenance medication programs, the authors found outcomes similar to those for patients taking methadone or single-agent buprenorphine.

Another 2015 study compared 31 mother-neonate dyads treated with buprenorphine-naloxone with a similar number of pregnancies treated with methadone maintenance. They demonstrated a 50% reduction in the incidence of NAS and an equal reduction in the length of stay for the buprenorphine-naloxone treated group.

The average dose of buprenorphine-naloxone in this study was 14.4 mg, higher than our 9.2 mg average dose, but our dose was a maintenance dose for women already stable on the medication, not an induction dose. This study did not undertake narcotic weaning during the pregnancies and excluded any births with congenital abnormalities. It also did not record the length of time or initiation point for maintenance in the pregnancy. The buprenorphine-naloxone treatment in the nonexposed group gives a clear signal that buprenorphine-naloxone therapy is about to find its place in opioid-dependence treatment in pregnancy.

Rates of smoking were very high in both narcotic-exposed groups (more than 80%) and remained substantial in the nonexposed group as well (more than 50%), as has been seen in other studies in our region. The finding that more of the women taking buprenorphine-naloxone quit illicit narcotic use (P < .001) likely reflects that the comparison group included a large number of patients who declined opioid substitution and tapering rather than any inherent attributes of the medication itself. Many in the comparison group chose to maintain their own approach to opioid dependence rather than accept prescribed opioid-substitution therapy, although more than 30% of them did quit illicit narcotics (Table 2).

The mean length of stay in both groups of opioid-exposed pregnancies is quite short, at 3 days or less. This contrasts with a recent study of methadone-maintained pregnancies with a mean stay of 15 days.45 Many of our patients live in remote communities and stay in a hotel located next to the hospital. They are able to be seen daily as outpatients and some have maternal and neonatal outpatient dispensing of opioid-withdrawal medications in that setting. This study included a limited way the safety of buprenorphine-naloxone in pregnancy. Because the drug is useful for its resistance to diversion to intravenous abuse and its opioid agonist component has a superior NAS profile than methadone, this combination medication might be a very useful medication in pregnancies complicated by opioid use disorder.46

Our outcomes are within the context of an established prenatal program that values opioid tapering to decrease incidence of NAS. This treatment goal would affect the outcomes of both opioid comparison groups, although perhaps not equally, owing to patient preference.

The opioid-exposed control and comparison groups were not homogeneous. This intention-to-treat prospective design follows all patients, whether or not they accepted prescribed maintenance therapy before pregnancy, and many declined any substitution therapy during the pregnancy. In particular, most of those exposed to opioids other than buprenorphine-naloxone were not taking maintenance therapy before pregnancy, and many declined any substitution therapy during the pregnancy. It would stand to reason that they would have the greatest opioid-related effects and the lowest birth weights, which they did.

Small sample sizes such as those in our study are inadequate to comment on rare outcomes such as congenital anomalies, which would be the outcome of interest when examining medication exposure during the organogenesis period of the first trimester.

In a vast geographically dispersed region such as northwestern Ontario (which is more than France), access to all commodities, including drugs of abuse, is intermittent. Both opioid-exposed groups had participants with ongoing illicit opioid use (20.0% of the buprenorphine-naloxone group and 63.4% of the group exposed to other opioids). We do not know the extent or effects of this withdrawal cycle experienced by ongoing illicit users resulting from variable availability of illicit opioids in these remote communities, many of which do not have road access.

Our outcomes are within the context of an established prenatal program that values opioid tapering to decrease incidence of NAS. This treatment goal would affect the outcomes of both opioid comparison groups, although perhaps not equally, owing to patient preference.

Conclusion

Buprenorphine-naloxone appears to be safe in pregnancy. Larger prospective studies are warranted to understand the role it can play in the complex behavioural and chemical aspects of managing opioid use disorders in pregnancy. This study describes a pregnant patient to a different opioid agonist that has greater abuse potential might not be necessary.

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INTRODUCTION

Opioid dependence in pregnancy is an increasingly common occurrence in rural and remote areas such as Northwestern Ontario.

BMJ Open

Observational study of the safety of buprenorphine+naloxone in pregnancy in a rural and remote population

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Opioid misuse is an epidemic in rural and remote areas of Northwestern Ontario, Canada, with up to 30% of women exposed during pregnancy. Community-based buprenorphine-naloxone programs have engaged many rural women in treatment programmes who otherwise would not receive care. This is the largest cohort of women exposed to buprenorphine-naloxone in pregnancy and contains detailed information about the daily dose, cumulative dose and exposure time with respect to each trimester of pregnancy. While 62 women had exposure to buprenorphine+naloxone in pregnancy, only 3 women had opioid exposure other than buprenorphine+naloxone (n=159). Women were included if they had multiple pregnancy or if they were part of a methadone programme (n=16). The majority of women came from Indigenous communities.

Outcomes: The primary outcomes were birth weight, preterm delivery, congenital anomalies and stillbirth. Secondary neonatal outcomes included gestational age at delivery. Agap scores at 1 and 5 min, NAS Score >7 and treatment for neonatal abstinence syndrome (NAS). Secondary maternal outcomes included the number of caesarian sections, postpartum haemorrhages, out of hospital deliveries and transfer of care to tertiary centres.

Research strengths and limitations

A retrospective cohort study was conducted of 855 mother-infant dyads between 1 July 2013 and 30 June 2015. Cases included all women who had exposure to buprenorphine-naloxone during pregnancy (n=62); 2 control groups were identified; the first included women with no opioid exposure in pregnancy (n=618) and the second included women with opioid exposure other than buprenorphine+naloxone (n=159). Women were included if they had multiple pregnancy or if they were part of a methadone programme (n=16). The majority of women came from Indigenous communities.

Conclusions: The prospective study set in Northwestern Ontario...
communities in order to provide access to treatment in areas with high rates of opioid dependence and no access to methadone.\textsuperscript{3} The WHO and several national Obstetrics and Gynaecology associations recommend that, when pregnancy is diagnosed, women participating in a buprenorphine+naloxone treatment programme switch to the buprenorphine mono-product because the safety of buprenorphine+naloxone has not been demonstrated in pregnancy.\textsuperscript{4, 5} A multicentre randomised controlled trial showed that buprenorphine alone has similar pregnancy outcomes and decreased severity of neonatal abstinence syndrome compared to methadone.\textsuperscript{6} Naloxone was added to buprenorphine as a deterrent to illicit use as it precipitates withdrawal from opioids when administered intravenously or intranasally but not via the buccal or sublingual routes.\textsuperscript{7, 8} Precipitated withdrawal has been shown to result in adverse pregnancy outcomes.\textsuperscript{9, 10} The caution against using buprenorphine+naloxone in pregnancy is not limited to concerns for withdrawal but also possible teratogenicity. However, to date, there have been no reports of teratogenicity in humans or animals.\textsuperscript{11} Congenital anomalies are only one marker of drug safety in pregnancy. The live birth rate, spontaneous abortion rate and stillbirth rate are also markers of safety, and among live births, preterm delivery, low birth weight and functional deficits are factors that may be affected by a medication.\textsuperscript{12} Further, the severity of pregnancy outcomes may be modified by the duration and intensity of the exposure to the medication. The buprenorphine mono-product is available only through a special access programme. In our setting, women are counselled to transition from buprenorphine+naloxone to either buprenorphine or long-acting morphine when they present for antenatal care. As a result of delays in obtaining buprenorphine through the special access programme, many women are exposed to buprenorphine+naloxone during early pregnancy and into the second trimester. In addition, for personal reasons, some women opt to remain on buprenorphine+naloxone throughout their pregnancy. This study documents the pregnancy outcomes of a cohort of women from rural and remote communities in Northwestern Ontario who continued to take buprenorphine+naloxone treatment during pregnancy as part of a community-based treatment programme.

METHODS

Participants

Maternal and neonatal data were collected from outpatient antenatal clinic records and inpatient medical records for all pregnancies between 1 July 2010 and 31 July 2015. Cases included all women who had exposure to buprenorphine+naloxone during pregnancy. Two control groups were identified; the first included women with no opioid exposure in pregnancy and the second included women with opioid exposure other than buprenorphine+naloxone. All women who were receiving opioid agonist treatment with buprenorphine+naloxone were advised to switch to the buprenorphine mono-product when available, once pregnancy was diagnosed as per national guidelines.\textsuperscript{2} Cases represent those women who elected to stay on buprenorphine+naloxone during their pregnancy. Women were excluded if they had a multiple pregnancy or were taking methadone as part of a treatment programme. All infants room-in with their mothers after delivery unless there was a medical or safety reason that precluded rooming-in. The majority of women came from Indigenous communities.

Data collection

A standard case report form was used to collect maternal and neonatal data. The maternal case report form contained information on the health and pregnancy history; smoking, drug and alcohol exposure; and intrapartum data. Smoking was defined by self-reported daily use of cigarettes and was further characterised by the number of cigarettes smoked per day. Alcohol and drug exposure were determined by self-report. Drug exposure was characterised further by urine drug screen results. The neonatal case report form contained information on birth weight, gestational age, Apgar, congenital anomalies and stillbirths.

The primary outcomes for the study was an assessment of the safety of buprenorphine+naloxone, including birth weight, preterm delivery (delivery prior to 37 +0 weeks gestational age), congenital anomalies and stillbirth. Secondary neonatal outcomes included gestational age at delivery, Apgar scores at 1 and 5 min, NAS Score >7 and treatment for NAS (two or more NAS Scores that are >7). NAS Scores were calculated using a modified Finnegan Scale at the bedside by nurses who have been trained to use this measure. Secondary maternal outcomes included the number of caesarean sections, post-partum haemorrhages, out of hospital deliveries and transfer of care to tertiary centres.

Statistical analysis

Categorical variables are presented as percentages while continuous variables are presented as a mean with SD. We compared cases to controls using a t-test for continuous variables and a Pearson $\chi^2$ test of independence or a Fisher’s Exact test, as appropriate, for categorical data. ORs are presented with the 95% CI. Data analysis was performed with SPSS statistical software V.20 (SPSS, Chicago, Illinois, USA) and Microsoft Excel V14.1.0 (Microsoft Corp, Redmond, Washington, USA). A $p$ value<0.05 indicated statistical significance.

Ethics

Ethics approval was granted by the Sioux Lookout Meno Ya Win Health Centre Research Review and Ethics Committee.

RESULTS

A total of 855 consecutive singleton births were included in the study, of these, 62 had exposure to buprenorphine+naloxone, 618 had no opioid exposure and 139 used illicit opioids during the pregnancy (figure 1). Sixteen women were excluded due to participation in a methadone treatment programme. Twenty-five women were excluded due to a multiple pregnancy. Maternal characteristics are described in table 1. The overall rate of opioid exposure in pregnancy is 27.8%. Data on the racial and ethnic make-up of our study participants as well as data on educational attainment were not collected. Previous studies of this population show that the majority (85%) of women are Indigenous.\textsuperscript{13} Educational attainment among Indigenous women living on reserve is low where 57% do not complete high school, 16% receive a high school diploma, 19% participate in postsecondary education and only 4% have a university degree.\textsuperscript{14} A total of 62 women had exposure to buprenorphine+naloxone in pregnancy (see figure 1). Of these women, three women continued prepregnancy buprenorphine+naloxone throughout pregnancy and after delivery. A further 48 women who were taking buprenorphine+naloxone prior to pregnancy switched to buprenorphine+naloxone after the first trimester as per national and international guidelines.\textsuperscript{15, 16} Eleven women were induced onto buprenorphine+naloxone during pregnancy, and this occurred in the first trimester for 6 women. The average daily dose of buprenorphine+naloxone was 8.2±5.8 mg. Ongoing illicit opioid use was identified in 12 women, and 27 women had positive urine drug screening. Six cases had positive urine drug screens for marijuana. No other illicit substances were identified on urine drug screening. Data were not collected for other psychoactive medications or antidepressant medications. Cases and controls were of similar age at the time of delivery. However, women who had no opioid exposure in pregnancy had fewer pregnancies and fewer births compared to cases. The OR of Hepatitis C infection for women taking buprenorphine+naloxone compared to no opioid use was OR 15.7, 95% CI 2.6 to 95.6. Women who were not on buprenorphine+naloxone but who were on methadone had significantly lower weight, gestational age, Apgars, congenital anomalies and stillbirths.

Figure 1 Patient flow chart.
taking buprenorphine+naloxone were more likely to smoke 1–5 cigarettes per day compared to women in the control groups while women continuing to use illicit opioids were more likely to be heavy smokers (>10 cigarettes per day). There was no difference in alcohol consumption between the three groups.

Prenatal patterns of substance use revealed a high number of women with polysubstance use defined as the use of at least one other illicit substance among women taking buprenorphine+naloxone (12.9%) and those continuing to use illicit opioids (35.3%) (table 2). Treatment with buprenorphine+naloxone decreased the odds of polysubstance use compared to pregnancy 0.13 (0.06 to 0.29) compared to women with ongoing illicit opioid use. The most frequent non-opioid drug of abuse was marijuana followed by cocaine (30.8%). The route of administration for women continuing to use illicit opioids during pregnancy was predominantly intravenous (67.9%) and intranasal (50.8%). Data on the primary opioid of abuse and route of administration were largely missing for women taking buprenorphine+naloxone as a result a valid comparison cannot be made.

The primary outcome of this study is the safety of in utero exposure to buprenorphine-naloxone (table 3). For the 62 women exposed to buprenorphine-naloxone during pregnancy, the duration of exposure (meanSD) was 212.9 ± 138.1 days with daily dose of 8.25 ± 5.8 mg. Among parameters used to define safety of the drug, there was no difference in the birth weight, number of preterm deliveries, number of congenital malformations or number of stillbirths in women taking buprenorphine-naloxone compared to women taking no opioids during pregnancy. Women who continued to use illicit opioids had a statistically significant reduction in birth weight of 292.2 g compared to women treated with buprenorphine+naloxone. There were no stillbirths among the cohort taking buprenorphine-naloxone, five among the women with no opioid exposure and one among the women using illicit opioids.

There were a total of five congenital malformations in the control group with no opioid exposure and none in the group with illicit opioid exposure. Two infants exposed to buprenorphine+naloxone had congenital malformations: one case of bilateral cleft palate and another case of atrial septal defect. The infant with the bilateral cleft palate had exposure to buprenorphine-naloxone from conception until the third trimester at which point the mother was switched to buprenorphine monoprod. The daily dose ranged from 2 to 4 mg, and the cumulative dose was 525 mg. There was alcohol exposure and smoking (>10 cigarettes per day) during the pregnancy but no other illicit opioids. The infant with the atrial septal defect had exposure to buprenorphine-naloxone from the first trimester until delivery. The daily dose ranged from 2 to 4 mg, and the cumulative dose was 564 mg. There was no other smoking, drug or alcohol exposure during this pregnancy; and there is no family history of congenital heart disease. Data on pre-pregnancy folate acid supplementation and prepregnancy or number of stillbirths in women taking buprenorphine

discussion

Almost one-third of the study population were exposed to opioids during pregnancy, but only 3.6% were on opioid agonist treatment prior to pregnancy. There was no evidence of teratogenicity or adverse pregnancy outcomes in a cohort of 62 women exposed to buprenorphine-naloxone during pregnancy compared to women who had no opioid exposure during pregnancy. Two cases of congenital malformations were identified in women exposed to buprenorphine+naloxone. One case of bilateral cleft lip and palate included a significant gestational age at the time of delivery, Apgar scores, NAS Scores and NAS treatment. Secondary maternal outcomes (table 4) showed that mothers exposed to buprenorphine+naloxone stayed in hospital an extra 1.1 days compared to mothers with no opioid exposure in pregnancy. There was no statistically significant difference in length of stay between cases and illicit opioid using controls. There was no difference in the number of cesarean sections, postpartum haemorrhages, out of hospital deliveries or transfers to tertiary care hospitals for cases compared to controls.
Buprenorphine-naloxone is an efficacious treatment for opioid dependence with the advantage of a lower overdose risk and ease of prescribing when compared to methadone treatment. 

**Maternal outcomes**

Women who continued to use illicit opioids during pregnancy did significantly worse than those who were in a treatment programme. A harm reduction strategy is applied in our catchment area as it has been shown that there are better pregnancy outcomes when a woman is part of a treatment programme compared to ongoing use of illicit opioids. Many women in this study were inducted on to buprenorphine-naloxone during pregnancy rather than the buprenorphine mono-product. In our jurisdiction, the buprenorphine mono-product is available through a special access program with lengthy delays between applying for an exemption and receipt of the drug, whereas buprenorphine-naloxone is readily available in communities as part of community-based harm reduction programs. As a result, women are induced onto buprenorphine-naloxone and maintained on this drug until such time that the buprenorphine mono-product becomes available.

The small retrospective cross-sectional studies are reviewed in the literature that look at the effect of buprenorphine-naloxone on pregnancy outcomes. The first compared the maternal outcomes of 10 women who took buprenorphine+naloxone in the first trimester of pregnancy with those women who were stable on buprenorphine+naloxone prior to pregnancy. The second was a case of an atrial septal defect in 1 in 1500 live births. Data regarding other confounders such as alcohol consumption, smoking, and illicit drug use are not available. Further longitudinal studies of the infants exposed to buprenorphine-naloxone are required to assess rare outcomes. Furthermore, longitudinal studies of the infants exposed to buprenorphine in utero should be performed to assess developmental outcomes. This would add valuable information on the safety of this medication in pregnancy.

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**Competing interests**

None declared.

**Ethics approval**

Sioux Lookout Meno Ya Win Health Centre.

**Provenance and peer review**

Not commissioned; externally peer reviewed.

**Data sharing statement**

Source data will not be shared publicly as this was not stipulated in the original ethics approval. Data may be obtained by emailing likelyfemaster.ca.

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Maternal-Fetal Monitoring of Opioid-Exposed Pregnancies: Analysis of a Pilot Community-Based Protocol and Review of the Literature

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Abstract

Objectives: To describe/analyse a novel, community-based prenatal monitoring protocol for opioid-exposed pregnancies developed by our centre in 2014 to optimize prenatal care for this population. A literature review of published monitoring protocols for this population is also presented.

Methods: Retrospective comparison of pre-protocol (n = 215) and post-protocol (n = 251) cohorts. Medline and Embase were searched between 2000 - 2016 using MeSH terms: [fetal monitoring OR prenatal care] AND [opioid-related disorders OR substance-related disorders] in Medline and [fetal monitoring OR prenatal care] AND [opioid addiction OR substance abuse] in Embase, producing 516 results. Thirteen studies included protocols for monitoring opioid-exposed pregnancies. No comprehensive monitoring protocols with high-quality supporting evidence were found.

Results: We evaluated 466 opioid-exposed pregnancies, 215 before and 251 after introduction of the protocol. Since implementation, there was a significant increase in the number of opioid-exposed patients who had undergone urine drug screening (72.6% to 89.2%, P < 0.001); a significant reduction in the number of urine drug screenings positive for illicit opioids (50.2% to 29.1%, P < 0.0001); and a significant increase in the number of patients who discontinued illicit opioid use by the time of delivery (24.7% to 39.4%, P < 0.01). There was no difference in the CS rate (27.4% vs. 26.3%, P > 0.05). There were no observed differences in the rate of preterm birth, birth weight <2500 g or Apgar score <7 (P > 0.05).

Conclusions: Care of women with increased opioid use during pregnancy is an important but under-studied health issue. A novel protocol for focussed antenatal care provision for women with opioid-exposed pregnancies improves standard of care and maternal/fetal outcomes.


INTRODUCTION

The abuse of illicit and prescription opioids is a rapidly developing problem in North America. In 2015, the Canadian Centre on Substance Abuse reported that 15.7% of females aged 15 or older had used prescription opioids in the preceding year.1 In northwest Ontario, opioid use has reached “epidemic” proportions.2 Remote First Nation communities are especially affected by opioid abuse, where up to 41% of adults between 20 and 50 years old are receiving opioid agonist therapy in their community.3

Pregnant women pose a particular challenge in treating opioid use disorders. The 2010 US National Survey on Drug Use and Health reported that 4.4% of pregnant women used illicit drugs in the past month.4 Although heroin use is relatively uncommon during pregnancy, abuse of prescription opioids is more prevalent and was reported by 1% of American pregnant women.5 The Canadian Maternity Experiences Survey, conducted by the Public Health Agency of Canada in 2009, reported that 6.7% of mothers had used illicit drugs in the 3 months preceding their pregnancy, and 1% admitted to use during pregnancy.6 In contrast, up to 30% of pregnancies in northwest Ontario are exposed to opioids.7 Obstetric health care providers in the region have responded to this social and clinical crisis by developing effective strategies to mitigate the maternal and fetal effects of opioid addiction.8

ABBREVIATIONS

BPP biophysical profile
IPP Integrated Pregnancy Program
UGR intrauterine growth restriction
NST non-stress test
OAT opioid agonist therapy
SLMHC Sioux Lookout Mem Yo Win Health Centre
UDS urine drug screening

Table 1. Fetal, neonatal, maternal, and obstetric complications of opioid use in pregnancy

<table>
<thead>
<tr>
<th>Complication</th>
<th>OR (95% CI)</th>
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<tbody>
<tr>
<td>Congenital malformations</td>
<td></td>
</tr>
<tr>
<td>Conotruncal septal defect</td>
<td>2.7 (1.1 to 6.3)</td>
</tr>
<tr>
<td>Gliocoma</td>
<td>2.6 (1.0 to 6.6)</td>
</tr>
<tr>
<td>Atrioventricular septal defect</td>
<td>2.4 (1.2 to 4.8)</td>
</tr>
<tr>
<td>Hypoplastic left heart syndrome</td>
<td>2.4 (1.4 to 4.1)</td>
</tr>
<tr>
<td>Anir septal defect</td>
<td>2.0 (1.2 to 3.6)</td>
</tr>
<tr>
<td>Ventricular septal hypoplasia</td>
<td>2.0 (1.0 to 3.7)</td>
</tr>
<tr>
<td>Spina bifida</td>
<td>2.0 (1.3 to 3.2)</td>
</tr>
<tr>
<td>Gastrochisis</td>
<td>1.8 (1.1 to 2.9)</td>
</tr>
<tr>
<td>Pulmonary valve stenosis</td>
<td>1.7 (1.2 to 2.6)</td>
</tr>
<tr>
<td>Tetralogy of Fallot</td>
<td>1.7 (1.1 to 2.8)</td>
</tr>
<tr>
<td>Right ventricular outflow tract obstruction</td>
<td>1.6 (1.1 to 2.3)</td>
</tr>
<tr>
<td>Conduclval defect</td>
<td>1.5 (1.0 to 2.1)</td>
</tr>
<tr>
<td>Neonatal complications</td>
<td></td>
</tr>
<tr>
<td>Admission to NICU</td>
<td>6.2 (5.1 to 7.4)</td>
</tr>
<tr>
<td>Low birth weight</td>
<td>3.6 (2.6 to 5.7)</td>
</tr>
<tr>
<td>SGA</td>
<td>2.2 (1.9 to 2.6)</td>
</tr>
<tr>
<td>Obstetric complications</td>
<td></td>
</tr>
<tr>
<td>Intrauterine growth restriction</td>
<td>2.7 (2.4 to 2.9)</td>
</tr>
<tr>
<td>Preterm labour</td>
<td></td>
</tr>
<tr>
<td>&lt;37 weeks</td>
<td>2.5 (2.0 to 3.1)</td>
</tr>
<tr>
<td>&lt;32 weeks</td>
<td>3.7 (1.9 to 7.3)</td>
</tr>
<tr>
<td>Placental abruption</td>
<td>2.4 (2.1 to 2.6)</td>
</tr>
</tbody>
</table>

Note: UOG, growth < 10th percentile or growth velocity decreasing across centiles for gestational age; low birth weight, <2500 g; SGA, <10th percentile birth weight for gestational age.

Because some of the more common fetal complications associated with opioid use during pregnancy include intrauterine growth restriction, low birth weight, and some cardiac malformations (Table 1),1-3 one of the primary goals of prenatal monitoring is to evaluate fetal growth and well-being. Despite the well-documented adverse effects of opioid exposure in pregnancy and the relatively high rate of occurrence in some communities, little research has been done regarding the optimal schedule of prenatal monitoring for these cases. This article describes the protocol that has been developed and implemented in our Integrated Pregnancy Program at Sioux Lookout Mem Yo Win Health Centre and reviews the literature on prenatal monitoring of opioid-exposed pregnancies.

METHODS

Descriptive patient population and prenatal data for SLMHC were gathered retrospectively. Pre-protocol and post-protocol fetal and obstetric variables were extracted from maternal and infant hospital charts including urine drug screening frequency and results, illicit drug use, birth
A literature search was also conducted using the Medline and Embase databases from January 2000 to August 2016. In Medline, “[Fetal Monitoring] OR “[Prenatal Care]” was combined with “[Opioid-Related Disorders] OR “Substance-Related Disorders)” to produce 231 results. In Embase, “[Fetus Monitoring] OR “[Prenatal Care]” was combined with “[Opiate Addiction] OR “Substance Abuse” to produce 287 results.

Table 2. Maternal characteristics of opioid-exposed pregnancies from July 2014 to June 2016

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Number of cases (%)</th>
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<tbody>
<tr>
<td>Hypertension</td>
<td>25 (10.0)</td>
</tr>
<tr>
<td>Type II diabetes mellitus</td>
<td>12 (4.8)</td>
</tr>
<tr>
<td>Gestational diabetes</td>
<td>26 (10.4)</td>
</tr>
<tr>
<td>HIV</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Hepatitis B</td>
<td>1 (0.4)</td>
</tr>
<tr>
<td>Hepatitis C</td>
<td>20 (8.0)</td>
</tr>
<tr>
<td>Prenatal nicotine use</td>
<td>217 (86.6)</td>
</tr>
<tr>
<td>Prenatal alcohol use</td>
<td>62 (24.7)</td>
</tr>
<tr>
<td>Prenatal cannabis use</td>
<td>44 (17.5)</td>
</tr>
</tbody>
</table>

Prenatal care is often initiated at remote nursing stations and transferred to the IPP in Sioux Lookout for an initial consultation around 12 to 14 weeks. IPP consultations are available at any point in the pregnancy, and telephone support is offered on a continual basis with physicians and nurses at the remote nursing stations. Depending on the community, ultrasounds may be available in nursing stations, but most often patients are required to travel by air to SLMHC, providing an opportunity for attendance at the IPP. Patients with addiction issues are often temporarily housed in a federally funded hostel in Sioux Lookout until their treatment course has been stabilized. In 2014, the IPP initiated a standardized prenatal monitoring protocol for pregnant patients with opioid use disorder (Figure 1).

The SLMHC protocol was developed on the basis of guidelines for monitoring pregnancies with hypertension, which have some similar feto-placental effects to opioid exposure, including IUGR, abnormal fetal heart rate, oligohydramnios, and absent or reversed end-diastolic umbilical artery Doppler velocimetry. The protocol is mainly focused on detecting placental insufficiency and IUGR. Fetal well-being and placental function are assessed using standard biophysical profile consisting of fetal tone, movement, breathing movements, amniotic fluid volume, and umbilical artery Doppler analysis of the systolic/diastolic ratio. Growth ultrasound consists of measurements of head circumference, biparietal diameter, femur length, and abdominal circumference. Non-stress tests are not integrated into routine BPP scores and are performed as clinically indicated. Patients monitor fetal movement (kick counts) informally without a set schedule. Due to high rates of intravenous drug use in our region, hepatitis C, serology is performed in addition to the standard provincially mandated prenatal screening.

Even though aspects of the protocol are specific to residents from remote communities, most are universally applicable. Travel, geography, and multiplicity of care providers add extra challenges to providing safe and effective regional obstetric care. As a result, the frequency of appointments may vary for patients living in remote communities. Patients with any complications are flown from their community to stay locally at a federally funded hostel adjacent to the hospital where they remain for the last portion of their pregnancy to allow for increased monitoring of fetal well-being and hospital care as needed. This confinement occurs at around 34 to 36 weeks for patients tapering OAT or with illicit drug use and at 38 weeks for stable OAT patients. Although induction of labour is not standard practice for opioid-exposed pregnancies, some pregnancies may be induced around 37 to 38 weeks if there is a perceived risk of maternal relapse to illicit drug use or indication of IUGR.

Delivering away from home without community support adds additional stressors for patients and their families, which we attempt to address by ensuring that all patients have an escort who travels with them to their appointments in Sioux Lookout. Although SLMHC is equipped to manage a variety of obstetric complications, 4% of patients are referred to distant (>350 km) urban obstetric centres when specialty support is anticipated. Although nuchal translucency, ductus venosus Doppler, and more advanced monitoring methods are available in larger centres, they are currently unavailable at most rural centres. Given the documented benefits of nuchal translucency in early detection of cardiac anomalies, it will be included in future protocols once available. Post-partum, babies all room-in with mother. Upon discharge, coordination with remote community-based opioid use treatment programs is the norm. Follow-up with family physicians and community nurses is undertaken as needed, either in the patient’s home community or in Sioux Lookout.

RESULTS

Limited analysis of our protocol’s efficacy revealed a significant increase in the number of opioid-exposed patients who underwent UDS following implementation, from...
72.6% to 89.2% ($P < 0.0001$). There was also a significant reduction in the number of UDSs positive for illicit opioids from 50.2% to 29.1% ($P < 0.0001$). We observed a significant increase in the number of patients who had quit using illicit opioids at the time of delivery, from 24.7% to 39.4% ($P < 0.01$). There were no observed significant differences in the number of infants born <37 weeks, <2500 g, or with an Apgar score <7 at 1 and 5 minutes ($P > 0.05$); however, our sample size was insufficient to provide a robust analysis of these variables. The small sample size also prevented an analysis of rates of stillbirth, RUGR, oligohydramnios, placental abruption, and congenital anomalies. Despite following a more rigorous schedule of prenatal monitoring, there was not a significant change in the rate of CS, 27.4% pre-protocol versus 26.3% post-protocol ($P > 0.05$). We did not have access to important determinants of health, such as maternal nutritional data, but we noticed that the availability of OAT provided some relief from the extreme poverty associated with opioid use disorder in our setting, allowing resources for improved nutrition.

**Literature Review**

Of 518 total search results, only 13 contained some form of prenatal monitoring protocol specific to substance-exposed pregnancies ($P < 0.01$). None of the protocols are supported by high-quality studies, and all are based on level III evidence (expert opinion). Some of the literature concerning specific components of monitoring protocols, such as frequency of prenatal visits or ultrasoundography, includes level I and II studies.

We reviewed the fetal monitoring protocols used in two retrospective cohort studies examining the effects of prenatal illicit opioid use, OAT, or detoxification on the fetus. The other 11 were described in review articles or clinical commentaries. Protocols varied in complexity and specificity; some briefly mentioned one or two tests and their frequency, whereas others described a basic set of guidelines. Although some studies examined individual components of a prenatal monitoring protocol, no study subjected its entire protocol to statistical outcomes evaluation.

**Prenatal Visits**

Prenatal appointments are the cornerstone of providing care to all mother-infant dyads, regardless of drug exposure. There is no clear consensus in the literature regarding the optimal baseline frequency of visits for opioid-exposed pregnancies. Most authors suggest “routine” or “frequent” appointments without stating the exact frequency or rationale.24,25,26,27,28,29 Two authors provided specific intervals for prenatal visits. Bolnick and Rayburn25 suggest biweekly visits until 32 weeks followed by weekly visits until delivery, whereas Caron and Hoy24 suggest weekly visits throughout the entire pregnancy.

Three authors28–30 reported that an increased frequency of prenatal visits decreased the risks of prematurity, low birth weight, SGA, and perinatal mortality in infants exposed to illicit drugs in utero (level II evidence). The 1992 study by Broekhuizen et al. of 23 926 pregnancies found that the association between prenatal care and infant outcomes was so marked that the authors claimed it was a stronger predictor of infant outcome than was substance abuse (level II evidence).31 Chang et al.32 were the only authors to specify an exact frequency of visits, reporting that weekly prenatal care from approximately 10 weeks’ gestation was associated with a reduction in the number of positive urine toxicology results and an increase in birth weight (level II evidence).

Opioid dependence is often accompanied by other challenging determinants of health such as poverty, homelessness, job instability, mental and physical health issues, and other addictions.33–36 These factors can make engagement in prenatal care difficult. Many women may fear losing custody of their child or legal proceedings against them and may be hesitant to disclose their drug abuse or may avoid prenatal care altogether.37,38 Comprehensive care programs that provide addiction counselling, social support, and prenatal care in one setting, such as the Toronto Centre for Substance Use in Pregnancy and the Early Starts Program at Kaiser Permanente Northern California, have been shown to improve maternal-fetal outcomes and attendance of regular prenatal care (level III evidence).39,40

**Serology and Toxicology**

Given the association between intravenous drug use, standard serology for illicit drug-exposed pregnancies includes hepatitis B and C, HIV, and sexually transmitted infections (STIs). Screening for these infections is recommended.35,41,42,43,44,45,46 Tests are generally performed at the initial visit and repeated in the second and third trimesters.25,26,28–30,33 General population and low-risk screening for HIV and hepatitis C virus are antibody tests and cover a 3- to 6-month timeframe. High-risk patients (e.g., those who inject drugs) need the more recent test evidence.

Maternal history may be unreliable and UDS can be a useful adjunct.47 UDS can provide an accurate profile of usage patterns and detection of other unknown substances.
Risk of congenital anomalies is similar to that of the general population (Table 1), and an anomaly scan between 18 to 22 weeks is recommended.24,25

Ultrasonography

IUGR is one of the most commonly reported adverse outcomes in opioid-exposed pregnancies14,15,18 (OR 1.7, 95% CI 1.02 to 2.9).19,20 These outcomes are associated with in-utero opioid exposure, BPPs may be an important tool in monitoring these pregnancies; however, the literature is equivocal. A 2008 systematic review of five RCTs (level I evidence) found inadequate evidence to support the use of routine BPPs in high-risk pregnancies.32 Other studies have, however, reported correlations between low BPP scores and fetal acidosis20 and perinatal morbidity/mortality,24,25 both of which are associated with fetal-opioid exposure. In a study examining the effects of methadone on brain development, Cetin et al.17 found that although methadone did not have a significant effect on the mean modified BPP score, the mean test length increased from 3.8 to 19.8 minutes when performed following methadone dosing.

Five protocols mentioned the use of BPPs, three of which suggest performing BPPs “as indicated”27,31,32 Izquierdo and Yonke1 suggest performing weekly BPPs if fetal growth is abnormal, whereas Shanker et al.28 suggest performing an initial assessment of amniotic fluid volume from 36 weeks onwards, with no mention of the other BPP components.

Maternal-Fetal Monitoring of Opioid-Exposed Patients

that may have been cut into a drug. Most authors suggest performing UDS either routinely 3,19 or at each prenatal visit.24,25,26,31,32 Some centres use UDS as an incentive for patients, whereas others suggest from 24 weeks onwards or twice weekly if IUGR is detected.42 Kaltenbach et al.33 suggest that mothers currently on OAT with consistently negative urine toxicology only require NSTs if IUGR is detected on ultrasound. If mothers are still using illicit opioids while on OAT, they suggest weekly NSTs beginning at 32 weeks.35

Although not specified in any of the protocols, performing NST prior to OAT dosing may provide a more accurate measure of cardiac activity, given the acute effects of opioids on the fetus.47,51,55

Doppler Flow Velocimetry

It is generally recommended that umbilical artery Doppler velocimetry be used to assess the fetofetal circulation in women with suspected severe placental insufficiency and IUGR.14,15,16,18,20

The SOGC recommends that this examination include standard cardiac views (four chambers, outflow tracts, cardiac axis, and sinus).34 The International Society of Ultrasound in Obstetrics and Gynecology advocates adding more detailed cardiac views, which may extend the optimal timing for cardiac views up to 22 weeks.36

Frequent ultrasounds in such long-term antenatal patients dealing with opioid use disorder has the additional uncertainty caring for the population with the highest rate of mental illness and addiction. Although we performed basic outcome analysis before and after implementation of our protocol, our sample size (at around 100 opioid-exposed pregnancies per year) was too small for further rigorous study. Despite the limitations, the approach to obstetric care of the opioid-dependent patient is multifaceted, it is not possible to ascribe outcomes to any one aspect of the screening and treatment program.

CONCLUSION

The large number of pregnant women with opioid use disorder in northwest Ontario and the limited research on prenatal monitoring in this population prompted the development of a prenatal monitoring protocol at our centre. Our protocol is clinically based, standardizing care in a region with diverse geography and travel requirements, and based on early appearance, appears to be effective in caring for this patient population and mitigating risks for the mother and infant. We will continue to monitor the effectiveness of our rural, primary care-focused protocol over the coming years.

REFERENCES


Opioid use disorder and type 2 diabetes mellitus: Effect of participation in buprenorphine-naloxone substitution programs on glycemic control

Devon Tilbrook MD CCFP Jeffrey Jacob Pierre Parsons CET Craig Edwards MPH Kassandra Loewen Len Kelly MD MClSc FCFP FRRM

Abstract
Objective To measure the effect of buprenorphine-naloxone as opioid substitution therapy on glycemic control in patients with type 2 diabetes mellitus and opioid use disorder.

Design Retrospective cohort study and secondary data analysis.

Setting Northwestern Ontario.

Participants Patients with diabetes receiving opioid substitution therapy, as well as patients with diabetes only, who live in 6 remote First Nations communities.

Main outcome measures Glycated hemoglobin A1c values during a 2-year time period in the 2 groups.

Results Over a 2-year period, there was an absolute decrease of 1.20% in mean glycated hemoglobin A1c values in patients with diabetes who also received opioid substitution therapy, compared with patients with diabetes who were not being treated for opioid dependence, whose values rose by 0.20%.

Conclusion Patients with diabetes who also suffer from opioid use disorder achieve significant (P = 0.01) improvement in glycemic control when treated with buprenorphine-naloxone substitution therapy compared with other patients with diabetes. Treating opioid use disorder with buprenorphine-naloxone substitution therapy has an unintended positive effect in diabetes management.

Editor’s Key Points
• The glycated hemoglobin A1c levels in patients with diabetes were examined along a 2-year continuum. Patients with diabetes participating in a buprenorphine-naloxone substitution program were compared with those not participating in such a program.
• Participation in a buprenorphine-naloxone program was associated with a decrease in glycated hemoglobin A1c level compared with the control group. The mean absolute decrease of 1.20% is clinically significant and statistically different compared with the control group (P = 0.01).
• While it is possible that some of the effect might be related to medications, such a large effect is likely owing to improved self-care and improved adherence to treatment of all health issues.

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The average change in HbA1c level of the study group was an absolute decrease of 1.20%. It varied by community from an increase of 0.34% to a decrease of 2.30%, with 5 of 6 communities showing an improvement in this measure of glycemic control (Table 1).

In this study, the control group of patients with diabetes and without buprenorphine-naloxone treatment experienced an average absolute rise in their HbA1c results of 0.20%. This average control group change in HbA1c level varied by community from an increase of 0.52% to a decrease of 0.60%, with half of the communities having a smaller increase and the other half a small decrease.

The absolute difference between the HbA1c levels in the 2 groups was 1.22% (P = .011), which is both clinically and statistically significant.

In this study, participation in a buprenorphine-naloxone medication-related program was associated with a decrease in HbA1c level compared with not participating in such a program. The decrease of 1.20% is clinically significant and favourably compares to the decrease associated with oral diabetes medications such as a glitazoiide inhibitors (18), biguanides such as metformin (18), dipeptidyl peptidase-4 inhibitors (0.75%), sulfonylureas (1.25%), and thiazolidinediones (1.25%). It is interesting that the study group had a higher baseline HbA1c level than the control group did (8.76% vs 8.90%) despite having a younger average age. This appears to reflect the burden of opioid use disorder on diabetes control shown by previous research. By the end of the study this relationship was reversed and the study group's HbA1c level was lower than that of the control group (8.57% vs 8.90%).

Participation in buprenorphine-naloxone programs will reduce disease burden and diabetes complications in the long term. This might have an even bigger effect considering the relatively young age of the patients with both comorbidities.

While it is possible that some of the effect might be medication related, such a large effect is likely owing to improved self-care and improved adherence to treatment of all health issues, as previous research on the pharmacology of buprenorphine administration did not find such a large effect. It is conceivable that patients participating in these programs also have more contact with health care professionals in regard to substance use disorders and might therefore receive improved follow-up of other health issues such as diabetes.

Limitation
One limitation of this study was the difference in age between the study group and the control group. Those in the diabetes-only control group were older than those in the buprenorphine-naloxone-treated group by an average of 13 years. However, as all eligible study participants with diabetes were included, this age difference likely reflects the difference in prevalence of opioid use disorder among different age strata in the communities. People aged 20 to 50 most predominantly affected. Our study also had a greater proportion of female participants than male, which reflects the different sex distribution of diabetes diagnoses in these communities.

Our control group was made up of patients with diabetes who were not prescribed buprenorphine-naloxone. This group would include participants without opioid use disorder but might also include participants with untreated or undiagnosed opioid use disorder. However, this inclusion does not change the positive effect that the treatment of opioid use disorder had on diabetes control, as all patients had the percentage change in their HbA1c level compared against their own baseline HbA1c level. As this was a retrospective observational study, we did not control for the initiation of various diabetes medications. As the control group was substantially larger than the study group, we believe such an analysis would not change the results. Furthermore, we postulate that the change in glycemic control is related to positive lifestyle changes, including improved adherence to diabetes medications. Therefore, changes in diabetes medications prescribed would not obfuscate the results.

All of the patients in this study were First Nations Canadians living in remote communities, who are known to experience high rates of T2DM. It is unknown if the results would be similar for other Indigenous populations, other ethnic groups, or urban populations.
**Review Article**

Prescription opioid prescribing, use/misuse, harms and treatment among Aboriginal people in Canada: a narrative review of available data and indicators

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**ABSTRACT**

Introduction: Prescription opioid (PO) misuse and related harms are high in Canada, and a major public health challenge. In Canada, 1.4 million individuals (4.3% of the total population) self-identify as Aboriginal, among whom substance use and related harms are elevated. While there are reports of PO use and associated problems among Aboriginal groups, no comprehensive data review currently exists.

Methods: A review of available data sources (ie, journal publications, public reports and ‘grey’ literature) was conducted following principles of a scoping review. Information and data were identified, extracted, and organized into major indicator categories: PO prescribing/dispensing, use/misuse, morbidity/mortality harms and treatment, and narratively reported.

Results: Data suggest that PO dispensing, use and misuse levels among Aboriginal populations are high and/or rising in select settings when compared to the general Canadian population. High levels of PO-related dependence and pregnancy harms exist (mainly in Northern Ontario); there is some indication of elevated opioid mortality among Aboriginals. Vast discrepancies in availability and access to interventions exist; some recent pilot studies suggest improved care.

Conclusions: Data regarding PO use and harms among Aboriginal people are limited, even though elevated problem levels are indicated; improved monitoring, and more effective yet culturally and contextually appropriate interventions for this acute problem are needed.

Key words: Aboriginal, Canada, harms, prescription opioids, review.

Introduction

Prescription opioid (PO) misuse and related harms have been an acute and prominent public health challenge in Canada for some time. Canada has one of the highest levels of PO misuse, morbidity and mortality globally, set in the context of the second highest (after the USA) PO dispensing rates on a per capita basis. Despite a variety of recent interventions on different (eg provincial) levels, some of the main PO-related problem indicators have continued to rise in Canada.

Canada is home to a substantial Aboriginal population of approximately 1.4 million people (4.3% of the total population), comprising diverse groups of self-identified First Nations (ie, registered (status) and non-registered (Indian), Mí纳斯 and Inuit peoples. Canadian Aboriginal peoples have unique histories, traditions and languages as well as sociocultural and environmental diversity, encompassing more than 600 distinct communities with more than 60 languages. Aboriginal people in Canada are mostly concentrated in Ontario and the Western provinces; their population, with children and youth comprising 46%, is growing rapidly.

Substance abuse and related harms are a major health and social problem in the Canadian Aboriginal population, at mostly elevated levels when compared to the general Canadian population. For instance, 43.2% of First Nations adults living on-reserve (vs 19% in the general Canadian population) are daily smokers; similarly, rates of binge drinking are substantially higher. Alcohol-related death rates are almost double (43.7 vs 23.6 per 100 000 in the general Canadian population) and, drug-related overdose rates are estimated to be two to five times higher. Four in five First Nations adults on-reserve identified alcohol and drugs as the biggest challenges currently facing their communities. Aboriginal youth cohorts are at between two and six times greater risk for every alcohol-related problem than their general population counterparts, and are more likely to use all types of illicit drugs. However, of note, there can be substantial variability among Aboriginal communities, and homogeneity should not be assumed. Further, Aboriginal populations have faced generational abuse, trauma and both systemic and individual racism by way of colonial structures and experiences (such as the residential school system), which have been directly linked to adverse mental and physical health outcomes and directly or indirectly contributed to the elevated substance use/abuse rates among these populations.

Consistent with these patterns, sporadic indicators of PO misuse and harms have recently arisen as a distinct problem among Aboriginal populations, particularly in rural and remote locations in conjunction with acute challenges of limited access to related interventions or care. However, comprehensive or systematic data on PO-related use, misuse or harms among the Aboriginal population are limited, inconsistent, or simply absent in Canada, partially due to the fact that Aboriginal populations are often excluded from national health surveys or health data information systems (which are regularly governed by jurisdictions or institutions different to those for general populations). Aboriginal populations are commonly not included in relevant survey sampling frames, and their heterogeneity and dispersed geographical placement further undermine their inclusion. Moreover, misclassification errors, non-response bias and a
lack of Aboriginal-specific identifiers can contribute to inconsistencies in existent survey data. In this context, the main objective of this article was to compile and review available data indicators on PO prescribing and dispensing, use and misuse and related morbidity and mortality among Aboriginal populations in Canada, and hence to both assemble existent data as well as identify major data and information gaps in this important arena.

Methods

After identifying our topic of interest (ie PO prescribing/use/misuse and related harm indicators among Aboriginal populations in Canada), we searched relevant scientific literature databases (ie Google Scholar, ProQuest, PubMed, MEDLINE, JSTOR, EBSCO), conducted web-based searches to identify information from relevant websites, reports and other non-journal publications (grey literature), eg from Statistics Canada, Health Canada, First Nations and Inuit Health Branch websites, publications, government/ survey/technical reports, organizational and Aboriginal-specific publications) between August and November 2015, using variations on applicable search terms (ie Aboriginal/Indigenous/First Nation/Métis/Inuit, prescription opioid/opiate, drug, substance, prescribing, disorders, prevalence, use/misuse/abuse, harms, overdose, mortality, morbidity, prevention, treatment, interventions); in addition, we manually cross-referenced sources and references, and consulted with select topic experts who provided additional references and source leads. In line with a scoping/narrative review, we sought to find all relevant information on all possible key indicators and we did not place strict limitations on search terms or study designs to be included. All databases were searched one at a time using all variations on applicable search terms until all relevant data was extracted and the database had been exhausted.

Data inclusion criteria included all sources from 2000 to 2015 that contained any information on Canadian Aboriginal peoples and PO use and indicators of interest (including where information on POs may have been amalgamated with other psychoactive medication). Conversely, the scope of our review does not explicitly include information on non-POs (eg heroin); such information was excluded. Information was excluded also when more recent data/information was available (eg from a series of reports) or where information was non-quantitative. Once the literature was assembled, relevant data and information were identified, screened and extracted, organized and narratively presented in the major content categories: PO prescribing and dispensing; PO use and misuse; PO-related morbidity and mortality harms and treatment and interventions among Aboriginal populations in Canada. For the purposes of this review, the term ‘Aboriginal’ was inclusively used to refer to all status and non-status First Nations, Métis and Inuit peoples in Canada living both on- and off-reserve, and data were reported as such unless it was explicitly specified otherwise (eg only First Nations; on-reserve) in the respective information source. POs were defined as opioid analgesics available for prescription in Canada, unless the terms deviated or data were aggregated, in which case the specific term(s) were indicated (prescription pills, prescription and illicit drugs, etc.). Direct comparisons with non-Aboriginal populations were included where available.

Results

Prescribing and dispensing

Available data suggest elevated amounts of PO dispensing to Aboriginal recipients compared to the general Canadian population, with mostly rising trends; the data also suggest high rates of prescribing of strong PO formulations and multi-prescriptions. Specifically, the federal Non-Insured Health Benefits (NIHB) program provides essential health goods and services to approximately 800 000 eligible Aboriginal (ie status First Nations and Inuit but not non-status First Nations or Métis) people across Canada living on- and off-reserve; the NIHB client population (in 2013/2014) is considerably younger than the overall Canadian population with 38.7% (vs 22.1%) aged less than 20 years, fewer seniors (265 years; 7.0% vs 15.7%), and an average age of 32 (vs 40) years.

In 2006/2007, the NIHB recorded 740 000 claims for PO prescriptions. Overall, annual PO claims increased to 933 000 by 2012/2013, constituting a 26% increase. In 2012/2013, ‘weak’ POs (ie meperidine and codeine) accounted for 64.1% of NIHB opioid claims, while ‘strong’ POs (ie oxycodone and hydroxymorphine) accounted for 22.3%. Overall, 5.8% of all NIHB drug plan claims were made for POs (vs 2.4–4.3% in general population public drug plans). Approximately 2500 (0.3% of total eligible population) NIHB clients made concurrent claims for POs, benzodiazepines and methadone in 2013/2014. Clients with more than 10 claims for POs accounted for 19.9% of all NIHB opioid claimants (vs 9.9–17.7% in general population plans) in 2012/2013. These high-usage clients accounted for the majority of PO costs and morphine equivalents dispensed; they were also more likely to receive higher-potency PO formulations. There were 931 148 claims for PO agonists (eg Tylenol 3) in 2012/2013, which also accounted for the largest NIHB pharmacy expenditure (C$20,159,000).

In addition to national patterns, there is evidence of regional variations in NIHB-based PO dispensing. Nearly 16 000 NIHB clients made a claim for an oxycodone formulation in 2006/2007; the majority (8000 or 51%) of these claimants were based in the province of Ontario, home to the largest percentage of NIHB clients in 2014 (197 092 or 24.4%). In addition, 56% of all Percocet and 49% of all OxyContin claimants were Ontario-based. In 2007, 898 PO prescriptions were dispensed per 1000 eligible NIHB clients aged 213 years in Ontario; 119 per 1000 were for oxycodone formulations. The rate of NIHB clients in Ontario receiving PO prescriptions has remained relatively stable at around 20% (as of 2000–2009), yet the quantity of POs dispensed has increased.

Outside NIHB data, regional variations in PO prescribing exist. In Manitoba, levels of PO prescriptions and the prevalence of repeat PO prescriptions in 2006/2007 were found to be higher among Métis compared to all other Aboriginal and non-Aboriginal general population comparison groups. This difference was consistent by age and sex; however, no significant differences in the amount of POs dispensed (measured in daily defined doses) emerged. Specifically, 20.8% of Métis had a prescription for one or more POs (vs 15.3%) and 7.7% of Métis had repeat (ie three or more in the past year) prescriptions (vs 4.4%). In the city of Winnipeg, 22.7% of Métis aged 216 years had one or more PO prescriptions (vs 15.8%) and 8.4% had repeat prescriptions.

NIHB-eligible First Nations populations in Alberta feature among the highest PO utilization across Canada, with codeine combinations identified as the most frequently dispensed PO formulation. Conversely, all Atlantic provinces (New Brunswick, Nova Scotia, Prince Edward Island, Newfoundland and Labrador) reported a decrease in PO claims between 2009 and 2013; 10% of NIHB-eligible Atlantic region First Nation residents aged 213 years made a PO claim in 2013.

Use and misuse

Some indicators of PO use and misuse are available for select Aboriginal subpopulations, indicating somewhat higher rates for Aborginals compared to general populations, although markedly higher rates have been reported for select (local) communities. Nationally, 4.7% of on-reserve First Nations adults aged 218 years and 1.3% of youth aged 12–17 years reported past-year non-prescription use of POs in 2010; correspondingly, 5% of on-reserve First Nations adults with at least one chronic health condition (vs 1.6% without) reported non-prescription use of POs.

Based on Health Canada’s 2008/2009 National Youth Smoking Survey, PO use among a total of 2620 off-reserve Aboriginal youth was found to be more common than among the general Canadian youth population and ‘abuse of prescription painkillers was five times greater among youth compared to non-Aboriginal youth. Rates were also higher among female and older youth. The prevalence of prescription drug use (including as well as sedatives and other

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The use and misuse of POs has been found to vary by province and region, with some (eg remote or Northern) communities reporting increases and higher levels compared to general populations. In Ontario’s North East Local Health Integration Network (including 41 First Nations and 19 urban and rural Aboriginal communities) higher rates of prescription and illicit drug use among Aboriginal people have been found. In 2009, the Nishnawbe Aski Nation (comprising 49 smaller Northern Ontario reserve communities with a population of approximately 45 000) declared a ‘state of emergency’ due to widespread PO misuse. Some in this Nation’s communities, 30–60% of the adult population, and up to 50% of youth, misuse POs and require treatment. In 2012, the Matawa First Nation (comprising nine Nishnawbe Aski Nation communities) estimated that approximately 2000 people (of a total on-reserve population of 4912) were addicted to POs. Constance Lake First Nation reported that 46% of community members admitted to abusing POs. Individual reserve communities (mostly ‘fly-in’ only, ie reachable only by air transportation) have also witnessed increases in PO misuse. For example, both Eabametoong and Cat Lake First Nation declared a ‘state of emergency’ due to an estimated 70% of community members, ranging in age from 11 to 260 years, abusing POs and consequent major social disruption (including crime, child neglect, loss of employment or economic functioning at a community level). Elevated levels of PO use and misuse among Aboriginal peoples are also prevalent in non-reserve contexts. In the city of Hamilton, Ontario, 19% of a total of 554 self-identified First Nations adults reported PO use (including codeine, morphine, oxycodone and fentanyl formulations) within the previous year. In Calgary, Alberta, 48% (n=144) of Aboriginal patients accessing addiction treatment through Native Addiction Services in 2000 reported inappropriate (mainly sedatives, relaxants and POs) medication use. Of these, 47% did so more than 10 times in the previous year; 41% obtained their medication from a physician. A secondary analysis compared rates of prescription drug abuse in Alberta, specifically among a sample (n=101) of illicit opioid users in inner-city Edmonton comprising and assessed as Edmonton-based subsamples from two other multi-site street drug-user studies. Nine in ten (>90%) of off-reserve First Nations respondents in both samples reported prescription drug abuse – most commonly POs (eg OxyContin, Dilaudid and Tylenol 3,4) – in the previous 30 days. In a sample (n=381) of urban Aboriginal adults in Edmonton, 24.8% reported past-year prescription drug abuse, with more than half (13.8%) involving POs; 69.5% of PO abusers acquired their POs through prescriptions. Prescription drug abuse was lower among First Nations and Metis students in Edmonton compared to First Nations and Metis student respondents from other areas of the province in the previous 12 months (6.9% vs 8.2%) as well as by lifetime (2.1% vs 6.8%). Furthermore, the 2008 Alberta Youth Experience Survey, measuring psychoactive drug use among grade 7–12 students (n=469), found that 24.1% of off-reserve Aboriginal students (vs 16.8% non-Aboriginal students) reported ever using illicit prescription drugs. Specifically, 23.1% of Aboriginal students (vs 15.1%) reported past-year use of codeine formulations; of these, the largest proportion (39.7%) reported using one or two times, while 27.7% reported using more than 10 times. Combined data from provincial youth health surveys conducted in British Columbia (BC) in 1992, 1998 and 2001 involving more than 4800 Aboriginal youth found that 11% of urban respondents had lifetime non-prescription use of prescription pills. A repeat survey (2008) involving more than 3000 Aboriginal youth found that 22% reported non-prescription pill use. Rates for on-reserve Aboriginal youth were even more elevated, with 13% reporting lifetime non-medical prescription pill use in 2001; this number had increased to 28% by 2008, including higher rates among females (24%) compared to males (19%). Another province-wide health survey of Aboriginal youth living on and off-reserve in BC (n=410) found that 11% reported any prescription drug use (past month), while 4% reported use the day prior to the survey. The 2008 BC Adolescent Health Survey showed 23% of self-identified Metis youth aged 12–19 years who were enrolled in the public-school system reported ever trying non-prescribed prescription pills. Morbidity and mortality Pregnancy-related opioid misuse and harms Various studies, mainly from Northern Ontario, have reported disproportionately high, and rising, levels of PO-exposed pregnancies, and related complications, primarily among First Nations women. In Northern Ontario’s Sioux Lookout Meno Ya Win Health Centre (SLMHC) – which provides health care to approximately 28 000 First Nations patients in the region including women flown in from remote reserves for delivery – overall PO (mostly oxycodone) exposure in pregnancy increased from 13% in 2009 to greater than 26% in 2014. Among narcotic-exposed pregnancies during 2010–2013, about half (48%) of the pregnant women who had used illicit narcotics reported binge use several times a month, while 46.5% of patients reported daily use of narcotics, which was a shift from predominantly occasional use in 2009–2010: route of administration shifted to intravenous use among some (30%), and became similarly common to smoking (12%) in 2011. In 2009–2010, 61 neonates out of a total (primarily First Nation) 482 live births in the SLMHC were exposed in utero to oxycodone. The incidence of oxycodone exposure during pregnancy tripled from 8.6% (2009) to 28.6% (2013), with more than four out of five cases related to oxycodone formulations. Rates of births involving neonatal abstinence syndrome in the SLMHC have simultaneously increased. Neonatal abstinence syndrome incidence rose from 4.4% of all births in 2010 to 5.3% in 2014, but was much higher in PO-exposed pregnancies. Among infants exposed to opioids in utero, the rate of neonatal abstinence syndrome was 66% among daily opioid-using mothers in 2015. About 20% of births among First Nations women (vs 5.6% of the general population) in Canada were born to teenage mothers in 2000; rates of neonatal abstinence syndrome have been found to be five times greater (9.2 vs 1.6 per 1000 hospital births) among infants born to teenage mothers compared to mothers older at first delivery. Emergency room hospitalizations, accidents, overdoses: As for other key indicators of morbidity, there were 12.1 emergency room visits per 10 000 First Nations people related to narcotic-specific withdrawal, overdose, intoxication, psychosis and harmful use in 2008/2009 in a sample of Ontario-based community hospitals; by 2010/2011, this rate increased four times to 55 per 10 000. On-reserve (vs off-reserve) motor vehicle collisions in Saskatchewan between 2001 and 2005 were more likely to include multiple collisions and result in severe injuries. Individuals involved in on-reserve motor vehicle collisions were more likely to feature substance use, with rates for prescription or illicit drug use 3.75 times greater than for those involved in off-reserve motor vehicle collisions. Among a total of 87 Aboriginal motor vehicle collision-related fatalities in BC between 2001 and 2005, drug use was considered a primary contributing risk factor in 16.9%. Treatment and other interventions Aboriginal communities, especially on-reserve, have traditionally experienced extreme shortages and access problems for substance abuse treatment (including, but not limited to, PO disorders). Treatment initiatives and availability – with specific tailoring for distinct populations and settings – for programs targeting PO abuse among Aboriginal peoples in Canada have been expanding, although many communities (particularly Northern and remote ones) still face barriers to availability and access. These communities often have limited access to healthcare services; where these services exist, long wait lists are common and many individuals have to travel outside of their home communities to access treatment. Thousands of First...
Nations individuals among a base population of 25,000 were estimated to be in need of treatment for PO-related addiction in Northern Ontario. A study among urban Aboriginal youth aged 14–30 years (n=397) in BC using opioids showed that only 23.4% had ever accessed methadone maintenance treatment, a standard opioid maintenance treatment; the majority (54.3%) of daily opioid-injecting participants had never received methadone maintenance treatment.

The National Native Alcohol and Drug Abuse Program—which provides on-reserve culturally based addiction services to 58 centres and administrators more than 550 community-based prevention programs across Canada—reported an increase in cases citing prescription drugs as the primary substance of abuse, from 24.8% of all program clients in 2008/2009 to 45% in 2013/2014 in the Atlantic region. Approximately 300 First Nations individuals living on- and off-reserve received addiction treatment services for prescription opioid-related problems in the two Northern Ontario Local Health Integration Networks in 2004/2005; this number had increased to 901 by 2008/2009. NHB claims for opioid dependence treatment medications (eg methadone) had the highest claim incidence among the major NHB therapeutic classes, totaling $131,222,720 in 2013/2014. The number of NHB clients making claims for Suboxone, a newer opioid treatment medication, had increased from 41 in 2011 to approximately 750 in 2012.

Recently, various pilot programs for PO dependence have been implemented principally in remote and Northern communities to address the lack of available treatment options. In a pilot study in a Nishnawbe Aski Nation community examining the feasibility of a community-based Suboxone taper-to-low-dose maintenance program in a sample of PO-dependent First Nations adults (n=22), 95% completed the program’s taper phase and 88% had no evidence of PO use 30 days post-treatment initiation. In the SLMHC, a year-long program evaluation of the Medical Withdrawal Support Service, involving inpatient opioid-detoxification with Suboxone, reported that 81% of clients (primarily First Nations individuals) successfully completed the program; 30% remained abstinent at 6-month follow-up.

The Dennis Franklin Cromarty High School in Thunder Bay, Ontario (offering residential schooling for grades 9–12 students from 24 remote First Nations communities) initiated a unique opioid-detoxification pilot initiative with integrated clinical, cultural and psycho-educational support for students with PO misuse. Of the 33 students enrolled, 22 (66%) were opioid-free at the end of the tapering period. Further, most students experiencing relapses continued to successfully finish their treatment cycle; 14 students engaged in Suboxone maintenance for up to 6 months.

Other pilot programs and treatment interventions have shown success beyond rates of abstinence. In 2014, 140 self-referred First Nations patients (20–50 years of age) were enrolled in an outpatient Suboxone substitution program in North-Western Ontario’s North Caribou Lake First Nation community. There, criminal or drug charges, including those involving youth, decreased by more than 60%; the needle distribution program dispensed less than half its previous volume, and school attendance increased in the year following program implementation.

While neonatal abstinence syndrome rates increased within Northern Ontario’s SLHMC overall between 2010 and 2013, a pilot opioid-tapering program featuring maternal long-acting morphine provision resulted in a decrease (from 10% in 2010 to 18% in 2013) in neonatal abstinence syndrome prevalence in opioid-exposed pregnancies among mothers who enrolled in the program. Of the 166 narcotic-using First Nations women at the SLHMC, half (53%) agreed to participate; by the time of delivery, 9% had quit and 83% had decreased their dose, although half still used oxycodone at least occasionally. As of 2014, the rate of NAS appears to have stabilized at approximately 20% of narcotic-exposed pregnancies in the SLHMC. These community-based opioid-substitution programs have now been implemented in 16 of the 30 First Nations communities in the SLHMC catchment area. In addition to these opioid-substitution therapy programs, many First Nations communities have developed and implemented culture-based and/or land-based interventions specifically designed for their community members. To further address PO-related concerns in Northern Ontario’s SLHMC, 20 physicians participated in a pilot educational intervention, resulting in a substantial reduction in physicians’ concerns about getting patients addicted to POs; in-depth interviews confirmed that safer PO prescribing practices had occurred following the intervention.

Discussion

In the context of recently high levels of PO misuse and related harms across general and special risk (eg street-involved) populations throughout Canada, we examined available data and indicators for Aboriginal populations. A first observation is that data on PO misuse and related harms among Aboriginal populations are extremely limited, largely fragmented and inconsistent; available data are mostly ad hoc or cross-sectional snippets that allow for little examination of over-time trends or comparisons within Aboriginal or with non-Aboriginal populations. In this respect, the data situation on PO-related indicators among Aboriginals may be considered worse than that for the general Canadian population, where grave deficiencies in systematic documentation and monitoring exist. Given the acuteness of the phenomenon under study, indicators on PO-related misuse and harms urgently need to be added to the essential health data. For these health indicators to be improved, better, more rigorous and consistent data and monitoring among Aboriginal populations are urgently required.

From the limited body of data available, the evidence suggests that PO misuse and harms among Aboriginal people in Canada are high (commonly higher than general populations) and have been rising in the select contexts where such assessments are possible. This includes the extreme examples of PO misuse or PO-related morbidity (eg regarding dependence or pregnancy-related problems) in Northern Ontario, where large proportions of entire communities or subpopulations have been severely afflicted by the harms of PO-related problems, but also extends to other settings. This picture resembles the overall situation of substance use and acute or chronic harms among Aboriginal people, where predominantly higher levels (eg than general populations) have been observed across different substance categories. Notably, most available problem indicators (regarding PO misuse or harms) are from (mostly) Northern Ontario and, to some extent, from Alberta, BC or Manitoba, whereas there is little information from other regions. While these reflect the regions with higher concentrations of Aboriginal peoples in Canada, it is not clear whether problems elsewhere are truly lower in occurrence or simply less documented.

Our data review can be considered positivist in nature and is largely limited to quantitative measures that do not consider the quality of data, methods or contexts in which these data were collected; in addition, our particular scoping/narrative approach to the research may have missed relevant information. Beyond these possible methodological constraints, the specific socioeconomic and cultural contexts of substance use among Aboriginal people need to be taken into consideration, although the extent of these complex interactions is beyond the scope of this article. It is well documented that substance use and its harms outcomes among Aboriginal people are crucially linked with the larger determinants of health, specifically the rampant health inequalities, colonization, generational abuse and trauma, cultural suppression, poverty, unemployment, individual and systemic racism, and overall marginalization that uniquely characterize Aboriginal populations in Canada. While the interplay of these historical or ecological determinants and harms for substances like alcohol (but also other substances) have been fairly well examined, this is less the case for psychotropic prescription drugs. In this wider context, POs may constitute a special case study that warrants attention; also in that a large proportion of the extensive amounts of POs consumed— and implicated in the
The occasional treatment of opioid use disorder

**INTRODUCTION**

Opioid use disorder (OUD) has become common in many regions of Canada, particularly in rural northwest Ontario.1 In the past, addicted patients had to access methadone-dispensing physicians if opioid agonist therapy was indicated. This generally took patients out of a primary care setting and away from their community, where robust addiction services were absent.3,4 Rural physicians who decide that opioid agonist therapy is a good option for their patient may now consider initiating a buprenorphine/naloxone combination therapy in the office setting or even offer home induction.5–12 This combination may encounter patients who mismanage their opioid prescriptions and are subsequently found to have OUD. Treating the addiction locally can help patients eliminate much of their dysfunctional behaviour and allow them to identify underlying life issues.

Buprenorphine/naloxone combination therapy was approved for the treatment of opioid dependence in 2003 in the United States and in 2007 in Canada. Numerous cases of safe office-based and home induction of buprenorphine/naloxone therapy have been documented.5–11 This combination antagonist-antagonist medication has a demonstrated safety profile (see "Pharmacologic characteristics") and can be used for managing opioid withdrawal or for opioid substitution maintenance therapy.12

In northwest Ontario, where an epidemic of OUD has been observed since 2009,13 rural clinicians are becoming familiar with using buprenorphine/naloxone therapy and maintaining patients on this treatment.14,15 This article reviews the medication and describes induction and maintenance therapy.

**OPIOID USE DISORDER**

The terminology now used by the American Psychiatric Association is "opioid use disorder," and clear criteria have been established for diagnosis. According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5),16 OUD "includes signs and symptoms that reflect compulsive, prolonged self-administration of opioid substances that are used for no legitimate medical purpose or, if another medical condition is present that requires opioid treatment, that are used in doses greatly in excess of the amount needed for that medical condition." Specific criteria can be found in DSM-5.17

**TREAT THE WHOLE PERSON**

In almost all cases, the underlying cause for OUD is pain — physical, emotional, spiritual and/or mental. Suffering in any of these realms may be the root cause for a person’s initial use of opioids and the subsequent development of OUD. A patient receiving opioid agonist (substitution) therapy will no longer experience the euphoric effects of illicit opioids, thereby losing a key coping mechanism. In addition to opioid agonist therapy, supports (typically called after-care) will be needed to assist the patient in dealing with his or her underlying issues. Although studies differ in their findings regarding the...
benefits of psychosocial supportive programs in the treatment of addictions. Furthermore, fear of withdrawal symptoms can be a powerful driver of ongoing addictive behaviours; buprenorphine/naloxone therapy works well to mitigate those symptoms.

**PHARMACOLOGIC CHARACTERISTICS**

At first glance it may seem an odd combination: an opioid agonist and an antagonist. The opioid component, buprenorphine, is a semisynthetic opioid derived from the opium poppy that is 40 times more potent than morphine. It binds strongly to the body’s opioid receptors (particularly the μ receptor) and acts very much like methadone, by competing with other opioids for access to these receptors. As with methadone, its long half-life provides relief from withdrawal symptoms. Compared to methadone, which is a full μ-opioid receptor agonist, buprenorphine is a partial μ-opioid receptor agonist and has a better safety profile, with minimal respiratory depression and associated morbidity and mortality.

Buprenorphine has limited euphoric effect when administered sublingually, but if administered intravenously, it can become a drug of abuse. When combined with naloxone, the risk of such diversion is decreased, as intravenous use may lead to withdrawal. Naloxone has almost no bioavailability when taken sublingually or orally. Hence the naloxone component of buprenorphine/naloxone allows the buprenorphine component to be safely used as agonist replacement therapy, with a built-in deterrent against diversion to intravenous use.

Precipitated withdrawal at induction must be avoided by ensuring the patient is in some opioid withdrawal. Because of buprenorphine’s higher affinity for the μ-opioid receptor, it displaces other opioids from the receptor. Given that most opioids are full agonists, this creates sudden withdrawal symptoms as the expression of full agonist activity is replaced by partial agonist activity. Another disadvantage of this strong receptor binding is that, should the patient require emergency analgesia, much higher dosages of opioids must be used to overcome the buprenorphine that is bound to the receptors.

**PATIENT ASSESSMENT**

A clinical assessment is needed to confirm the diagnosis of OUD, identify concurrent disorders and clarify the patient’s treatment goals. Screening blood tests are beneficial for diagnosing blood-borne infections and other health issues in a high-risk population. Investigations should include a pregnancy test, complete blood count, liver function tests, screening for hepatitis B, hepatitis C and HIV infection, a urine drug test and screening for sexually transmitted infections. Useful resources are available through the Centre for Addiction and Mental Health for this initial assessment. Since opioid agonist therapy is a harm-reduction strategy, the patient with OUD must have adequate harmful effects to warrant therapy. It is also important to recognize that chronic pain is a common comorbidity in patients who have opioid addiction. Adjunctive therapies (e.g., anticonvulsives, antidepressants, nonsteroidal anti-inflammatory drugs) may be required to manage pain while the patient is receiving opioid agonist therapy.

**STARTING BUPRENORPHINE/NALOXONE THERAPY**

Starting the treatment is typically referred to induction. Induction and maintenance therapy can be given in outpatient settings including the office, unsupervised at home or as direct observed therapy. Induction instructions are similar in all 5 settings. Provinces have different prescribing requirements (Table 1).

<table>
<thead>
<tr>
<th>Province</th>
<th>Methodone exemption required</th>
<th>No methadone exemption required*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saskatchewan</td>
<td>British Columbia</td>
<td></td>
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<tr>
<td>Manitoba</td>
<td>Alberta</td>
<td>Ontario</td>
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<tr>
<td>Northwest Territories</td>
<td>Quebec</td>
<td>New Brunswick</td>
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<td></td>
<td>Nova Scotia</td>
<td>Prince Edward Island</td>
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<td></td>
<td>Yukon Territory</td>
<td>Nannot</td>
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</tbody>
</table>

*Some jurisdictions require online continuing medical education.

**WITHDRAWAL SYMPTOMS**

Be prepared to manage withdrawal symptoms and common side effects. Patients are typically still experiencing significant withdrawal symptoms for the first 2 days of induction therapy. Some physicians simply provide reassurance and remind patients that their withdrawal will be relieved within a couple of days (most patients have significant improvement by day 5). When using buprenorphine/naloxone, patients experience at least some transient side effects from buprenorphine/naloxone (e.g., headache, nausea). Table 3 lists the most common side effects. Note that there is some overlap between the symptoms of withdrawal and the side effects of buprenorphine/naloxone.

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**Table 1: Provincial and territorial buprenorphine/naloxone prescribing requirements**

<table>
<thead>
<tr>
<th>Province</th>
<th>Methodone exemption required</th>
<th>No methodone exemption required*</th>
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<tbody>
<tr>
<td>Saskatchewan</td>
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<td>Manitoba</td>
<td>Alberta</td>
<td>Ontario</td>
</tr>
<tr>
<td>Northwest Territories</td>
<td>Quebec</td>
<td>New Brunswick</td>
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<td></td>
<td>Nova Scotia</td>
<td>Prince Edward Island</td>
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<tr>
<td></td>
<td>Yukon Territory</td>
<td>Nannot</td>
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</tbody>
</table>

*Some jurisdictions require online continuing medical education.

**Table 2: Recommended length of abstinence before first dose of buprenorphine/naloxone**

<table>
<thead>
<tr>
<th>Drug route</th>
<th>Length of abstinence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buprenorphine by any route</td>
<td>None</td>
</tr>
<tr>
<td>Methadone by any route</td>
<td>2–3.5 (dropout individual variance), ideally from a dosage ≤30 mg</td>
</tr>
<tr>
<td>Other opioids</td>
<td></td>
</tr>
<tr>
<td>Intravenously</td>
<td>≥12 hr</td>
</tr>
<tr>
<td>Intranasally (snorting), smoking, chewing, orally</td>
<td>≥24 hr</td>
</tr>
</tbody>
</table>

**Table 3: Typical opioid withdrawal signs and symptoms, and common acute buprenorphine/naloxone side effects**

<table>
<thead>
<tr>
<th>Opiate withdrawal signs and symptoms</th>
<th>Buprenorphine/naloxone side effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nausea/vomiting</td>
<td>Headache</td>
</tr>
<tr>
<td>Dizziness</td>
<td>Nausea/vomiting</td>
</tr>
<tr>
<td>Alimentary cramps</td>
<td>Diaphoresis</td>
</tr>
<tr>
<td>Constipation</td>
<td>&quot;Bone pain&quot; or arthralgia</td>
</tr>
<tr>
<td>Myalgia</td>
<td>Myalgia</td>
</tr>
<tr>
<td>Fever/chills</td>
<td>Unmasking of chronic pain</td>
</tr>
<tr>
<td>Somnolence</td>
<td>Euphoria</td>
</tr>
<tr>
<td>Vomiting</td>
<td>Rhinorrhea</td>
</tr>
<tr>
<td>Lacerication</td>
<td>Phlebitisation</td>
</tr>
<tr>
<td>Tumors</td>
<td>Anxiety</td>
</tr>
<tr>
<td>Redness</td>
<td>Fatigue, &quot;feeling lazy&quot;</td>
</tr>
<tr>
<td>Invisibility</td>
<td>Mydriasis</td>
</tr>
</tbody>
</table>
effects of buprenorphine/naloxone. Most of the side effects are transient and resolve within a few days, except for constipation, hyperhidrosis and any underlying chronic pain.

PROCEDURE
After OUD has been established as a diagnosis, a clinical assessment has been completed and the patient agrees to the treatment plan, induction therapy can be scheduled. The patient must be instructed to abstain from opioids according to the time frames suggested in Table 2; otherwise he or she may risk precipitated withdrawal. The goal of induction therapy is to determine the dosage of buprenorphine/naloxone that relieves symptoms of withdrawal for a full 24 hours, without overdosing. In the case of office induction, during daily visits for the first 4 to 5 days, assess for signs of drowsiness. Excessive drowsiness may indicate that the dosage is too high and should be decreased by 2 mg (or more). Some mild drowsiness can be expected at first, and the patient should be cautioned against driving or using heavy equipment until this effect resolves, typically within a week.

Day 1
- Ask the patient about his or her last illicit opioid use (when, which opioid, how much and by what route). If the patient has used an opioid within the time frames listed in Table 2, it may be best to delay induction therapy by a few hours.
- Assess the patient’s level of opioid withdrawal by using the COWS. A COWS score of 12 or greater is recommended, but lower scores may still be acceptable depending on how long it has been since the patient’s last illicit opioid use.
- Buprenorphine/naloxone comes in 2 mg and 8 mg dosages of buprenorphine. The tablets can be divided and are applied under the tongue until dissolved (2–10 min). For most patients, 4 mg is an appropriate first dosage (a smaller dosage may be appropriate for some patients; a larger starting dosage is not recommended). This dosage is provided by direct observation.
- The patient returns for reassessment at least 5 hours later, at which time, if he or she is still experiencing withdrawal symptoms, another 4 mg dose (or less if appropriate) is given. The maximum amount given on day 1 is typically 8 mg (in 2 divided doses). However, a third dose of 4 mg (total 12 mg) can be given 2–3 hours later for certain patients (e.g., those who are pregnant or at high risk for not completing induction therapy owing to severe withdrawal) to reduce withdrawal symptoms as quickly as possible.

Day 2
- Assess the patient’s level of withdrawal. If he or she is still experiencing any withdrawal symptoms, more than the total dosage given on day 1 will be needed. A COWS score of 12 or greater was required only to avoid precipitated withdrawal on day 1; now the goal is to eliminate withdrawal. Typically, 4 mg is added to the previous day’s total, but if the previous day’s dose lasted almost the full 24 hours, 2 mg may be a more appropriate titration. Hence, the dosage given at the beginning of day 2 is [day 1 total dosage + 4 mg (or 2 mg)].
- If the patient is not experiencing any withdrawal symptoms on day 2, it may be that the total dosage given on day 1 is the appropriate dosage. In that case, the amount given on day 2 is the same as the total dosage that was given on day 1.
- If the patient seems excessively drowsy, the dosage from day 1 may have been too much, and less than the day 1 total dosage should be given.
- If the patient can be given the option of returning later in the day for an additional dose if withdrawal symptoms return.
- The recommended maximum total dosage for day 2 is 16 mg.

Day 3
- Assessment and dosing continues as described for day 2.
- Typically only 1 dose is provided on day 3 (and beyond).
- The recommended maximum total dosage for day 3 is 20 mg.

Day 4
- The recommended maximum total dosage for day 4 is 24 mg.
- To go above 24 mg of buprenorphine/naloxone is off-label use in Canada. However, some patients may require a higher dosage. In Europe and the US, the maximum dosage is set at 32 mg; beyond this amount, there is no further benefit owing to the ceiling effect of buprenorphine.

STABILIZATION PHASE
The first 2 to 3 months of buprenorphine/naloxone therapy are referred to as the stabilization phase.

The concept of stability in the treatment of opioid addiction generally refers to achievement of many or all of the following goals:
- Elimination of injection drug use
- Consistent attendance for direct observed therapy, with very few missed doses
- Improved function in activities of daily living
- Improved quality of life.

It is important to recognize that it is common for patients to still use illicit drugs during the stabilization phase, and some patients will continue to use illicit drugs throughout buprenorphine/naloxone therapy. In these cases, one should remember the overall goals of harm reduction. Abstinence may not be achieved for every patient, so consideration should be given to the benefits of therapy, such as:
- Decreased or discontinued injection drug use
- Improved finances
- Improved quality of life
- Ability to maintain employment or to care for children
- Decreased risk of violent altercations
- Improved attendance for routine health care.

The following criteria are helpful in determining a therapeutic dosage for the patient:
- No withdrawal symptoms for the full 24 hours between doses
- Reduced cravings (but cravings may still be present)
- Cessation of opioid abuse
- A slip or relapse to opioid use does not result in euphoria
- No sedation and minimal other side effects.

MAINTENANCE THERAPY AND BEYOND
The overall goal is to reduce harm caused by OUD that affect the individual, the family and the community. These harms include, but are not limited to:
- Transmission of blood-borne infections (e.g., HIV, hepatitis C) and sexually transmitted infections (e.g., hepatitis B, chlamydia, gonorrhea)
- Complications of intravenous drug use (e.g., soft tissue infections, deep vein thrombosis, pulmonary embolism, endocarditis, osteomyelitis, sepsis)
- Financial difficulties (e.g., selling necessary belongings, not buying adequate groceries)
- Prostitution
- Criminal activities, especially break and enter, and theft
- Physical assaults and altercations
- Pregnancy complications (e.g., spontaneous abortion, preterm labour)
- Neonatal abstinence syndrome among infants born to women with OUD
- Children being neglected
- Children being apprehended and placed into care by child protective services
- Poor school attendance by children
- Poor vaccination rates (with resulting risks of outbreaks of vaccine-preventable diseases)
- Suicide and homicide.

One of the primary goals of therapy is to retain the patient in treatment, as dropping out or sudden discontinuation of buprenorphine/naloxone therapy leads to high rates of relapse to opioid abuse. With this in mind, we need to consider the various barriers and events that might increase the risk of attrition.

The maintenance phase is the time to address various issues related to OUD, such as:
- Psychiatric comorbidities
- Other drug and alcohol abuse
- Unstable relationships
- Parenting skills, education, employment
- Financial issues
- Health issues.

It is a time for long-term goal setting. Moving beyond OUD and avoiding future relapse requires that the patient has constructed a different life, with healthy coping mechanisms and strong social supports. Often, there is deep emotional trauma from which the patient needs to heal.

Some patients will therefore be in the maintenance phase for life. Others may be able to taper off after several months to a year. The length of maintenance therapy is very individual.

Patients who wish to stop buprenorphine/naloxone therapy should be counseled carefully, as the risk of relapse is very high. They may wish to attend a detoxification program to get through the final withdrawal from buprenorphine/naloxone, or medications for symptom management can be provided by the family physician. Slow tapering over several weeks is recommended. If relapse occurs, the patient should be welcomed back to opioid ago-
nist therapy without judgement. Recovering from relapse may provide lessons and insights that could allow a successful discontinuation later.

Alternative dosing regimens

Once a patient has been maintained on a stable dosage for a period of time, an alternative dosing schedule might be preferred if the patient’s dosage is appropriate to allow it. The long half-life of buprenorphine allows for longer dosing intervals of up to 2 or even 5 days, as long as the maximum dosage given on any one day does not exceed 24 mg. One caveat of alternative dosing regimens is that managing missed doses can be complicated.17-20

URINE DRUG SCREENING

The clinical utility of urine drug testing is as follows:

• To assess stability of the patient’s condition
• To provide a starting point for discussion of triggers and coping strategies
• To assess for illicit nonopiod drug use and allow for additional treatment planning
• To enable the patient to participate in an incentive program
• To corroborate the patient’s self-report of drug use or abstinence
• To detect substances that may be unsafe in combination with buprenorphine/naloxone (e.g., benzodiazepines)
• To document the presence of buprenorphine as a replacement therapy agent.

It is important to note that there is no evidence to support the use of punishment, or the threat of punishment, in the treatment of addictions. This means that buprenorphine/naloxone therapy should not be withheld as a consequence (punishment) for a positive urine drug test result. The fear of being “kicked off” buprenorphine/naloxone creates an unnecessary stress for patients who may still be struggling with drug use. Many patients have intense fear and anxiety regarding opioid withdrawal. Stress and anxiety are common triggers for drug use, and therefore any addiction treatment program should aim to decrease stress in a patient’s life and assist with general stress management.

CONCLUSION

Buprenorphine/naloxone combination therapy is a safe and effective outpatient treatment strategy for OUD. Rural physicians can benefit from knowing about it. Even if they decide not to become involved in prescribing it, some of their patients may be taking it, and it is important to understand its pharmacologic characteristics and be comfortable with its use.

REFERENCES

First Nations hepatitis C virus infections
Six-year retrospective study of on-reserve rates of newly reported infections in northwestern Ontario
Janet Gordon MD, Natalie Bocking MD MPH CCFP FRCPC, Kathy Pouteau MD MD Ed CM MPH CCFP
Terri Farrell MD CM DCH CCFP, Gareth Ryan MD MClSc FCFP FRRM

Abstract
Objective To document rates of newly reported hepatitis C virus (HCV) cases from 2010 to 2015 in remote First Nations communities.

Design Retrospective analysis of aggregate data of newly reported HCV antibody-positive (Ab+) cases.

Setting Northwestern Ontario.

Participants A total of 31 First Nations communities (an on-reserve population of 20,901) supported in health care by the Sioux Lookout First Nations Health Authority.

Main outcome measures The aggregate characteristic data included year of notification, age range, and sex for a 6-year period (2010 to 2015).

Results There were 267 HCV Ab+ cases in the 6-year study period. The incidence in 2015 was 324.2 per 100,000 population. This is 11 times the rate for all of Ontario. The most common associated risk factor was sharing of intravenous drug use equipment. Women made up 52% of patients with newly reported HCV Ab+ cases. More than 45% of cases were in patients between 20 and 29 years of age.

Conclusion This high burden of newly reported HCV Ab+ cases in geographically remote First Nations communities is concerning, and prevention and treatment resources are needed. This burden of disease might pose more urgent health and social challenges than can be generalized from the experience of the rest of Canada.

Editor’s Key Points
- Canada’s Aboriginal population faces a disproportionate and increasing burden of newly reported hepatitis C virus (HCV) infections. This problem has been increasing in northwestern Ontario since the First Nations leaders declared an “epidemic” of opioid abuse in 2009. In 2015, the rate of newly reported HCV antibody-positive cases was 324.2 per 100,000 in the 31 rural and remote First Nations communities in northwestern Ontario.
- First Nations community members in their 20s comprised more than 45% of newly reported cases between 2010 and 2015. There was a high rate of intravenous drug use among those with newly reported HCV antibody-positive cases (65.9%).
- Much can be learned about the course of HCV infection in isolated communities. Some of these lessons might be applicable to urban-based subcultures with loosely defined geographic and social boundaries. Community awareness, education, and prevention strategies are critical aspects of such clinical and research initiatives and exploration of these questions must move forward within individual community contexts.

This article has been peer reviewed.
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national rates of newly reported hepatitis C virus (HCV) infection in Canada are declining.1 Despite this reduction, Canada’s indigenous populations face a rising burden of disease.2 Modelled estimates of HCV prevalence in Canada have shown a 3-fold higher prevalence among the Aboriginal population compared with the non-Aboriginal population.3,4 There is a paucity of robust population-based data on HCV infection in Aboriginal Canadians. Available information largely focuses on urban-based populations. Studies in Winnipeg, Manitoba, and Prince George, BC, document high rates of HCV infection in “street-exposed” urban Aboriginal people.5,6 These high rates of HCV infection are associated with intravenous drug use (IVDU), similar to Canada-wide data, which show that 80% of newly reported HCV infections in 2007 were IVDU-related.7 In 2009, First Nations leaders in northwestern Ontario declared a state of emergency concerning the widespread use of opioids in their communities.8 Since then, regional hospital- and community-based programs have been developed to offer treatment for opioid use disorder.9,10 Most important, all of these programs is increased screening for blood-borne infection. The rising levels of HCV infection encountered by local clinicians prompted program initiatives. This study of an on-reserve First Nations population spread across 31 remote communities in northwestern Ontario documents rates of newly reported HCV antibody-positive (Ab+) test results in a rural Aboriginal population over a 6-year period, 2010 to 2015.

METHODS

In 2015, the Sioux Lookout First Nations Health Authority (SLFNHA) Chiefs in Assembly and the regional Chiefs Committee on Health approved research on HCV infection in their communities.11 The SLFNHA supports community-based medical services and other health promotion programs in 31 remote First Nations communities in northwestern Ontario. Aggregate data were received from the Health Canada First Nations and Inuit Health Branch (FNHB)-Ontario Region on newly reported HCV Ab+ test results notifications from these 31 on-reserve communities. The data consisted of HCV antibody status notifications received by the FNHB-Ontario Region through the provincial reportable disease system from 2010 to 2015. Case characteristics were collected by the FNHB through routine case and contact management of reportable diseases. The aggregate data used included year of notification, age, and sex. Risk factor data were limited to a 5-year period (2011 to 2016). Testing was done in both local community nursing stations and in hospital settings. The total number of screening tests performed and RNA serology data were not available. Cases were limited to individuals with HCV Ab+ test results who were reported to the provincial public health system and who lived on reserve in the SLFNHA catchment area. Individuals who lived off reserve were not included in this study. According to Indigenous and Northern Affairs Canada (INAC), the on-reserve population of the 31 communities was 20,901 in 2015. Population counts were estimated by INAC using the Indian Registration System. Age-standardized rates were calculated by the indirect method using the 2006 Canadian population. The population estimate does not account for patient migration and does not include nonregistered community members. Ethics approval was received from the Sioux Lookout Meno Ya Win Health Centre Research Review and Ethics Committee.

RESULTS

In 2010, 15 notifications for HCV Ab+ status were recorded. This increased to 86 notifications in 2014 and 73 in 2015 (Table 1). The age-standardized rates of annual HCV Ab+ test result notifications increased dramatically between 2010 (66.6 per 100,000 population, 95% CI 41.9 to 71.3) and 2015 (242.2 per 100,000 population, 95% CI 288.9 to 359.5). Figure 1 compares these rates with those of Ontario and Canada.12,13 Women accounted for 52% of patients with newly reported HCV Ab+ cases. More than half (54%) of the female patients were in the 20- to 29-year-old age group. Only 41% of HCV infection cases in men were in patients in the 20- to 29-year-old age group, with 52% in the 30- to 64-year-old age group. More than 65% of cases were in patients between 20 and 29 years of age (Figure 2). The most commonly reported risk factor was sharing IVDU equipment, which occurred in 86.5% of cases (Table 2).

Fewer than 5 new notifications for HIV infection were reported during the 6-year study period.

Table 1. Newly reported HCV antibody-positive test results and rates per 100 000 in SLFNHA by year: The total no. of reported cases was 267.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>ON-RESERVE POPULATION</th>
<th>NO. OF CASES</th>
<th>RATE PER 100,000 (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>18 536</td>
<td>15</td>
<td>56.6 (4.9 to 71.3)</td>
</tr>
<tr>
<td>2011</td>
<td>19 072</td>
<td>27</td>
<td>135.5 (112.7 to 158.3)</td>
</tr>
<tr>
<td>2012</td>
<td>19 505</td>
<td>38</td>
<td>169.9 (144.4 to 195.5)</td>
</tr>
<tr>
<td>2013</td>
<td>20 076</td>
<td>27</td>
<td>113.1 (82.3 to 133.9)</td>
</tr>
<tr>
<td>2014</td>
<td>20 463</td>
<td>86</td>
<td>364.7 (273.7 to 402.1)</td>
</tr>
<tr>
<td>2015</td>
<td>20 901</td>
<td>73</td>
<td>324.2 (288.9 to 359.5)</td>
</tr>
</tbody>
</table>

HCV—hepatitis C virus, SLFNHA—Sioux Lookout First Nations Health Authority.

In 2015, the rate of newly reported HCV Ab+ cases was 324.2 per 100,000 population in the 31 rural and remote First Nations communities in northwestern Ontario. This is 11 times the 2014 provincial rate of 30.1 per 100,000 and is higher than previous estimates for the Canadian Aboriginal population (Figure 1).11,14

DISCUSSION

The proportion of newly reported HCV Ab+ cases reported among women 20 to 29 years of age in this review was slightly higher (52%) than that among men in this age group (41%), but the relative number of women tested is not known. This result is similar to other studies of Canadian Aboriginal populations, but differs from the Ontario balance, in which men accounted for 62% of newly reported HCV Ab+ cases in 2014.15 Opioid use disorder is common among community-based opioid agonist therapy (OAT) programs have been recently developed in many communities and include routine screening for blood-borne infections.
With support from the regional chiefs, early activities included representatives from the SLFNHA, the FNIHB, Sexually Transmitted and Blood-borne Infection management if increases in HIV infection occur. Regional health services might be more able to monitor and respond to serious changes in disease profiles.27

These communities are geographically remote and the burden of HCV infection in such isolated communities might pose more urgent health and social challenges than can be generalized from the experience in the rest of Canada.31 Limited funding for opioid use disorder treatment programs in northern and remote regions can lead to high rates of opioid exposure in pregnancy with tragic outcomes.9,28 Screening for HIV infection can be considered in these groups.

Conclusion

We report high rates of newly reported HCV Ab+ cases in 31 remote First Nations communities in northern Ontario. This is likely associated with the recent opioid “epidemic” in northern and remote communities as well as the increased rates of HCV infection.6,22

Limitations

This study has many limitations. Cases were defined as newly reported HCV Ab+ tests, but do not necessarily mean a change in risk of the virus. The study of reported HCV Ab+ cases in northwestern Ontario might partly reflect increased testing associated with the initiation of opioid use disorder treatment programs, however increases in testing, treatment, and regional health promotion initiatives. Case detection was primarily through targeted screening of high-risk individuals and is likely an underestimate of the actual prevalence of the disease. This is similar to Canada wide detection practices, in which population screening is primarily focused on high-risk individuals. As RNA results were not available for research purposes, we were unable to distinguish between cases that evolved into chronic HCV infection and those that resolved spontaneously. As such, the actual burden of chronic HCV infection is still unknown. Program data received from INAC are sourced from the Indian Registration System and likely underestimate actual populations living on reserve. Given the small population sizes, rates should be interpreted with caution. Not all communities were similarly affected by HCV infection and some communities had no newly reported cases. Genotype results and comorbidity information were not available. As information on testing by sex and age group is absent, conclusions about incidence in these groups are limited.

Recent Health Outbreak in on-reserve First Nations communities in Saskatchewan speaks to the vulnerability of isolated communities to public health emergencies.26 Centralized federal management of on-reserve public health and infectious disease surveillance mechanisms to provide an appropriately efficient, focused response. Well-resourced regional health services might be more able to monitor and respond to serious changes in disease profiles.27

In response to use patterns and increased rates of HCV infection, an interagency initiative has been assumed by the SLFNHA under the auspices of the Anishinaabe Bimaadiziwin Research Program. Dr Farrell is Chief Operating Officer for the Sioux Lookout First Nations Health Authority, the FNIHB, Mr Ryan is a community physician, and Dr Pouteau is a community health educator. Mr Ryan is a community physician, and Dr Pouteau is a community health educator.

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References


Abstract

Northwestern Ontario in Canada provides a unique clinical challenge for providing optimal medical care. It is a large geographic area (385,000 km²) and is home to 32 remote First Nations communities, most without road access. These communities suffer a heavy burden of infectious disease and specialist consultations are difficult to obtain. The Division of Infectious Diseases at the Ottawa Hospital and the Sioux Lookout Meno Ya Win Health Centre established a telemedicine-based infectious disease consultation service in July 2014. We describe the implementation of this service, types of cases seen and patient satisfaction, as well as some of the challenges encountered. Information on visits was prospectively collected through an administrative database, and patient satisfaction surveys were administered after each initial consultation. During our first year of operation, 191 teleconsultations occurred; 76 initial consultations, 82 follow-up appointments and 33 case conferences. The scope of cases has been broad, mostly involving musculoskeletal infections (26%), followed by skin and soft tissue infections (23%), HCV, acute rheumatic fever, and respiratory infections (including pulmonary tuberculosis) were other diagnoses. Patient satisfaction has been very high and 28 telemedicine patient visits have occurred in their remote home communities, minimizing travel. The infectious disease consulting service and local clinicians have succeeded in addressing needs for care in infectious diseases in northwestern Ontario, where important gaps in service to First Nations’ communities continue to exist. Regular scheduled available access to an infectious disease specialist is a well-received advancement of care in this remote region of Canada.

Keywords

Telemedicine, infectious diseases, remote, indigenous

Jalal Muthai, Michael Kirlew MD CCFP, Raphael Saginur MD FRCP and Yoko S Schreiber MD FRCP MC

Introduction

Infectious diseases are very common in the remote 32 First Nations communities in the Sioux Lookout region in northwestern Ontario. The area suffers from a high incidence of tuberculosis, and has documented higher rates of other infectious diseases such as hepatitis C, blastomycosis, acute rheumatic fever, and infections due to CA-MRSA, compared to the rest of Canada.¹ ² Reason for this are thought to primarily reflect social determinants of health: lack of access to clean running water, and overcrowded and inadequate housing.¹ ³ Some infections, such as blastomycosis, are highly endemic in the region. Illnesses are often advanced on presentation, due to a high prevalence of comorbidities such as diabetes, drug use and limited access to health resources.

While rural physicians are used to diagnosing and treating complex diseases, the high burden of infectious diseases in the region benefits from the integrated, systematic support of infectious disease specialists who are familiar with the geographic and cultural characteristics of the region and its population. Involvement of infectious diseases specialists in the care of patients with infections has been shown to improve patient and economic outcomes.¹ ³ ⁴ Sioux Lookout Zone is primarily a First Nations population, 82% of the 28,000 population being Ojibway or Cree First Nations members.¹ ³ ⁴ The region covers an area of 385,000 km² with Sioux Lookout Meno Ya Win Health Centre (SLMHC) in Sioux Lookout serving as the regional hospital. Of its 32 remote northern communities, only seven can be reached by road. All others rely on scheduled round trips by bush plane or watercraft to their closest hospital. Of its 32 remote northern communities, only seven can be reached by road. All others rely on scheduled round trips by bush plane or watercraft to their closest hospital.

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RESEARCH/Original Article

Management of infectious diseases in remote northwestern Ontario with telemedicine videoconference consultations

Jai Mashru, Michael Kirlew MD CCFP, Raphael Saginur MD FRCP and Yoko S Schreiber MD FRCP MC

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Characteristics of the telemedicine application

Development

The first aspect of program development was two independent visits to the region by the infectious disease specialists. The study included teleconsultations with local communities across a variety of settings, including rural communities. While telemedicine has also been used to connect remote and isolated Aboriginal communities, its use and acceptability in the infectious disease context has not been documented in this setting.

We describe the development and first year of operation of a telemedicine-based consultation service between SLMHC, Ontario, Canada, and the Districts of Infectious Diseases at The Ottawa Hospital (TOH), Ontario, Canada.

Table 1. Patient demographics (n = 76 patients)

<table>
<thead>
<tr>
<th>Gender</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>49</td>
<td>25</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Visit types.

<table>
<thead>
<tr>
<th>Visits (n = 191)</th>
<th>Consultations</th>
<th>Follow-ups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sioux Lookout</td>
<td>67</td>
<td>9</td>
</tr>
<tr>
<td>Community</td>
<td>9</td>
<td>19</td>
</tr>
<tr>
<td>Patients (n = 76)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seen in Sioux Lookout alone</td>
<td>57</td>
<td></td>
</tr>
<tr>
<td>Transferred care to community</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Only seen in community</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Reason for visit (n = 191 visits).

<table>
<thead>
<tr>
<th>Infection site</th>
<th>No. of visits (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin and soft tissue</td>
<td>43 (23%)</td>
</tr>
<tr>
<td>Respiratory</td>
<td>37 (19%)</td>
</tr>
<tr>
<td>Musculoskeletal</td>
<td>50 (26%)</td>
</tr>
<tr>
<td>Gastrointestinal</td>
<td>15 (9%)</td>
</tr>
<tr>
<td>Intra-abdominal</td>
<td>5 (3%)</td>
</tr>
<tr>
<td>Bloodstream</td>
<td>26 (14%)</td>
</tr>
<tr>
<td>Blood borne</td>
<td>3 (2%)</td>
</tr>
<tr>
<td>CNS</td>
<td>4 (2%)</td>
</tr>
<tr>
<td>Other</td>
<td>5 (3%)</td>
</tr>
<tr>
<td>Total</td>
<td>191</td>
</tr>
</tbody>
</table>

Demographic data included: age, gender, home community, diagnoses, visit type (consultation or follow-up), and language spoken at visit (Sioux Lookout or remote First Nations community). Ethical approval was received by SLMHC Research and Ethics Committee.

Demographics and summary of operations

Of the 76 patients seen over a one-year period in the infectious diseases telemedicine clinic, all but one were First Nations (see Table 1). Ages ranged from 2–84 years, with a mean age of 45.1 years. English was the mother tongue of only 24 of the 50 survey respondents and translators were available at all clinics. Ninety-one (61.76) patients lived in remote First Nations communities; 11 patients were from Sioux Lookout and four from neighboring rural communities.

In this first year of operation there were 76 initial consultations and 115 follow-up appointments or case conferences, for a total of 191 infectious diseases telemedicine appointments (see Table 2). Out of 191 appointments, 28 (14.7%) were seen in their home community thus eliminating travel to SLMHC. The number of follow-up appointments per patient ranged from 0–10, with an average of 1.1 (standard deviation (SD) ± 1.87) (see Table 2). The scope of diagnoses was broad and included rare conditions such as pediatric cases of acute rheumatic fever and the adult tuberculosis. Skin and soft tissue infections (23%) such as infected diabetic foot ulcers were common, accounting for 32 of the 76 diagnoses. Respiratory infections accounted for nearly one-fifth of visits and included one case of pulmonary blastomycosis and three patients with active tuberculosis. Table 3 summarizes visits in relation to type of infection. During the time of implementation of the infectious diseases telemedicine clinic, a high incidence of acute rheumatic fever was observed. Three patients with rheumatic fever were also seen in the clinic to assist public health with case management. A quarter of visits occurred for musculoskel- etal infection (including osteomyelitis and pyomyositis). Three visits were in relation to HCV.

Overall patient satisfaction was 98% in the nine questions asked of each patient (see Table 4). Patients who indicated an unsatisfactory experience did not provide any reasons in the free commentary section of the questionnaire. Interestingly, two people were satisfied but would not recommend telemedicine to a friend. Image and sound quality were acceptable from a patient perspective, but clinicians felt examination of wounds was limited by poor image resolution and lack of three-dimensional ability. Inability to conduct a hands-on physical exam, especially in the assessment of pedal pulses and assessment of sensation in patient with diabetic foot ulcers, was identified as a particular limitation by the specialists, especially when no healthcare provider was present at the interview.

Smooth running of the program was largely driven by a core team of “telemedicine champions” at either end: the infectious diseases specialists and their administrative assistant in Ottawa, and a family physician and the nurse telemedicine coordinator in Sioux Lookout. Absence of one or more of the members negatively impacted the scheduling of patients, visit and/or follow-up process.
A rural infectious diseases telemedicine program in a region with a gap in the provision of healthcare to First Nations communities. Most healthcare in Canada comes under provincial jurisdiction, and gaps in access to and support are often caught in jurisdictional red-tape when attempting to access care, in view of the common need for care across a provincial boundary. Most healthcare in Canada comes under provincial jurisdiction, with the exception being care of First Nations on reserves which is a federal responsibility. Amongst others, these factors have contributed to an ever-growing gap in the provision of healthcare to First Nations communities across the region of Canada. Previous described telemedicine specialist care programs have been found to benefit patient and physicians and demonstrate high patient satisfaction. There is limited information on the use of telemedicine in indigenous communities. While support for infectious diseases through telemedicine has been used in the management of different types of infections in various settings, our program is the first (to our knowledge) to implement an infectious diseases telemedicine program in a region with primarily First Nations communities. Overall, most patients were pleased with the encounter and would recommend it to others. An overview of the types of consultations received indicates that complex infections are common in this population, and that our telemedicine program can provide clinical expertise and follow-up care. Although we did not assess patient outcomes, other studies have demonstrated that infectious diseases consultants’ involvement improves patient-related outcomes and shortens length of hospital stay. The latter may be particularly important for some patients who are often required to stay in Sioux Lookout for their care. Earlier return home would allow patients to benefit from their personal support systems in their community and follow-up care at their local nursing station. Allowing a visit to occur in the community minimizes disruption of work and family life.

Furthermore, we were able to assist local public health initiatives addressing a high number of incident acute rheumatic fever cases. Active case management was provided through our telemedicine clinic. This clinical link created the foundation for continued involvement in regional rheumatic fever control efforts through establishment of a multidisciplinary Acute Rheumatic Fever working group, and most recently, an Emerging Infectious Diseases Response Team.

Avoiding expensive travel out of community (CDN$3000–15,000 per flight) for patients in Sioux Lookout, Thunder Bay and Winnipeg has the potential for massive cost savings. Currently, most communities lack the infrastructure and resources to support administration of intravenous antibiotics in the community. Few acute infections necessitate hospitalization, patients are often required to stay in Sioux Lookout to complete their intravenous treatment. Once there is adequate support for home intravenous programs in the communities, length of stay may be further reduced or avoided if follow-ups could occur in the community. Previously published economic analyses question whether telemedicine is indeed cost-effective from the standpoint of the provider. It is generally believed that true monetary gains rely on overall socioeconomic benefits that take patient and physician travel costs and hours of missed work for appointments into account.13,15 Our study underscores the potential positive impact that specialist consultations through telemedicine can have on health and well-being, as well as on community and healthcare associated costs.

Limitations of our study include no formal assessment of clinical outcomes. Similarly, we can only hypothesize that the program helps to contain costs of care and treatment, but we did not perform an economic analysis. Savings on travel for a specialist appointment may be offset in part by requirements for travel from the community to Sioux Lookout, Thunder Bay or Winnipeg for imaging procedures. Overall, the telemedicine program was well-received among most patients. Unfortunately, we were unable to gain more insight on why telemedicine may not be satisfactory for some patients or why telemedicine may not be favorably received by some, while also aiming to update audiovisual components, will help improve the experience.

There are program limitations regarding the ability to perform physical examination. These limitations relate in part to the technology available. As the technology improves, the ability to auscultate and to observe the three-dimensionality of lesions and perhaps even palpate lesions may improve. In the interim, the presence of a healthcare provider who can perform a physical examination under the direction of the specialist would be useful in bridging this gap. Heavy reliance on telemedicine challenges at either end jeopardizes the sustainability of the program in face of high staff turn-over in northern communities. Formalizing the relationship through contracts or a memorandum of understanding can assist in securing reliability and ensuring accountability.

Our program began by initiating community visits by the urban infectious disease specialist clinicians, who met local key stakeholders and First Nations leaders in their communities and follow-up care at their local nursing stations. Allowing a visit to occur in the community minimizes disruption of work and family life. Furthermore, we were able to assist local public health initiatives addressing a high number of incident acute rheumatic fever cases. Active case management was provided through our telemedicine clinic. This clinical link created the foundation for continued involvement in regional rheumatic fever control efforts through establishment of a multidisciplinary Acute Rheumatic Fever working group, and most recently, an Emerging Infectious Diseases Response Team.

Conclusion
With our program we demonstrate telemedicine to be a meaningful tool for clinical specialist support in rural practice, specifically in First Nations communities. Understanding local needs and infrastructure is key to filling important gaps. Regular scheduled available access to an infectious disease specialist from a region that suffers a large burden of infectious disease and geographic challenges is a well-received clinical advancement for care in our region, with potential for major socioeconomic benefits.

Acknowledgments
The authors would like to thank Allison O’Dell from SLMHC and Dora Klees from TOH for considerable logistical and patient-related support. Dr. Kelly for his help with reviewing the manuscript, as well as SLFNHA, KOTS and OTN for their support of the infectious diseases telemedicine initiative.

Declaration of conflicting interests
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References

Potential role for interferon-γ release assays in tuberculosis screening in a remote Canadian community: a case series

Wilson Kwong MD MSc, Thomas Krahm, Ann Cléand, Janet Gordon, Wendy Wobeser MD MSc

Background: Current Canadian guidelines suggest that neonatal Bacille Calmette-Guérin (BCG) vaccination does not result in false-positive tuberculosis (TB) skin tests, despite a growing body of evidence that interferon-γ release assays may be a more specific alternative in identifying latent tuberculosis infections in vaccinated populations. We set out to evaluate the relationship between TB skin tests and interferon-γ release assays in patients who previously received neonatal BCG vaccine.

Methods: All children with a positive skin test at age 14 years or 10 years of age (in the case of more recent TB skin test screening) in a remote community in Northeastern Ontario, Canada, were considered for interferon-γ release assay testing.

Results: Of the 11 children who underwent routine screening at 14 years of age for latent TB infection, 7 had a positive skin test (≥10 mm). All 7 of these children had received the BCG vaccine as newborns and all had a negative TB skin test during their routine screening at 4 years of age. No potential exposure to active TB could be identified. Chest radiographs were normal, and none of the children had symptoms suggestive of active TB. The 7 children underwent interferon-γ release assay testing using QuantiFERON Gold. All 7 tests were negative.

Interpretation: With the addition of interferon-γ release assays to routine skin test screening, we provide evidence that neonatal BCG vaccination may contribute to a false-negative skin test in youth at 14 years of age. Consideration should be given to the possibility that neonatal BCG may contribute to false-positive TB skin tests.

Conclusion

There is a need for considering the role of interferon-γ release assay testing in adolescents with positive TB skin test results who have received the BCG vaccine as newborns. Implementing such practices into First Nation communities must take into account the unique and remote conditions inherent to these populations. The costs and logistics of implementing interferon-γ release assay testing need to be considered when recommending its use in smaller communities.

Competing interests: None declared.

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hospital electronic laboratory archives. Possible iGAS cases were identified if (1) the isolate was recovered from a normally sterile site (defined below), (2) the patient was admitted to hospital, or (3) the specimen was obtained in the operating room. Chart reviews were completed on all possible cases to determine whether patients met the Ontario Provincial Case Definition for iGAS [8]. The case definition included GAS isolated from normally sterile sites (blood, joint [excluding bursa], cerebrospinal, pleural, peritoneal, periarticular, and deep tissue/abscess specimens obtained during surgery) or GAS isolated from a nonsterile site with evidence of clinical severity (toxic shock syndrome, necrotizing fasciitis, proventriculitis, gangrene, meningitis, GAS pneumonia, or death directly attributed to iGAS).

In order to capture iGAS cases transferred directly from Sioux Lookout to Thunder Bay, cases reported to Thunder Bay District Health Unit (TBDHU) with a primary residence from one of the 26 communities were identified. As one of 36 public health units in Ontario, TBDHU has undertaken active surveillance for iGAS since an outbreak of emm9 GAS in 2008 [9]. Duplicates of cases already identified through SLHMC were removed. Details on cases transferred directly to Winnipeg were unavailable.

Information collected by chart review included basic demographics, specimen details, clinical severity, comorbidities, risk factors, and antibiotic sensitivity profiles. Streptococcal toxic shock syndrome was defined as previously described [10]. History of skin condition included chronic dermatitis/wound causing breaks in skin integrity. Cases identified as nosocomial were excluded. In addition, the number of throat and wound swabs that yielded GAS and were submitted to SLMHC from an average of the crude rates each year and calculated per 100,000 population. Ethics approval was obtained through the SLMHC Research Review and Ethics Committee as well as the Research Ethics Board from the University of Toronto, Canada.

RESULTS
Overall, 6674 specimens processed between 2009 and 2014 yielded GAS, and 65 cases of iGAS disease were identified. The number of cases per year ranged from 9 to 18. The annualized incidence of iGAS was 56.2 per 100,000 (95% CI, 35.4–76.9). The mean age of cases was 40 years, with a range of <1 to 87 years. There was a bimodal distribution of age-specific incidence with peaks in the 0–19 and 40–59 age groups (Figure 1). Eleven cases (17%) occurred among infants less than 1 year of age. The majority of iGAS cases occurred during the months of October to March; however, there was no statistically significant seasonal trend. The annual proportion of wound swabs positive for GAS ranged from 40% to 48%. The average annual rate of wound swabs positive for GAS was 61 episodes per 1000 population. Rates increased between 2009 and 2013 and decreased in 2014. The average annual rate of throat swabs positive for GAS for 46.6 episodes per 1000 population. Rates increased between 2010 and 2014. Wound swabs positive for GAS were more prevalent during the summer months, whereas GAS-positive throat swabs did not demonstrate a seasonal trend. There was no detectable association between trends of iGAS incidence and either positive wound swab or positive throat swab rates.

The 2 most common comorbidities identified were diabetes mellitus (38.5%) and skin conditions (38.5%) (Table 1). The most prominent other potential risk factor was alcohol dependence (25%). There was significant overlap in underlying conditions among the 25 patients with underlying diabetes, 10 had skin conditions, 3 had alcohol dependence, and 2 had both skin conditions and alcohol dependence. Seven of 16 persons with alcohol dependence also had skin conditions, and 5 of 7 persons reporting intravenous drug use were also dependent on alcohol. Overall, 49 (75.4%) cases had positive blood cultures, among the 13 with blood cultures that were negative or not done, 9 (13.8%) had positive deep tissue/abscess specimens (taken aseptically in the operating room), 5 (7.7%) had positive synovial fluid, and 1 (1.5%) had positive peritoneal fluid cultures. One case had a nonsterile specimen positive for GAS with evidence of clinical severity. Primary bacteremia was present in 17 (26.2%) cases (Table 2), 1 postpartum bacteremia was identified. Cellulitis was identified at the time of presentation in 38 (55.4%) cases, and septic arthritis was present in 6 (9.2%) cases. Streptococcal toxic shock syndrome and necrotizing fasciitis each occurred in 6 (9.2%) cases, and the crude 28-day case-fatality rate for all iGAS was 6.2%. No cases of nosocomial infection were identified. Antibiotic susceptibility profiles were available for 59 isolates. All isolates were sensitive to penicillin. Sixteen isolates (24.6%) were resistant to both erythromycin and clindamycin. Of the 65 iGAS cases, 46 isolates were available for emm typing. Among these, 14 different emm types were identified (Table 3). The most common emm types were emm114 (17.4%), emm12 (13.2%), emm18 (13.0%), emm10 (10.9%), and emm82 (10.9%). emm type variability over time was observed. Of the 16 isolates demonstrating to erythromycin and clindamycin, 7 were identified as emm21 and 5 were identified as emm214. The cases associated with these isolates were from different communities and temporally unrelated.

DISCUSSION
The incidence of iGAS in Canada increased significantly over the last decade (from 2.81 to 4.63 per 100,000 between 2000 and 2009) [12]. In 2013, the Canadian and Ontario rates for

Table 1. Characteristics of 65 iGAS Cases Identified From 26 Rural and Remote First Nations Communities in Northwestern Ontario Between 2009 and 2014

<table>
<thead>
<tr>
<th>Case Characteristics</th>
<th>Number (%)</th>
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<tr>
<td><strong>Diabetes</strong></td>
<td>25 (38.5)</td>
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<td><strong>Skin condition</strong></td>
<td>25 (38.5)</td>
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<tr>
<td><strong>Coronary artery disease</strong></td>
<td>6 (9.2)</td>
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<td><strong>Active cancer</strong></td>
<td>3 (4.6)</td>
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<td><strong>Periarticular dialysis</strong></td>
<td>3 (4.6)</td>
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<td><strong>Liver failure</strong></td>
<td>3 (4.6)</td>
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<tr>
<td><strong>Connective tissue disorder</strong></td>
<td>3 (4.6)</td>
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<tr>
<td><strong>Other potential risk factors</strong></td>
<td>3 (4.6)</td>
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<tr>
<td><strong>Alcohol dependence</strong></td>
<td>16 (24.6)</td>
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<tr>
<td><strong>Previous positive wound swab for GAS</strong></td>
<td>16 (24.6)</td>
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<tr>
<td><strong>Previous positive deep tissue/abscess specimen</strong></td>
<td>11 (16.9)</td>
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<tr>
<td><strong>Injection drug use</strong></td>
<td>8 (12.3)</td>
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<tr>
<td><strong>Other substance use</strong></td>
<td>6 (9.2)</td>
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<td><strong>Hepatitis C</strong></td>
<td>6 (9.2)</td>
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<tr>
<td><strong>Hepatitis B</strong></td>
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<td><strong>Peritoneal dialysis</strong></td>
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<td><strong>Active cancer</strong></td>
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<td><strong>Coronary artery disease</strong></td>
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<td><strong>Other potential risk factors</strong></td>
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**emm** typing. Among these, 14 different emm types were identified (Table 3). The most common emm types were emm114 (17.4%), emm12 (13.2%), emm18 (13.0%), emm10 (10.9%), and emm82 (10.9%). emm type variability over time was observed. Of the 16 isolates demonstrating to erythromycin and clindamycin, 7 were identified as emm21 and 5 were identified as emm214. The cases associated with these isolates were from different communities and temporally unrelated.

DISCUSSION
The incidence of iGAS in Canada increased significantly over the last decade (from 2.81 to 4.63 per 100,000 between 2000 and 2009) [12]. In 2013, the Canadian and Ontario rates for

Figure 1. Incidence of invasive group A streptococcal cases in 26 rural and remote First Nations communities in Sioux Lookout area between 2009 and 2014 by age.
Table 2. Clinical Features of 65 iGAS Cases Identified From 26 Rural and Remote First Nations Communities in Northwestern Ontario Between 2009 and 2014

<table>
<thead>
<tr>
<th>Clinical Feature</th>
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<tr>
<td>Blood</td>
<td>49 (75.4)</td>
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<tr>
<td>Other sterile source</td>
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<td>Yeast isolate</td>
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<td>Clinical presentation</td>
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<td>Cellulite</td>
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<td>Primary bacteremia</td>
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<td>Septic arthritis</td>
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<td>Pyomyositis</td>
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<td>Peritonitis</td>
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<td>Meningitis</td>
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<td>Diarrhoea</td>
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<tr>
<td>Streptococcal toxic shock syndrome</td>
<td>6 (9.2)</td>
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<tr>
<td>Necrotizing fasciitis</td>
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<tr>
<td>Necrotising myositis</td>
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Abbreviations: iGAS, invasive group A streptococcal

Table 3. Types of 40 Cases of iGAS Identified From 26 Rural and Remote First Nations Communities in Northwestern Ontario Between 2009 and 2014

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</table>

Table 3. emm types of 40 Cases of iGAS Identified From 26 Rural and Remote First Nations Communities in Northwestern Ontario Between 2009 and 2014

The proportion of iGAS isolates that demonstrated resistance to erythromycin (24.6%) and clindamycin (24.6%) was higher than reported in other regions in Canada. A recent analysis of iGAS strains with skin and soft-tissue infections has been primarily related to inadequate and overcrowded housing [30, 31]. Disparities in the social determinants of health, including inadequate and overcrowded housing, are well-documented public health issues facing First Nations communities in Northwestern Ontario [32–34]. The proportion of iGAS isolates that demonstrated resistance to erythromycin (24.6%) and clindamycin (24.6%) was higher than reported in other regions in Canada. A recent analysis of iGAS cases from Peel and Toronto regions in Ontario demonstrated an increase in erythromycin resistance from 2.2% in 1992–1995 to 19.5% in 2008–2010 and then to 7.3% in 2013 [35]. A 2011 publication from the Canadian province of British Columbia reported resistance in all GAS isolates in 2011 to be 14.3% and 11.9% for erythromycin and clindamycin, respectively [36]. Limitations

Data from Winnipeg could not be accessed therefore, our data likely underestimate GAS infection acquired in some communities. Given the small population size and reported case numbers, rates should be interpreted with caution. Risk factors were self-identified in patient charts and may therefore be underestimated. The population of the Indian Registry System relies on individuals to register for ‘Indian status’ and may thus underestimate the true population of communities, which would result in an overestimation of iGAS rates.

Conclusions

More than 200 different GAS emm types have been reported worldwide [37]. The most common emm types identified in the present investigation belong to the so-called (kg, emm83, emm101) and generalist (kg, emm83, emm28, emm87, emm114) emm types only with a few strains belonging to emm types with tropism for throat (kg, emm1) [38]. This is similar to the epidemiology of iGAS cases in nearby Thunder Bay region but differs from the remainder of Ontario [9, 13]. This variation in emm type distribution has important vaccine implications. A 30-valent M-protein vaccine begun clinical trials in Canada and the United States in September 2015. Although this new vaccine is reported to account for greater than 90% and 78% of invasive disease serotypes in the United States and Europe, respectively, only 70% of the emm types identified in this population are covered. The diversity of strains and rapid serotype replacement observed in Northwestern Ontario may mean that the vaccine will offer reduced protection in a population that experiences a disproportionate burden of severe disease [39, 40]. Acknowledgments

We thank Leah Vanderploeg and other public health nurses at Thunder Bay District Health Unit for conducting chart reviews and confirming case details. Financial support. No funding was received for this study.

Potential conflicts of interest. All authors: No reported conflicts of interest.

Funding. This study was supported by a CIHR-FCDAF Grant for Potential Conflicts of Interest. Conflicts that the editors consider relevant to the content of the manuscript have been disclosed.

References

5. Rudolph K, Bruce MG, Bruden D, et al. Epidemiology of invasive group A streptococcal infection in Alaska, 2008–2010 and then to 7.5% in 2013 [35]. A 2011 publication from the Canadian province of British Columbia reported resistance in all GAS isolates in 2011 to be 14.3% and 11.9% for erythromycin and clindamycin, respectively [36].
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Epidemiologic features of invasive group A Streptococcus infection in a rural hospital: 6-year retrospective report and literature review

Introduction: High rates of invasive group A Streptococcus disease were suspected by clinicians in northwestern Ontario. Patients with sepsis were being encountered with bacteremia positive for group A Streptococcus. This study was designed to assess the incidence of invasive group A Streptococcus infection in the region and provide best-practice treatment information.

Methods: We performed a retrospective chart review at the Sioux Lookout Meno Ya Win Health Centre (SLMHC) from 2009 to 2014 to examine rates of infection due to invasive group A Streptococcus and outcomes. All blood cultures from 2015 were also examined to calculate the relative rates of distinct pathogens responsible for cases of bacteremia. A literature review on this topic was performed, with attention to rural incidence where available and clinical practice guidelines.

Results: Invasive group A Streptococcus disease was diagnosed in 65 patients during the study period. Most (37 [57%]) had bacteremia without a clinical focus. Type 2 diabetes mellitus was a comorbid condition in 27 (42%) and skin conditions in 30 (46%). The case fatality rate was 4.6%. In 2015, group A Streptococcus accounted for 8% of all positive blood cultures from in- and outpatients in the catchment area. The calculated annual incidence rate of invasive group A Streptococcus infection was 37.2 cases per 100 000 population.

Conclusion: Rural physicians may encounter group A Streptococcus bacteremia in their practice. The death rate associated with these infections can be as high as 20%, and patients require urgent treatment, typically with intravenous penicillin and clindamycin therapy. The rate of invasive group A Streptococcus infection in the predominantly First Nations population served by the SLMHC exceeded the Canadian rate eightfold and is comparable to rates observed in low-income countries and among Indigenous populations in Australia. This disparity may result from inadequate housing, overcrowding or limited access to clean water.


Méthodes: Nous avons mené une étude rétrospective des dossiers de patients du Centre de santé Meno Ya Win de Sioux Lookout (SLMHC) entre 2009 et 2014 afin d’étudier les taux d’infections invasives à streptocoque du groupe A et les résultats. Nous avons également examiné toutes les hémocultures effectuées en 2015 afin de déterminer les taux relatifs de pathogènes distincts responsables de cas de bactériémie. Nous avons procédé à une analyse documentaire sur le sujet, en portant attention à l’incidence en milieu rural lorsque les données étaient disponibles ainsi qu’aux guides de pratique clinique.
Résultats : Soixante-cinq patients ont reçu un diagnostic d’infection invasive à streptocoque du groupe A pendant la période à l’étude. La plupart d’entre eux (37 [57 %]) présentaient une bactériémie sans manifestations cliniques. Vingt-neuf (42 %) patients présentaient également un diabète de type 2 et 30 (46 %) patients présentaient des affections cutanées. Le taux de mortalité clinique était de 4,6 %. En 2015, les infections à streptocoque du groupe A comptaient pour 8 % de la totalité des hémocultures positives provenant des patients hospitalisés et des patients externes dans la région à l’étude. On a calculé un taux d’incidence annuel d’infections invasives à streptocoque du groupe A de 37,2 cas par 100 000 personnes.

Conclusion : Les médecins en milieu rural peuvent rencontrer des cas de bactériémie à streptocoque du groupe A dans le cadre de leur pratique. Le taux de mortalité associé à ces infections peut atteindre 20 %. Les patients ont besoin d’un traitement urgent, reposant généralement sur l’administration de pénicilline et de clindamycine par voie intraveineuse. Le taux d’infections invasives à streptocoque du groupe A dans la population majoritairement autochtone desservie par le SLHMC était 8 fois plus élevé que le taux observé dans la population canadienne et est comparable aux taux observés dans les pays à faible revenu et chez les populations aborigènes d’Australie. Cette disparité pourrait être attribuable au logement inadéquat, au surpeuplement ou à l’accès limité à l’eau potable.

Introduction

Streptococcal disease caused by the Lancefield group A Streptococcus (S. pyogenes) is a common occurrence in clinical practice, often presenting as common “strept throat” or impetigo. Group A Streptococcus is also associated with 2 autoimmune-mediated diseases that can follow simple infections: poststreptococcal glomerulonephritis and acute rheumatic fever.1,2 More serious disease may occur when the streptococcal infection becomes invasive (Fig. 1).

Housing and access to clean water are among ongoing inequities in social determinants of health in many First Nations communities and are of particular relevance in the context of infectious diseases. In Australia, inadequate sanitation and overcrowding in Indigenous communities are associated with increased risk of infection, with group A Streptococcus being a predominant pathogen.3,4

We suspected that northwestern Ontario has a substantial burden of illness related to group A Streptococcus, as we have previously documented high rates of acute rheumatic fever2 and poststreptococcal glomerulonephritis in the region.

In this study, we report on the scope of invasive group A Streptococcus infections seen in a rural northern Ontario hospital and provide a summary of the relevant literature.

Methods

Retrospective chart review

The Sioux Lookout Meno Ya Win Health Centre (SLHMC) in northwestern Ontario serves a primarily First Nations population. Its catchment area includes 51 remote fly-in communities across an area of 385 000 km². We used microbiology data from the SLHMC laboratory from Jan. 1, 2009, to Dec. 31, 2014, to identify potential cases of invasive group A Streptococcus infection. Case definition followed the Ontario guidelines (Table 1). For each confirmed case, we recorded the patient demographic characteristics and disposition, and information relating to comorbidities and other risk factors.

We also collected laboratory data for all positive bacteremia results in 2015 in order to compare the epidemiologic features of invasive group A Streptococcus infection to those of other invasive infections treated at the same institution.

Data were input and analyzed with the use of Microsoft Excel.

Literature review

We conducted a search of the English-language literature from January 2005 to February 2016 using MEDLINE and Embase. Combinations of the following search terms were used: “Streptococcus pyogenes,” “bacteremia,” “arthritis, infectious,” “cerebrospinal fluid,” “peritonitis,” “shock, septic,” “necrotizing,” “pyomyositis,” “gangrene,” “meningitis,” “bacterial,” “death,” “Canada,” “Indians, North American,” “Oceanic ancestry group,” “rural health services,” “rural population” and “rural health.”

Ethics approval

This research was approved by the Sioux Lookout Meno Ya Win Research Review and Ethics Committee.

RESULTS

Epidemiologic features in northwestern Ontario

In 2015, the SLHMC collected 106 positive blood culture isolates from 100 in- and outpatients. Duplic- ate and repeat cultures for the same patient were not included. Group A Streptococcus bacteremia accounted for 8% of the positive blood cultures (Fig. 2).

In the analysis of cultures positive for group A Streptococcus from 2009 to 2014, we identified 65 cases that met the case definition for invasive disease. Of the 65 patients, 48 were from remote First Nations communities north of Sioux Lookout, and 17 were from Sioux Lookout and Pickle Lake. The annual number of cases over the study period ranged from 6 to 14. No temporal or geographic clustering of cases was identified. The average annual incidence for the study period was 37.2 cases per 100 000 population.

Of the 65 cases, 34 (52%) were in females, and the mean age of all patients was 42.2 years (Table 2). The age distribution was bimodal, peaking among those aged less than 1 year and again among those aged 40–49 years (Fig. 3). Fifteen cases (23%) met the criteria for severe infection. The most common comorbidities were skin conditions (50 patients [46%]) and diabetes mellitus (27 [42%]). Use of nonsteroidal anti-inflammatory drugs (NSAIDs) was the most common risk factor (17 patients [26%]) (Table 3).

Sixty-three cases (97%) were diagnosed based on the isolation of group A Streptococcus from a sterile site, typically blood (53 cases [82%]) (Table 3). Bacteremia without focus was the most common clinical presentation (37 cases [57%]), followed by skin and soft-tissue infections (18 [28%]). Other presentations are listed in Table 4. Streptococcal toxic shock syndrome (STSS) developed in 5 of the 6 patients with necrotizing fasciitis and 4 of the 37 with nonlocal bacteremia.

Twenty-nine patients (45%) were transferred to a tertiary care centre for treatment. Three deaths directly attributable to invasive group A Streptococcus infection occurred during the study period, giving a case fatality rate of 4.6% (Table 5).

Literature summary

In Ontario, invasive group A Streptococcus infection is a provincially reportable disease. The case

Table 1: Key definitions

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confirmed case of invasive group A Streptococcus infection</td>
<td>Isolation of group A Streptococcus from a normally sterile site, or isolation of group A Streptococcus from a nonsterile site and evidence of clinical severity</td>
</tr>
<tr>
<td>Evidence of clinical severity</td>
<td>Any of the following: streptococcal toxic shock syndrome, necrotizing fasciitis, myositis, pyomyositis, gangrene, meningitis, group A streptococcal pneumonia (cannot be used as sole marker), presence of another life-threatening condition, death directly attributable to invasive group A Streptococcus infection</td>
</tr>
</tbody>
</table>

Streptococcal toxic shock syndrome

Hypotension plus 2 of the following: renal failure (impairment, caudalopathy, liver function abnormalities, acute respiratory distress syndrome, generalized rhabdomyolysis, macular rash

Fig. 1. Group A streptococcal diseases.

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Staphylococcus aureus

Fig. 2. Isolates from positive blood cultures from in- and outpatients at the Sioux Lookout Meno Ya Win Health Centre in 2014. Note: MRSA = methicillin-resistant Staphylococcus aureus, MSSA = methicillin-sensitive S. aureus.

Table 2: Characteristics of patients presenting with invasive group A Streptococcal infection to SLMHC between 2009 and 2014

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No. (%) of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean ± SD, yr</td>
<td>42.2 ± 24.9</td>
</tr>
<tr>
<td>Female</td>
<td>52 (2)</td>
</tr>
<tr>
<td>Clinically severe infection</td>
<td>23 (1)</td>
</tr>
<tr>
<td>Comorbid condition(s)</td>
<td></td>
</tr>
<tr>
<td>Skin condition</td>
<td>46 (1)</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>42 (1)</td>
</tr>
<tr>
<td>Alcohol dependence</td>
<td>20 (1)</td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>12 (1)</td>
</tr>
<tr>
<td>Chronic renal failure</td>
<td>11 (1)</td>
</tr>
<tr>
<td>Risk factor(s)</td>
<td></td>
</tr>
<tr>
<td>Use of nonsteroidal anti-inflammatory</td>
<td>26 (2)</td>
</tr>
<tr>
<td>drug</td>
<td></td>
</tr>
<tr>
<td>Staphylococcus aureus cagrowth on</td>
<td>22 (2)</td>
</tr>
<tr>
<td>current wound swab</td>
<td></td>
</tr>
<tr>
<td>Previous wound swab positive for group</td>
<td>20 (1)</td>
</tr>
<tr>
<td>A Streptococcus</td>
<td></td>
</tr>
<tr>
<td>Previous diagnosis of invasive group A</td>
<td>8 (1)</td>
</tr>
<tr>
<td>Streptococcus infection</td>
<td></td>
</tr>
<tr>
<td>Immunosuppressive drug use</td>
<td>6 (1)</td>
</tr>
<tr>
<td>Intravenous drug use</td>
<td>6 (1)</td>
</tr>
<tr>
<td>3D = standard deviation, SLMHC = Sioux</td>
<td></td>
</tr>
<tr>
<td>Lookout Meno Ya Win Health Centre,</td>
<td></td>
</tr>
<tr>
<td>MSSA = methicillin-sensitive S. aureus</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Source of group A Streptococcal isolates from patients presenting to SLMHC between 2009 and 2014

<table>
<thead>
<tr>
<th>Source</th>
<th>No. (%) of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sterile site</td>
<td>97 (52)</td>
</tr>
<tr>
<td>Blood</td>
<td>82 (46)</td>
</tr>
<tr>
<td>Synovial fluid</td>
<td>6 (1)</td>
</tr>
<tr>
<td>Deep tissue (aspiration surgery)</td>
<td>3 (1)</td>
</tr>
<tr>
<td>Abcess (septic aspiration)</td>
<td>3 (1)</td>
</tr>
<tr>
<td>Peritoneal fluid</td>
<td>2 (1)</td>
</tr>
<tr>
<td>Cardiopulmonary fluid</td>
<td>1 (1)</td>
</tr>
<tr>
<td>SLMHC = Sioux Lookout Meno Ya</td>
<td></td>
</tr>
<tr>
<td>Win Health Centre</td>
<td></td>
</tr>
</tbody>
</table>

Table 4: Clinical presentation of invasive group A Streptococcal infections

<table>
<thead>
<tr>
<th>Presentation</th>
<th>No. (%) of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacteremia without focus</td>
<td>37 (57)</td>
</tr>
<tr>
<td>Skin and subcutaneous infection</td>
<td></td>
</tr>
<tr>
<td>Necrotizing fascitis</td>
<td>6 (9)</td>
</tr>
<tr>
<td>Pneumonitis/pneumonia</td>
<td>3 (5)</td>
</tr>
<tr>
<td>Other</td>
<td>10 (15)</td>
</tr>
<tr>
<td>Septic arthritis</td>
<td>6 (9)</td>
</tr>
<tr>
<td>Deep-tissue infection</td>
<td>3 (5)</td>
</tr>
<tr>
<td>Meningitis</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Group A streptococcal pneumonia</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Endocarditis</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Other</td>
<td>1 (2)</td>
</tr>
</tbody>
</table>

Clinical manifestations

A diagnosis of STSS requires hypotension as well as the presence of at least 2 of renal impairment, coagulopathy, liver function abnormality, adult respiratory distress syndrome or generalized erythematous macular rash. 11,14,15 The clinical course of STSS may be rapidly progressive, with death rates as high as 50%. 26–34

Streptococcal toxic shock syndrome may develop in 5.0%–28.6% of patients with invasive group A Streptococcal infection. 26,30,31,32,33,34 Patients with necrotizing fascitis appear to be at greatest risk (10%). 26,30,31

Necrotizing fasciitis

A total of 5.6%–21.8% of cases of invasive group A Streptococcal infection present as necrotizing fasciitis. 11,13,30,32,36,42–44 This disorder presents nonspecifically and is difficult to diagnose initially. 11,42,43

Severe pain, disproportionate to external appearance, is characteristic. 26 Necrotizing fasciitis due to group A Streptococcus is associated with young and otherwise healthy patients 11 and often affects the lower extremities. 11,25–27

Timely and extensive debridement is associated with better outcomes. 49,50–52 Volume resuscitation, intravenous antibiotic therapy and intravenous immunoglobulin therapy may also be important components of treatment; clindamycin may inhibit toxin production. 49,53–55 Death rates range from 16% to 50%. 26,30,31,32,34,42–45

Meningitis

Group A streptococcal meningitis is the presence of isolates positive for group A Streptococcus in cerebrospinal fluid, or clinical and biochemical signs of meningitis accompanying group A streptococcal bacteremia. 18 Up to 5% of cases of invasive group A Streptococcal infection are meningitis, 11,12,21,29 but the 14-year study of the incidence of this infection in Australia showed that, although Indigenous patients constituted less than 10% of the study population, they accounted for 52% of cases of bacteremia due to group A Streptococcus. 32

Epidemiologic features

The highest incidence rates of invasive group A Streptococcal infection are typically reported among young (5–19 yr) and older (> 70 yr) patients. 10–12 Pre-disposing factors for this infection include diabetes, immunosuppression, malignant disease, varicella infection, intravenous drug use, alcohol abuse, skin trauma and NSAID use. 2,13–15

The global incidence of invasive group A Streptococcal infection has been increasing since the mid-1980s. 10,14–19 In Canada, the incidence increased from 2.86 per 100 000 population in 2004 to 4.72 per 100 000 population in 2013. 21,22

The highest reported incidence rates of invasive group A Streptococcal infection are associated with Indigenous communities in Australia, with rates of 23.8–82.5 per 100 000 population. 21,22 A recent
Pathogen is a rare cause of bacterial meningitis (1%–10%). Group A streptococcal meningitis has a high morality rate (25%–50%). Neurologic sequelae develop in almost half of survivors, a higher proportion than with other forms of meningitis. Neurologic sequelae develop in almost half of survivors, which is often the main presentation of invasive group A Streptococcus infection.

The most common manifestation of invasive group A Streptococcus infection is bacteremia without focus (up to 20%). Other infection profiles include septic arthritis (4%–15%) and pneumonia (10%), 14,12,14,12,14.4 Neurologic signs and soft-tissue infections are also common, occurring in 20%–50% of cases. 10,13,14,12,14

**DISCUSSION**

The average annual incidence rate of invasive group A Streptococcus infection in our rural population was 37.2 cases per 100 000 population, with a case-fatality rate of 4.6%. This incidence is 8 times several decades ago and may explain our lower than expected mortality rate.

The scope of invasive group A Streptococcus infection in northern Ontario was similar to the disease profiles encountered in the literature. Most of our cases (57%) were bacteremia without focus, which is the most common presentation of invasive group A Streptococcus infection. The second most common presentation was skin and soft-tissue infection (28%), including necrotizing fasciitis (9%). Streptococcal toxic shock syndrome developed in 11% of cases, which is also in keeping with established estimates of 5%–28%. 13,14,15,16,17,18,19,20

**TREATMENT**

Treatment for invasive group A Streptococcus bacteremia consists of high-dosage penicillin and clindamycin given intravenously for 10–14 days. 21 Intravenous antibiotic therapy is continued for at least 24 h after the patient has become afebrile. 14,22,22,22,22


Acute post-streptococcal glomerulonephritis in northwestern Ontario: A five-year retrospective study

K. Lowney, J. Kelly, C. Oliver, et al.

Acute post-streptococcal glomerulonephritis (APSGN) is a rare but severe complication of group A streptococcal (GAS) infections. This study aimed to determine the incidence and risk factors associated with APSGN in northwestern Ontario. A retrospective study was conducted in the region from 2011 to 2015. The incidence rate of APSGN in northern Ontario was 11.5 cases per million population per year. The risk factors associated with APSGN included age, renal function, and presence of additional infections. The study also highlighted the challenges in the diagnosis and management of APSGN in remote and rural settings.

Outcomes and conclusions: This study is the first to describe the incidence and risk factors of APSGN in northern Ontario. The findings suggest that APSGN is a serious complication of GAS infections, and the public health and healthcare systems need to be prepared to manage these cases effectively.

Keywords: Acute post-streptococcal glomerulonephritis; Nitrogen; Renal disease

APSGN

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Keywords: Acute post-streptococcal glomerulonephritis; Nitrogen; Renal disease

APSGN
The risk of developing APSGN following infection with a nephrotoxic strain of GAS is estimated to be 15% (7,26,28,29). Our report demonstrates the severity of APSGN in Indigenous populations, and raises concerns about the role postinfectious glomerulonephritis may play in the development chronic kidney disease in this population.

One adult patient achieved complete remission. Three cases had persistent hypertension and diabetes mellitus as a result of renal parenchymal loss, and case 12 developed ESRD and remains on hemodialysis.

Newborn and infant APSGN cases occurred with acute hypertension. Those cases ranged from outpatient observation to diuretic and antihypertensive therapies. Three cases (patients 11, 12 and 15) experienced persistent hypertension, and proteinuria and was on two oral antihypertensive medications at the time of the report. The mean age of APSGN among children < 18 years of age in northern Ontario was 6 years, with a median age of 12 years (range 2 to 18 years).

The risk of APSGN was significantly higher in First Nations children (3.3 per 100,000 person-years) compared to the general population (1.8 per 100,000 person-years). Our report highlights the need for ongoing surveillance and research into the factors that contribute to the increased risk of APSGN among Indigenous children in northern Ontario.
TABLE 4
Incidence of acute post-streptococcal glomerulonephritis in developed and less-developed countries compared to the rate in northern Australia

<table>
<thead>
<tr>
<th>Country</th>
<th>Development Status</th>
<th>Incidence Rate (per 100,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developed</td>
<td>Adults</td>
<td>6.0</td>
</tr>
<tr>
<td>Less-developed</td>
<td>Adults</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Incidence rates presented as cases per 100,000 persons/year. *Data adapted from reference 5.

antibiotic therapy may reduce illness spread in an APSGN outbreak (14). This may be reflected in the spotty pattern of our cases. Primordial prevention of GAS infections remains the most effective strategy for mitigating the burden of APSGN (41). The conceptual framework developed by the World Health Organization Commission on Social Determinants of Health illustrates the complex pathways in which social determinants of health impact equity and well being (42). Research highlights the role of stigma and discrimination, education systems, access to health care, food insecurity and lack of adequate housing (43-46).

A direct causative pathway from particular determinants of health (such as inadequate housing and access to potable water) to a particular infectious disease cannot be proven without rigorous prospective methodology. Conditions that facilitate the transmission of infectious disease may make the primordial prevention of GAS infections a challenging objective (47). A Chilean study (38) observed a correlation between low socio-economic status and increased number of APSGN cases, with 80% of cases over a 20-year period overlapped for one month with the establishment of a new set of normal ranges for ASOT values. We used the absolute patient times in our calculations. All APSGN outbreaks would be considered elevated according to the new standards, although they were at the same time. Due to the retrospective nature of our study, we were also not able to perform strain typing of clinical isolates of GAS, which would be helpful in understanding the epidemiology of GAS infection in the region. It remains important to consider environmental data from the chart that would help delineate the contributors of crowding and sanitation to transmission and infection.

CONCLUSION
The incidence rate of APSGN in northern Aboriginals matches the norm for a less-developed country and is more than triple that expected for the rest of Canada. Inadequate, overcrowded housing and limited access to clean water experienced by many remote First Nations communities may drive the high burden of GAS infection and its sequelae in this region.

DISCLOSURES: The authors have no financial disclosures or conflicts of interest to declare.

In Australia, inadequate sanitation and overcrowding in Indigenous communities continues to be associated with increased risk, with GAS being a predominant pathogen (48-49). In this and previous studies, we have documented high regional rates of infections due to CA-MRSA (skin and soft tissue infections, bacteremia) and GAS (BE APENMN) (14,17,51). The remote First Nations communities in our catchment area struggle with overcrowded housing. Many communities have decades-long ‘boil water’ advisories (50). We acknowledge the limitations of our study. The present study was a retrospective chart review with general limitations of and possible errors in data collection, missed cases and potential bias of cases recalled by clinicians. Subclinical APSGN cases may not have been identified clinically or investigated. Low sensitivity, not available for patients diagnosed in the latter years of our study (microscopic hematuria and proteinuria) can take years to resolve following APSGN (16,18,49). Our study period overlapped for one month with the establishment of a new set of normal ranges for ASOT values. We used the absolute patient times in our calculations. All APSGN outbreaks would be considered elevated according to the new standards, although they were at the same time.

The incidence rate of APSGN in northern Aboriginals matches the norm for a less-developed country and is more than triple that expected for the rest of Canada. Inadequate, overcrowded housing and limited access to clean water experienced by many remote First Nations communities may drive the high burden of GAS infection and its sequelae in this region.

REFERENCES
Northern tropics? Seven cases of pyomyositis in northwestern Ontario

Kassandra Loewen BA1, Michael Kirlew MD CCFP2, Paul S Benvenuto MD3, Neety Panu MD FRCP4, Anukul Panu MD FRCP, Natalie Bocking MD MPH CCFP FRCP, Len Kelly MD M FCP FFRM5

OBJECTIVE: To document the incidence and clinical characteristics of (tropical) pyomyositis in a predominantly First Nations population in northwestern Ontario.

METHODS: The present study was a retrospective case series conducted over a 38-month period in a population of 29,105 in northwestern Ontario.

RESULTS: The authors identified seven cases of pyomyositis and described demographics, comorbidity, clinical course, and the results of imaging and microbiology investigations. The incidence of pyomyositis in northwestern Ontario is 7.6 cases per 100,000 person-years, a rate that is approximately 13 times higher than the only published incidence rate for a developed country (Australia).

CONCLUSION: The rate of pyomyositis is high. It may be mediated by overcrowded housing, inadequate access to clean water, and high background rates of methicillin-resistant Staphylococcus aureus infection, injection drug use and type 2 diabetes mellitus.

Key Words: Indigenous peoples; MRSA; Pyomyositis

Pyomyositis is a rare primary infection of skeletal muscle characterized by intramuscular abscesses. It is believed to involve hematogenous spread and Staphylococcus aureus is the predominant causative organism (1-8). Primary pyomyositis is distinct from secondary pyomyositis, which arises from contiguous spread from nearby osteomyelitis, septic arthritis or extramuscular abscess (4-9,11). More commonly encountered in the tropics, it has often been identified as ‘tropical’ pyomyositis (4,12). Since first being reported outside of tropical countries, in the United States in 1971, cases of pyomyositis are being encountered in temperate regions with increasing frequency (4,13-15). This trend has been correlated with increasing rates of community-acquired methicillin-resistant S aureus (CA-MRSA) infections and increased number of patients with compromised immune function (16,17), including those with type 2 diabetes mellitus (T2DM) (4,6,18), injection drug use (IDU) or HIV infection (7,19).

METHODS

Setting: The catchment area for the Sioux Lookout Meno Ya Win Health Centre (SLMHC) in northwestern Ontario comprises approximately 29,105 individuals, 80% of whom live in remote First Nations communities where access to adequate housing and clean water is often limited (20-22). Previous regional research has demonstrated rates of CA-MRSA infection that are among the highest in Canada (21,23). IDU also has a high prevalence in the authors’ catchment area (24-26), with one community documenting 40% of adults participating in treatment for opioid use disorder (27). The regional population is disproportionately affected by T2DM, with age-standardized rates in some communities as high as 26.1% (28,29). Rates of end-stage renal disease (ESRD) are three times higher than the Canadian average (28-30). HIV rates, by contrast, are one of the lowest in the province (31,32).

RESEARCH

Seven confirmed cases of primary pyomyositis were identified. Two other patients were excluded: one with a muscle infection secondary to osteomyelitis and the other had noninvasive radiographic findings. The average age at diagnosis was 33.1 years (range 11 to 48 years), with a male to female ratio of 2.5:1. Of seven cases, three had T2DM; two had a history of IDU; one had ESRD and three had no relevant comorbidities (Table 1). No HIV or malignancies were reported and one patient had recently been prescribed prednisone. There were no deaths; however, several patients experienced prolonged and complicated hospital admisions.

<table>
<thead>
<tr>
<th>Age, years</th>
<th>Sex</th>
<th>Race</th>
<th>IDU</th>
<th>ESRD</th>
<th>T2DM</th>
<th>HIV</th>
<th>MSRA</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Male</td>
<td>None</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Recover</td>
</tr>
<tr>
<td>6</td>
<td>Female</td>
<td>None</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Recovery</td>
</tr>
<tr>
<td>21</td>
<td>Male</td>
<td>None</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Resolu</td>
</tr>
<tr>
<td>47</td>
<td>Male</td>
<td>None</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Death</td>
</tr>
<tr>
<td>58</td>
<td>Female</td>
<td>None</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Recovery</td>
</tr>
</tbody>
</table>

Seven confirmed cases of primary pyomyositis were identified. Two other patients were excluded: one with a muscle infection secondary to osteomyelitis and the other had noninvasive radiographic findings. The average age at diagnosis was 33.1 years (range 11 to 48 years), with a male to female ratio of 2.5:1. Of seven cases, three had T2DM; two had a history of IDU; one had ESRD and three had no relevant comorbidities (Table 1). No HIV or malignancies were reported and one patient had recently been prescribed prednisone. There were no deaths; however, several patients experienced prolonged and complicated hospital admisions.

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In no case was pyomyositis the initial working diagnosis. Initial diagnoses included polymyositis rheumatica, rheumatic low back pain and pyelonephritis, and necrotizing fasciitis. On average, the diagnosis of pyomyositis was made 13.5 days (range four to 28 days) after symptom onset. All the patients had a series of CT or MRI scans, with the exception of patient 7 who was diagnosed during an emergency physicians’ round. Three cases underwent US examinations before CT or MRI.

In some cases, predisposing conditions were present. Patient 3 had been diagnosed with a previous soft-tissue infection prior to 5 cases, group A Streptococcus, and Streptococcus aphteae 18 days after developing symptoms of pyomyositis and had not completed his course of antibiotics. Patient 6 had fallen a distance of 5 ft (1.52 m) and landed on his right gluteus two weeks before presenting. Here was the case with the only history of recent trauma.

All cases but one involved muscle groups of the pelvis and thigh, the outlier being the paraspinal pyomyositis running from C5 to T6. Patients had leukocytosis at presentation. MRSA was the most common causative organism and was cultured from patient 3. Five patients had leukocytosis at presentation. MRSA and pyelonephritis, and necrotizing fasciitis. On average, the diagnosis of pyomyositis was made 13.5 days (range four to 28 days) after symptom onset. All the patients had a series of CT or MRI scans, with the exception of patient 7 who was diagnosed during an emergency physicians’ round. Three cases underwent US examinations before CT or MRI.

The incidences of pyomyositis in northwestern Ontario exceeds the Australian rate by 15.64. This elevated rate in a temperate climate may be mediated by social determinants of health and this could lead to a higher risk rate of pyomyositis in 0.5 cases per 100,000 person-years (14). In tropical regions, pyomyositis accounts for 1% to 5% of all hospital admissions (55). We report an incidence of 7.6 cases per 100,000 person-years, a rate of pyomyositis more than 15 times higher than the estimated Australian incidence (14).

Our study showed that the incidence of pyomyositis in northwestern Ontario exceeds the Australian rate by 15.64. This elevated rate in a temperate climate may be mediated by social determinants of health and this could lead to a higher risk rate of pyomyositis in 0.5 cases per 100,000 person-years (14). In tropical regions, pyomyositis accounts for 1% to 5% of all hospital admissions (55). We report an incidence of 7.6 cases per 100,000 person-years, a rate of pyomyositis more than 15 times higher than the estimated Australian incidence (14).


Conclusion Les SARM d’origine communautaire sont une cause fréquente d’infection de la peau et des tissus mous et peuvent être courants dans les populations surpeuplées et où l’accès à l’eau potable est limité. Les SARM d’origine communautaire se présentent habituellement sous la forme d’une infection cutanée externe de la peau et des tissus mous, mais une infection invasive peut se produire et entraîner une maladie plus grave et compliquée. Les choix de traitement et la nécessité d’une approche empirique aux SARM sont influencés par le type et la gravité de l’infection.

Méthicilline-résistante S. aureus. 2 distinct origins. Méthicilline-résistante S. aureus était d’abord identifiée à un hôpital au Canada en 1961, après la découverte de la résistance à la méthicilline. En 1990, les SARM étaient largement répandues dans les hôpitaux en Europe. En 1978, un cas d’infection d’origine communautaire a été signalé à l’hôpital Royal Victoria de Montréal, au Canada. Étant donné que l’infection résistante à la méthicilline est une caractéristique de la SARM, elle était susceptible d’infecter la population de manière plus large et rapide. La résistance à la méthicilline est devenue une caractéristique de la SARM, et elle était susceptible de se propager rapidement dans la population. En 1978, un cas d’infection d’origine communautaire a été signalé à l’hôpital Royal Victoria de Montréal, au Canada. Étant donné que l’infection résistante à la méthicilline est une caractéristique de la SARM, elle était susceptible d’infecter la population de manière plus large et rapide. La résistance à la méthicilline est devenue une caractéristique de la SARM, et elle était susceptible de se propager rapidement dans la population.

Main message Staphylococcus aureus est un agent commun de pathologie cutanée et muqueuse. Il est responsable de divers types d’infections cutanées et muqueuses, y compris les infections superficielles, les infections de tissu mous et les infections de tissu profond.

Comparing CA-MRSA and HA-MRSA. Community-associated MRSA et HA-MRSA sont génétiquement, épidémiologiquement, et phénotypiquement distincts (Table 1).

Contemporary advances in laboratory technology have demonstrated that methicillin resistance was acquired through different genes in CA-MRSA and HA-MRSA isolates. Specifically, staphylococcal chromosomal cassette mec (SCCmec) types I, II, and III confer methicillin resistance in HA-MRSA whereas SCCmec types IV and V confer methicillin resistance in CA-MRSA. The SCCmec types carried by HA-MRSA are larger than those carried by CA-MRSA and confer resistance to additional non-beta-lactam antibiotics. Community-associated MRSA is therefore susceptible to a broader range of antibiotics than HA-MRSA is.2,7,10,21 A study of pathogens isolated at Canadian hospitals between 2007 and 2009 found the susceptibility of CA-MRSA to trimethoprim-sulfamethoxazole accounts for slightly (98%), gentamicin (98%), and clindamycin (86.1%) to be greater than that of HA-MRSA (85.6%, 85.6%, and 27.8%, respectively). Antibiotic sensitivity profiles can consequently be used as an inexpensive means of classifying MRSA as health care associated or community associated.10,11 For example, clindamycin susceptibility is predictive of CA-MRSA with 95% sensitivity, 80% specificity, and a likelihood ratio of 4.86.10 Methicillin-resistant S. aureus isolates that are resistant to 3 or more non-beta-lactam antibiotics can safely be categorized as HA-MRSA.10 Before advances were made in laboratory genetic technologies, epidemiologic risk factors were used to differentiate cases of HA-MRSA and CA-MRSA infection. The location of acquisition (ie, community or hospital) provided its designation.2–7 In the contemporary era, the method of differentiating HA-MRSA and CA-MRSA no longer aligns with clinical reality as CA-MRSA has found its way into hospitals and is becoming an increasingly prevalent hospital pathogen.2–7 An American study found the community-associated strains of MRSA are increasing both in communities and in hospitals.2–7 In Canada, more than 20% of nosocomial MRSA infections are caused by hospital-associated MRSA.2 A recent study from Alberta found 27.6% of such hospital-onset MRSA infections were caused by CA-MRSA and 27.5% of community-associated infections were caused by HA-MRSA.2 Both communities and hospitals have become antibiotic-resistant environments and are apparently exchanging bacterial isolates.
There is consistent evidence that CA-MRSA is more likely than HA-MRSA to be associated with SSTIs. Several studies documenting the epidemiology of MRSA in indigenous populations have been published. Studies from communities in the United States, Canada, Australia, and New Zealand demonstrate high and increasing rates of CA-MRSA infection in indigenous populations, where HA-MRSA is rare. In Canada, Muileboom et al found the proportion of S aureus isolates demonstrating methicillin resistance isolated from cultures obtained in one northern Ontario laboratory increased from 31% in 2008 to 56% in 2012. Kileel et al reported an incidence rate of MRSA bacteremia of 41.1 cases per 10,000 person-years in northern Western Ontario. In northern Saskatchewan, Goldberg et al found that the rate of CA-MRSA infection increased from 8.2 cases per 10,000 person-years in 2001 to 168.1 cases per 10,000 person-years in 2006. A previous study found that 95.5% of MRSA isolates from these remote communities were CA-MRSA. A 1-year study at the Children’s Hospital of Winnipeg in Manitoba found that 79% of patients from outside of Winnipeg who presented to this hospital with CA-MRSA infection lived in rural communities in northern Manitoba, southern Nunavut, or northernwestern Ontario. Among these patients, the rate of MRSA infection was relatively high (618). A large study assessing MRSA infection rates among children across Canada between 1995 and 2007 found that 25% of all cases occurred in First Nations children. The confluence of environmental and host factors might explain the disproportionate MRSA burden in indigenous communities. Environmental conditions associated with social and material deprivation, such as overcrowding and inadequate access to in-home pressurized water service, are associated with the transmission of MRSA and the development of MRSA-associated SSTIs. These same environmental conditions are present in nonsevere infection or as step-down therapy. These agents have good oral bioavailability.

Table 2. Treatment of outpatient SSTIs in the era of CA-MRSA

<table>
<thead>
<tr>
<th>SSTI</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple cutaneous abscess (in a low-risk patient not involving face, hands, or genitalia)</td>
<td>Incision and drainage alone; obtain culture</td>
</tr>
<tr>
<td>Pusulant cellulitis (without abscess: treat for CA-MRSA if risk factors present)</td>
<td>Tetracycline, trimethoprim-sulfamethoxazole, or clindamycin</td>
</tr>
<tr>
<td>Nonpusulant cellulitis (no edema: treat for CA-MRSA if risk factors present)</td>
<td>- Hemolytic streptococcus b-invasive</td>
</tr>
</tbody>
</table>

The current clinical practice guidelines for CA-MRSA and HA-MRSA treatment from the Infectious Diseases Society of America recommend increasingly aggressive treatment with increased severity of infection. A distinction is made between purulent and nonpurulent SSTIs. Uncomplicated abscesses without evidence of systemic toxicity might be treated by incision and drainage without antibiotics (level 1 evidence). Evidence from 3 randomized controlled trials and a systematic review indicates not providing antibiotics to patients who undergo incision and drainage for reported abscesses is associated with lower refection rates and comparable wound healing (level 1 evidence). Empiric treatment of purulent cellulitis, when needed, might include oral (triamcinolone, trimethoprim-sulfamethoxazole, tetracyclines, or linezolid level II evidence). Nonpurulent cellulitis is generally caused by Streptococcus group A, C, or G, to which MRSA is less likely to be caused by S aureus; most commonly CA-MRSA. Treatment of nonpurulent cellulitis should therefore target streptococcal species with a β-lactam antibiotic, without routine addition of an agent active against MRSA or MRSA. Most, if not all, MRSA encountered by family physicians will be CA-MRSA, as it occurs primarily in the community context and is distinct from its highly drug-resistant relative, CA-MRSA (Table 2). Complicated SSTIs and invasive MRSA infections, including bacteremia, septic arthritis, endocarditis, reported abscesses, and pneumonia, are typically treated with parenteral vancomycin (level I and II evidence). Susceptibility to clindamycin, trimethoprim-sulfamethoxazole, and tetracyclines is often retained in CA-MRSA isolates and these agents can be considered in nonsevere infection or as step-down therapy. These agents have good oral bioavailability.

Figure 1. Rates of community-associated methicillin-resistant Staphylococcus aureus infections in northern Saskatchewan: N = 2731.
Alternative vancomycin for the treatment of severe or invasive MRSA infection include linezolid, daptomycin, and tigecycline.30-32 Newer agents recently approved or developed that are the cephalosporins cefaroline and cefcotriazole, the lipoglycopeptides telavancin, dalbavancin, and oritavancin, and the oxazolidinone tedizolid.75-81 Pharmacologic and clinical considerations for each antimicrobial agent are list in Table 3. Telavancin, oritavancin, and dalbavancin might be of particular interest to community-based health care services because of their once-daily, one-time, and weekly dosing, respectively (only dalbavancin is currently available in Canada).155 Table 3 provides a list of additional agents active against MRSA that are not available in Canada.

Table 3. Antibiotics relevant in the treatment of MRSA

<table>
<thead>
<tr>
<th>Class</th>
<th>Agent</th>
<th>Route</th>
<th>Activity</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lincosamides</td>
<td>Clindamycin</td>
<td>Oral</td>
<td>Bacteriostatic</td>
<td>300-450 mg orally 4 times daily or 600-900 mg IV every 8 h</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IV</td>
<td></td>
<td>Increasing resistance among community-associated MRSA and methicillin-resistant Staphylococcus aureus; inducible resistance in MRSA</td>
</tr>
<tr>
<td>Lipoglycopeptides</td>
<td>Dalbavancin</td>
<td>IV (weekly)</td>
<td>Not available</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ceftaroline</td>
<td>IV</td>
<td></td>
<td>Not available</td>
</tr>
<tr>
<td></td>
<td>丙氟西林</td>
<td>IV</td>
<td></td>
<td>Not available</td>
</tr>
<tr>
<td></td>
<td>Ceftobiprole</td>
<td>IV</td>
<td></td>
<td>Not available</td>
</tr>
<tr>
<td></td>
<td>Vancomycin</td>
<td>Oral</td>
<td>Bacteriostatic</td>
<td>600 mg IV every 12 h or 600 mg IV every 12 h</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IV</td>
<td></td>
<td>Indicated for SSTI; multiple drug interactions, risk of myositisogenus if used 2 wk or longer; high cost</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ORAL</td>
<td></td>
<td>Indicated for SSTI; multiple drug interactions, risk of myositisogenus if used 2 wk or longer; high cost</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IV</td>
<td></td>
<td>Indicated for SSTI; multiple drug interactions, risk of myositisogenus if used 2 wk or longer; high cost</td>
</tr>
</tbody>
</table>

Table 4. Additional agents active against MRSA not available in Canada

<table>
<thead>
<tr>
<th>Agent</th>
<th>Route</th>
<th>Activity</th>
<th>Status at Time of Writing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telavancin</td>
<td>Oral</td>
<td></td>
<td>Not available; not yet marketed</td>
</tr>
<tr>
<td>Oritavancin</td>
<td>IV (weekly)</td>
<td></td>
<td>Not available</td>
</tr>
<tr>
<td>Oritavancin</td>
<td>IV (1-time dose)</td>
<td></td>
<td>Not available</td>
</tr>
<tr>
<td>Orally; MRSA—methicillin-resistant Staphylococcus aureus; NDC—Health Canada Notice of Compliance.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To be commonly encountered.21,32 Treatment of these infections is beyond the scope of this article.30,32

For patients colonized with MRSA, decolonization treatment can be considered under special circumstances, such as recurrent infections in an individual or household (level III evidence).20,20,85 Decolonization regimens might involve nasal administration of mupirocin, daily 4% chlorhexidine soap baths, and a course of doxycycline and rifampin (level I).20,20 Success rates are modest (< 50%) at best and largely influenced by comorbidities, and thus decolonization is not routinely recommended.15,28,65,66 It is recommended that household contacts and patients exercise good hand-washing practices. Households should avoid sharing razors and other personal hygiene equipment; however, family bedding, clothing, and dishes can be washed together as usual. Aside from covering open wounds, there is no need to isolate persons colonized with MRSA within a household or to wear personal protective equipment when engaging the colonized individual. However, gloves should be used when handling wounds.20

Future research directions. This is an evolving science, and there is much to learn about community spread of CA-MRSA. As HA-MRSA primarily involves inpatients, it lends itself more easily to study. As CA-MRSA began entering the hospital setting it now lends itself to hospital-based research. While specific clinical questions around initial drug choice and duration remain, regional population studies are needed to inform empiric treatment for the community-based clinician.

Conclusion

The prevalence of CA-MRSA appears to be on the rise globally, and disadvantaged communities with overcrowded housing and limited social capital are disproportionately affected. Community-associated MRSA cannot be found in both hospitals and the community and is predominantly associated with prudent SSTIs

Treatment of endemic CA-MRSA infections needs to be balanced with the principles of antibiotic stewardship.

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Contributions

All authors contributed to the literature review and interpretation, and to preparing the manuscript for submission.

Competing interests

None disclosed

Correspondence

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References


Idealized versions of health care are common, and access to health care is often viewed as an unambiguous good. In the social determinants of health literature, for example, access to health care is treated as an intermediate determinant of health. This conceals a simplistic inference: the better your access to health care, the better your health. The reality is more complex: a modern industrial health care system can be a determinant of ill health, especially where it is culturally unsafe. At present, Canadian health care for Indigenous people is not culturally safe owing to the ways that health law, health policy and health practice continue to erode Indigenous cultural identities. The origins lie at the colonial foundations of Canada. Colonialism is the primary distal determinant of Indigenous ill health. As a process of enforced assimilation of Indigenous peoples, the drive to assimilate Indigenous communities into mainstream Canada continues to this day. Contemporary health care contributes to assimilation through what one Anishnabe healer describes as “cultural erosion” (Tom Chisel, Sioux Lookout First Nations Health Authority: personal communication, 2015). As I use the phrase, it refers to the damage to individual and cultural Indigenous identities, with consequent ill health, that is inflicted by Canada’s health care system. It is a problem of racism arising from the imposition of Canadian health law and health policies on Indigenous communities. Racism affects every aspect of health care delivery for Indigenous peoples in Canada. To understand cultural erosion, systemic and epistemic racism merits particular attention. Systemic racism concerns the unjust distribution of power that is built into law, policy and economic practice. It is the imposition and perpetuation of inequities through governance, rather than through individual intention, decision or behaviour. Examples are commonly bureaucratic. Dr. Michael Kirlew, a community physician for Wapekeka First Nation, cites two (personal communications, 2015/16). First, federal Non-insured Health Benefits medical referral forms require physicians to provide a patient’s personal health information irrespective of consent from the Indigenous patient. If the physician does not provide the information, the referral is denied. Second is the routine denial of requests for medical transportation — for example, Indigenous children from remote communities being denied travel for care despite their physicians’ judgment. Another familiar example is the underfunding of the nursing stations of northwestern Ontario and Manitoba. Canadian health care is founded on systemic racism through the violent unilateral imposition of Canadian social, economic, cultural and political dominance over Indigenous land and lives under section 91(24) of the Constitution Act, 1867, Indians, and Land Reserved for the Indians, as well as under the Indian Act, 1985. The Truth and Reconciliation Commission (TRC) of Canada describes it succinctly: Canada asserted control over Aboriginal land. In some locations, Canada negotiated Treaties with First Nations; in others, the land was simply occupied or seized. The negotiation of Treaties, while seemingly honourable and legal, was often marked by fraud and coercion, and Canada was, and remains, slow to implement their provisions and intent. Indigenous peoples were tricked out of, robbed of or pushed off their traditional lands, with the consequent erosion of their own complex systems of spirituality, law, trade, governance and health. Health law and policy in Canada is part of this unilateral assertion of governance, and thus,
The basic moral principles familiar to all health care professionals oblige us to end cultural erosion. Two principles from the cultural safety literature are also invaluable: first, that Indigenous cultures require integration of these principles, as well as the TRC’s summary of the final report of the Truth and Reconciliation Commission (2015). These are: recognition and respect for persons; and respect for human and cultural identity is mandated by moral respect for persons. The basic moral principles familiar to all health care professionals allow us to end cultural erosion. Recognition and respect for human and cultural identity is mandated by moral respect for persons; and respect for human and cultural identity is mandated by moral respect for persons.

References

3. Palmer P. Genocide, Indian policy, and legis­lation of human and cultural identity is mandated by moral respect for persons; and respect for human and cultural identity is mandated by moral respect for persons.
6. Honoring the truth, respecting the future: the future­summary of the final report of the Truth and Reconciliation Commission (2015). This article has been peer reviewed.

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Community-based first aid: a program report on the intersection of community-based participatory research and first aid education in a remote Canadian Aboriginal community

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ABSTRACT

Context: Community-based first aid training is the collaborative development of locally relevant emergency response training. The Saskatchewan Wilderness Emergency Response: Education Initiative was developed, delivered, and evaluated through two intensive 5-day first aid courses. Saskatchewan First Nation is a remote Aboriginal community of 450 people in northern Ontario, Canada, with no local paramedical services. These courses were developed in collaboration with the community, with a goal of building community capacity to respond to medical emergencies.

Issue: Most first aid training programs rely on standardized curriculums developed for urban and rural contexts with established emergency response systems. Delivering effective community-based first aid training in a remote Aboriginal community required specific adaptations to conventional first aid educational content and pedagogy.

Methods: Three key lessons emerged during this program that used collaborative principles to adapt conventional first aid concepts and curriculum (1): standardized approaches may not be relevant nor appropriate; (2) relationships between course...
participants and the people they help are relevant and important; (3) curriculum must be attentive to existing informal and formal emergency response systems. These lessons may be instructive for the development of other programs in similar settings.

Key words: Aboriginal health, community-based participatory research, emergency responders, first aid education, prehospital medicine.

Context
This article considers the intersection of conventional first aid education and the remote fly-in Aboriginal community of Sachigo Lake First Nation in sub-Arctic Canada. This intersection highlighted incompatibilities between standard first aid and local community needs. These were addressed through a community-based collaboration and the development of a unique, community-specific first aid program.

Over the past 4 years, through a process of community consultation and collaboration, the Sachigo Lake Wilderness Emergency Response Education Initiative (SLWEREI) was developed, delivered, and evaluated. This unique community-based first aid program involved two intensive 5-day first aid training courses for lay community members, held in 2010 and 2012. Through two courses, the program has trained 26 adults, approximately 5% of the community population.

Training centered on providing essential life-support in emergency situations, with a focus on patient transport and the provision of adaptive care in low-resource and wilderness settings. Course curriculum and pedagogy were based on community priorities, needs, and feedback received through community consultation.

Community consultation was both formal and informal involving an initial 1-day site visit and needs assessment, formal interviews with key stakeholders focused on curriculum and pedagogy, survey feedback from course participants, and conversations with community members over the telephone and during the weeks spent in Sachigo Lake First Nation over the past 4 years.

Curriculum covered topics ranging from basic trauma care and cardiopulmonary resuscitation to mental health first aid, diabetic emergencies, and safe patient transport. The courses involved little time in a classroom setting with the majority of learning focused on practical skills training and simulation with debrief. The SLWEREI was based on a simple premise, buttressed by World Health Organization and American Heart Association guidelines: in underserviced settings, first response education may enhance community resilience and capacity to manage emergencies and save lives.1,2

This article reports on curricular and pedagogical lessons learned as the authors developed a unique first aid training program. Its purpose is not to present the research details or outcomes of this initiative; these have been described elsewhere3,4. The specific adaptations to first aid educational content and methodology required to deliver effective community-based training in remote Aboriginal communities have not been described elsewhere.

Sachigo Lake First Nation is a remote Aboriginal community of 450 people in northern Ontario, Canada with no local paramedical services. The community is accessible by plane throughout the year, and by seasonal ice road for several weeks during the winter. Full-time nursing staff provides services at a local nursing station. A family physician visits the community for 2–3 days per month. Hospital care is provided hundreds of kilometres away in Sioux Lookout, with transport times rarely less than 4 hours.

Issue: Standard first aid and community based first aid
First aid is ‘the assessment and interventions that can be performed by a bystander (or by the victim) with minimal or no medical equipment’.5 First aid emerged from a paramilitary tradition, rooted in the International Red Cross. In North America, organizations such as the American Heart Association, National Life Saving Society, and the Red Cross outline the scope and principles of conventional first aid education.

As a field of clinical practice, first aid arises from a tradition of algorithmic guidelines, universal practice standards, strictly delineated levels of certification and scopes of practice, and a normative and a fundamentally positivistic approach to health and physiology. The notion that health emergencies are adequately similar across cultures and geographies forms a central premise of ‘standard first aid’, permitting a universal and algorithmic bystander response and educational model. Clinical protocols and first aid practice have been rooted in the simplification of diagnostic, therapeutic, and transport decisions for sick patients, coupled with a drive to provide simple and universal approaches to emergencies through basic training for non-clinicians. This model for immediate and on-scene clinical care and transportation has proven tremendously successful across a variety of settings from the battlefield to shopping centers, and first aid training programs have been recognized internationall as an essential form of health protection and promotion.6 Non-conventional first aid programs have been successful at improving outcomes in low-resource contexts with minimal paramedical services in places such as Ghana, Northern Iraq, Cambodia, and Uganda.7,8

Over a period of years, this team has worked with Sachigo Lake First Nation to analyze the pedagogy and curricula of conventional courses. Through this partnership, the team has customized a first aid training curriculum to Sachigo Lake First Nation. This collaborative approach revealed incompatibilities between standard first aid and the lived experience and needs of the Sachigo Lake community. The customized first aid program and experience captures several lessons learned that the authors now identify as central to first response capacity-building and first aid programs in remote settings. Together, these core concepts describe what the authors call ‘community-based first aid’, a community-oriented approach to first aid education.

Lessons learned
The authors distilled several concepts into three lessons:

1. Standard algorithmic approaches may not be relevant or appropriate.
2. Relationships between course participants and the people they help are relevant and important.
3. Curriculum must be attentive to existing informal and formal emergency response systems.

First aid education pedagogy in a unique context
In a remote community, standard first aid approaches may be neither relevant nor appropriate. Standard first aid curricula face limitations in a remote Aboriginal community such as Sachigo Lake. To build a first response curriculum for this program, the authors drew on basic life support and first aid resources from the Heart & Stroke Foundation, American Heart Association and the European Resuscitation Council; wilderness medicine programs from Wilderness Medical Associates International; and emerging mental health first aid materials from the Mental Health Commission of Canada. These conventional first aid resources face two serious limitations for effective capacity building in a remote setting like Sachigo Lake.

First, these sources often assume an advanced literacy and the cultural and cognitive dominance of the written word among learners. Participants had a wide range of literacy levels, but few participants learned primarily from text. It was identified that these first aid curricula place heavy emphasis on flow charts and acronyms, both of which led to significant...
challenges for participants. For example, some conventional first aid curricula use the acronym AVPI when assessing a patient’s level of consciousness to represent: Awake, responds to Voice, responds to Pain, or Unresponsive. Early course simulations showed that prompting learners to use this acronym as a memory tool was leading to confusion and flustering students. This issue was not specific to one or two students, but a challenge expressed by all students. Assessment of the patient’s level of consciousness was altered to an intuitive approach, requiring participants to identify if the patient was behaving normally, abnormally, or unresponsive, and to identify if the level of consciousness was improving or worsening. Through consultation, the authors focused on similar assessment principles but phased acronyms out of the curriculum as they were found to be a stumbling block, rather than a helpful cognitive aid.

Second, conventional curricula emphasize pathophysiology, requiring trainers to develop health and physiology literacy in order to understand and provide emergency care. For example, Heart & Stroke Foundation resources on stroke and myocardial infarction are laden with graphics about atherosclerosis and thrombosis. While these pathophysiological teachings serve some learners well, it was observed that this approach could distract participants from the essential steps involved in responding to a family member with signs of stroke or chest pain. The program described in the present article did not treat pathophysiological knowledge as a prerequisite for problem solving and decision-making. Pathophysiology was addressed in the curriculum when questions arose from participants. Participants were not taught to identify symptoms of a myocardial infarction in order to make first response decisions because this would require an unnecessary cognitive link between symptoms, pathophysiology, and first response decision-making. Instead, participants were taught a generalized approach to patients complaining of chest pain, requiring only a link between observed symptoms and behaviors, and first response actions. This approach focused on symptom recognition, critical decision-making, safety, and treatment.

Third, both conventional and wilderness first response algorithms were found to be contextually and geographically inappropriate. Seemingly universal instructions like ‘call 911’, ‘wait for the ambulance’ or ‘go to your nearest emergency department’ appear throughout commonly available first aid programs. This provides incomplete or inappropriate training to first responders who provide care over extended periods in settings without ambulances or formalized dispatch services.

In Sachigo Lake, where there are no paramedical or 911 services, using conventional urban first aid materials re-emphasized service inequities without providing meaningful training alternatives. The current program focused not on when to call for help, nor on protocols, but on relying on oneself and each other to identify a problem, think critically about the situation, and to initiate an appropriate treatment based on the situation. A significant amount of time was spent discussing which patients needed to be transported to the nursing station, how, how quickly, and by whom. While similar principles are taught in conventional first aid courses, the emphasis is on the fact that there is a professional coming to help in an emergency. This is not the case in remote communities such as Sachigo Lake.

Conversely, wilderness medicine curricula offer an emphasis on remote settings and delays in accessing professional care, but this approach omits wilderness-specific approaches that may alleviate an indigenous community from their traditional environment and way of life. Further, wilderness medicine curricula often are designed for the person who occasionally travels in a remote context. This program’s participants articulated a sense of home, safety, and comfort in remote parts of the boreal forest, which was incongruous with discourses and imagery of intrepid adventurers and rescue helicopters that dominate wilderness medical approaches. Helicopters do not have the range to reach Sachigo Lake First Nation. As such, to reach the nursing station or an aircraft, patients are transported by a combination of snow machine, all-terrain vehicle, boat or truck, depending on location and season.

In Sachigo Lake, presenting wilderness medicine materials might inappropriately convey that the program participants’ traditional way of life is inherently or unacceptably dangerous. For example, it is common for members of Sachigo Lake to travel alone or in small groups to hunt and fish in the region surrounding the community. While this might represent a health or safety risk to outsiders, locals in Sachigo Lake understand traveling in their local region and wilderness surroundings as a safe and normal activity. As part of the program curriculum, simulations were based on this context. During simulations, participants had only the materials and resources that they would have with them while traveling by snow machine or boat, such as a tarpaulin, a gun, an ax, a sleeping bag, rope, tape, food, water, and an extra set of clothes. To manage mock patients, they were instructed to use the materials and equipment they would carry routinely to stabilize, treat, and transport patients to the nursing station in their community. Significant periods of time were spent debating simulations, discussing ways to improvise splints, bandages, or transportation packages. This program’s curriculum offered approaches to emergency management suited for extended patient care in remote settings.

Developing a community-based first aid program with a remote First Nations community highlights subtle conflicts between the culture of first aid and the context in which it was being taught. Neither conventional urban programs nor alternative wilderness first response curricula offer training that is particularly well suited to an isolated, Aboriginal community like Sachigo Lake First Nation. Delivering community-based first response curricula may reveal similar geographical or cultural themes in other unique settings.

First aid delivery in a small close-knit community

Community-based first aid programs must consider the relationships between course participants and the people they help. Conventional structured approaches to teaching first response, whether designed for the general public or for professional rescuers, are developed under the assumption that the majority of responses involve patients who are strangers. You are walking along the street and you suddenly come across an elderly man who has collapsed...” and so the scenario plays out. This ‘stranger assumption’ in standard first aid education, where the victim is identified as an anonymous individual identifiable only by their pathology or clinical problem, is incongruous in a tightly-knit community such as Sachigo Lake, where everyone is a friend or a family member.

The stranger assumption in standard first aid creates barriers in a remote community by disregarding existing well-developed relationships. Course participants in Sachigo Lake approached first aid role-play scenarios not as an individual within a community of strangers, but within a network of existing interwoven relationships. This community-based first aid education program adapted to meet the needs in such a community. Patients had names, rescuers were related, first response necessarily involved close friends. These relationships were important community resources. For example, during training exercises, relationships and personal connections to the patient were mentioned frequently and were treated as an asset in the provision of personalized, appropriate, and holistic care. Conventional medical and professional models might identify these relationships as a liability, conflict, or problematic barrier to dispassionate decision-making. In Sachigo Lake, these relationships were used as an asset, to involve close family members from within the community as a health resource, and to build community resilience by strengthening the health capacity of families rather than addressing community needs exclusively through access to health professionals.

As part of the 2012 course, the authors added a module on mental health curriculum that focused on three key areas: thoughts of suicide or self-harm, substance misuse and intoxication, and organized and disorganized behavior. These themes were identified by the community as priority topics based on their shared experience and previous incidents.

Mental health and substance abuse issues disproportionately impact Aboriginal population compared to the rest of Canadian population. Suicide is one of the largest...
contributors to premature death on reserve in Canada, with Aboriginal populations suffering three times the potential life years lost due to intentional injury compared to the general population.10 There were several suicide attempts in 2011 in Sachs Bog Lake, all among young people. All were non-fatal. Similarly, substance abuse is a major issue in the region, with some remote communities reporting a narcotic addiction rate of 70% among their adult population.11 In a survey investigating the severity of substance misuse problems as reported by Aboriginal Canadians, 83% of locally elected leaders reported alcohol and illegal drugs as problems in their community.12

When a layperson provides first aid to a stranger, one would rarely encounter someone who would disclose their suicidal thoughts. This program’s needs assessment and evaluation identified that although mental health first aid is rarely considered part of a conventional life-saving first response program, mental health emergency skills were important to local responders as trauma management or cardiopulmonary resuscitation. In this small, remote Aboriginal community, where everyone is a family member or close friend, the mental health curriculum was central to meeting community needs and building local capacity to manage emergencies in a holistic and realistic fashion.

Language and curricula need to embrace established relationships for a community-based course to connect with community priorities and to reflect the community in which they live. The authors believe that community-based first aid programs can enhance community capacity by adapting curriculum to recognize these existing and important relationships.

**Formal and informal systems**

In a remote community, first aid education must be attentive to existing informal and formal emergency response systems. Conventional first aid training is intrinsically reliant on the existence of an identifiable transition point between bystander first aid providers and a formal healthcare system. Red Cross or American Heart Association Guidelines, for example, assume that first aid providers will intersect with a formal system of professional providers outside the hospital. In many Canadian communities, informal emergency response involves a bystander performing a varying level of first aid, and using a telephone to dial 911 dispatch services. Once dispatch services are contacted, a formal system is activated, and a patient’s care will flow from paramedical to hospital care. In settings where emergencies are not addressed in this manner, developing local capacity requires that planners understand how a community responds to an emergency to be able to enhance systems without supplanting, bypassing, or ignoring them.

Because Sachs Bog Lake has no formal dispatch or paramedical services, the activation of formal emergency services begins when the patient arrives at the nursing station. All pre-nursing station care is provided through an informal system. Trying to understand this informal system has been part of the collaboration. In Sachs Bog Lake, this informal system is complex, situational, seasonal, adaptive, and well understood by community leaders. The authors’ observation is that, in many cases, it is also extremely effective. Patients requiring urgent care often receive treatment and transport to the nursing station within minutes. In many cases, nearly the entire community responds to an emergency. Hence, nearly all available resources are present.

During course development and delivery in Sachs Bog Lake, curriculum and simulations allowed participants to activate and enhance both formal and informal response systems. Just as course delivery was unique because everyone on course was a friend or family member, so too was it distinct because of a shared experience of an informal emergency response system.

In a final large simulation on course, community members responded to a mock plane crash where four patients had been critically injured. This simulation was based on previous aircraft crash in the community, and other similar incidents in the region. Participants responded to the incident, stabilized, packaged, and transported the four patients to the nursing station where two nurses on duty received the patients. This simulation integrated an informal pre-nursing station response system with professional nursing care, and it was seen as a success by course participants, local government, nursing staff, and course instructors. This simulation represented a unique intersection of community-based methods and first aid education where the conventional interface between layperson and professional emergency systems was modified to meet the needs in this remote community. Understanding how individuals in a community respond informally to an emergency is a latent strength in the community that can be reinforced through adaptive curricula.

Other communities may have similar informal response systems that can be enhanced through a similar approach to community-based first aid. Community-based first response training initiatives must be mindful of these informal systems, and find ways to enhance, rather than supplant or undermine, them.

**Conclusions**

Conventional first aid education relies on the notion that protocols and approaches to managing emergencies are applicable across all settings. In a remote Aboriginal community in northern Canada, with no paramedical services, such algorithmic approaches to first response are inappropriate. This program’s collaborative approach to community-based first aid revealed three lessons central to building capacity in a remote community through the development of an education program. They stand in contrast to principles of ‘standard’ and ‘universal’ first aid that have previously dominated this field. The reported observations may be instructive for the development of other programs in similar settings.

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**References**

Community-Based Emergency Care: A Model for Prehospital Care in Remote Canadian Communities

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INTRODUCTION

Over 95,000 First Nations people live in 85 remote communities in Canada where federal nursing stations or clinics are the only source of local healthcare.1 Most of these communities are without ambulance services; citizens need to board a plane to access an emergency department. Health Canada reports identify first responders as “critical” requirements in remote communities, but untrained laypeople usually deliver on-scene care and transport patients to local health centres.2 Despite a $2.4 billion annual expenditure on Ontario’s prehospital care system, approximately 25,000 Ontarians in 29 remote First Nations communities have no formal paramedicine or 911 dispatch services.3

Standard ambulance systems, 911 dispatch, and uniformed paramedical professionals have been developed and refined for settings with road access and hospitals, but may not meet first response needs in isolated communities. Addressing unique geographical, cultural, and epidemiological circumstances in remote communities demands a new approach to local medical first response, and the development of systems founded on First Nations self-determination and self-governance of health services.4 A community-based approach might answer the urgent call for effective, sustainable, and scalable local care.5,6

EMERGENCY CARE IN REMOTE CANADIAN COMMUNITIES

Remote and isolated First Nations populations in Canada face dramatically elevated morbidity and mortality from mental health and addiction problems, cardiovascular and respiratory diseases, diabetes and obesity, and infectious diseases.7,8 These problems all manifest in health emergencies, ranging from mental health crises to myocardial infarction, stroke, diabetic emergencies, severe sepsis, and physical trauma. Remote communities in Northwestern Ontario also face injury rates five to eight times the Canadian average, accounting for 30% of deaths.9 Delivering quality care for these patients requires a strong “chain of survival,” with integrated care systems from the place of initial injury or illness to definitive treatment at local clinics or regional hospitals.9,10 For most Canadians, that chain of survival begins with bystander first aid and the relatively prompt activation of a formal Emergency Medical Services (EMS).

Health Canada’s report on essential services in remote and isolated communities identifies that “Community-Based First Responders are critical to transport the patient from the community to the nursing stations.”10 Remote communities in the Nishnawbe Aski Nation (NAN) in Northern Ontario are without formal paramedic services, while the exception of a handful of reserves on the James Bay coast. Volunteer programs and Crisis and Emergency Response Teams deliver fragmented and heterogeneous services. Volunteer teams struggle with burnout, turnover, and inconsistent service.10 Patients with urgent medical needs can overwhelm community clinics and nursing staff, who often deliver emergency care beyond their regulated scope of practice while communicating simultaneously with regional physicians and air ambulance providers.1 Air ambulance and private aviation services transport patients from nursing stations to regional hospitals.10 These evacuations are not infrequent: roughly one in every 12 people in the region were transported by air

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ambulance between January 2012 and September 2013.\textsuperscript{13} In the 2013-2014 fiscal year, Health Canada spent $175 million on medical transportation for Ontario and Manitoba remote communities, mostly by air ambulance and scheduled flights. During this same period, $103 million was spent on direct clinical care delivery.\textsuperscript{14}

Without formal paramedicine systems in many remote First Nations communities in Canada, bystanders, friends, and family members shoulder the responsibility to transport severely ill and injured patients to local nursing stations and clinics.\textsuperscript{8,9,10,12} The result is a fragile and unpredictable chain of survival. In spite of the occasional heroic success story, these informal systems are an unsafe and unwieldy patchwork of community goodwill and clinical near-misses.\textsuperscript{6,11} All are characterized by inadequate training, tragic underfunding, and inexusable inequity.\textsuperscript{6,11,12} Remote communities and their citizens deserve better.

**Lights and Sirens May Not Work Everywhere**

The Canadian Association of Emergency Physicians' (CAEP) 1997 position paper on rural, remote, and isolated emergency health care in Canada tasks nursing stations with initial triage of outpatients, definitive care for minor conditions, and stabilization and transfer to hospital where required.\textsuperscript{11} The report asserts that “adequate access to ambulance services should be available in all rural communities,” and “regional 911 dispatch by qualified emergency medical dispatchers should be available throughout Canada.”\textsuperscript{14} This is the conventional approach to fixing a gap in prehospital care: expand the standard EMS system based on 911 dispatch, professional paramedics, and standardized clinical protocols. While these may be effective strategies in regions with easier access and more resources, conventional approaches are not learned that one-size-fits-all paramedicine protocols and land ambulance service might not meet the needs of patients and providers in rural communities.\textsuperscript{1,2} CAEP’s 1997 position paper also identifies that the principles of emergency medicine do not differ between rural and urban settings... but the method... differs significantly.” The principle here is that remote communities should have excellent prehospital care. Importing standard ambulance services to remote communities is likely not the right method. Developing local capacity is perhaps a more appropriate strategy.

**Community-Based Emergency Care**

We propose a different solution based on community workers. Training locals as first responders and educators, instead of focusing on recruiting professionals trained elsewhere, would improve local capacity by giving locals the skills to recognize illness and injury, provide basic treatment, and focus on disease prevention and health promotion. In communities where untrained volunteers are already doing their best to deliver care, community-based programs would support the existing culture of caring and helping behaviour with reasonable remuneration, coordinated local training and appropriate training, and basic equipment. Local programs could encourage nursing station staff to work with first responders and community health workers. Lay health workers have been shown to deliver transformative maternal-child health and infectious disease interventions in low resource settings—a similar approach might improve emergency care in remote Canadian communities.\textsuperscript{15} In short, a community-based emergency care strategy could reduce unnecessary costs and unnecessary deaths.

Over the past five years, we worked with First Nations leaders to develop Community-Based Emergency Care (CBEC), a new approach to prehospital care in remote communities.\textsuperscript{1} CBEC is a proposed model grounded in the development of a new group of emergency medical providers called Community Emergency Health Workers (CEHWs). Supported by a handful of paramedics at the regional level, CEHWs from remote communities would be trained through a customized, comprehensive, and culturally appropriate curriculum, based on an existing distinct set of emergency clinical protocols.\textsuperscript{6} Hired in remote communities to deliver essential and timely care, transport patients, and collaborate with local nursing and medical staff, CEHWs would also lead local health promotion, extend emerging models for remote community paramedicine to address health care needs in some of Canada’s most underserviced settings.\textsuperscript{6} CEHWs and volunteer responders would form the backbone of a distributed model of community-based care, providing basic treatment, and focus on disease prevention programs and train a fully integrated model for first response emergency care in these unique geographical and cultural settings, delivering on-scene first response and connecting it with local community care, transport medicine services, and regional advanced care.

Rather than displacing informal systems with standard paramedicine services, CBEC aims to enhance and support existing systems with the training and infrastructure needed to deliver excellent and accessible services. Operated through First Nations governance institutions and delivered by local providers, CBEC contributes to a philosophy of self-determination that has been linked with positive health outcomes and is essential to the cultural vision of First Nations in Canada.\textsuperscript{4} Like similar international initiatives, CBEC would build on a global evidence base demonstrating that local health workers can deliver essential culturally appropriate emergency care and transform community health for conditions ranging from physical trauma to mental health.\textsuperscript{8,9,10,12} CBEC can create jobs, enhance community resilience, improve access to care, and save lives. CBEC offers a new approach to a problem that has been ignored for too long.

**Conclusions**

In remote communities, citizens face stark inequities in access to emergency services, and have identified CBEC as a homegrown approach to delivering care in settings where conventional ambulance services would be ineffective. Local workers can develop the skills to deliver emergency care in their communities, excellent evidence-based first response and transport to a local clinic may come in the form of a trained and skilled friend or family member. It is time to invent new approaches to first response and invest in community-based approaches to emergency care.

**Keywords:** First Response, prehospital care, rural and remote health, community-based health care, Aboriginal health

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REFERENCES


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An environmental scan of emergency response systems and services in remote First Nations communities in Northern Ontario


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ABSTRACT

Background: Approximately 24,000 Ontarians live in remote indigenous communities with no road access. These communities are a subset of Nishnawbe Aski Nation (NAN), a political grouping of 49 First Nations communities in Northern Ontario, Canada. Limited information is available regarding the status of emergency care in these communities.

Objective: We aimed to understand emergency response systems, services, and training in remote NAN communities.

Design: We used an environmental scan approach to compile information from multiple sources including community-based participatory research. This included the data collected from key informant interviews (n=10) with First Nations community health leaders and a multi-stakeholder roundtable meeting (n=33) in October 2013.

Results: Qualitative analysis of the interview data revealed four issues related to emergency response systems and training: (1) inequity in response capacity and services, (2) lack of formalised dispatch systems, (3) turnover and burnout in volunteer emergency services, and (4) challenges related to first aid training. Roundtable stakeholders supported the development of a community-based emergency care system to address gaps.

Conclusions: Existing first response, paramedical, and ambulance service models do not meet the unique geographical, epidemiological and cultural needs in most NAN communities. Sustainable, context-appropriate, and culturally relevant emergency care systems are needed.

Introduction

In 2015, Canada’s Auditor General identified inequitable health services among remote First Nations communities, including severe under-equipment and understaffing of nursing stations and healthcare staff working beyond their scope of practice [1]. Emergency medical services are among the most deficient. The burden of emergency health conditions among remote First Nations is dramatically elevated compared with other Canadian communities. Elevated rates of chronic and infectious disease manifest as critical health emergencies including mental health and addictions crises, myocardial infarctions, diabetic emergencies, and acute sepsis [2]. These service deficiencies coupled with increased risk of emergency health conditions exacerbate the potential for severe illness or death.

Background

The February 2016 Health and Public Health Emergency Declaration issued by Nishnawbe Aski Nation (NAN) and the Sioux Lookout Area Chiefs Committee on Health aimed to bring public attention to the healthcare inequities that exist in the province of Ontario within the remote reserves south of Sioux Lookout and NAN Territory [3]. NAN is a First Nations political organisation that represents 49 First Nations communities in northwestern Ontario, many of which are located in remote regions in the far north of the province. Figure 1 geographically depicts NAN communities connected by seasonal and permanent roads, and with their proximity to closest hospitals. The map shows NAN communities grouped into seven Tribal Councils according to region [4]. Of the estimated 49,000 people represented by NAN and off reserve, roughly 24,000 live in communities.

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Indigenous health; emergency medical services; remote health; health services; Nishnawbe Aski Nation; environmental scan; community-based participatory research

INTRODUCTION

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RESEARCH ARTICLE
without permanent road access and rely on federal nursing stations or clinics as their only source of local healthcare.

Emergency department care is accessible only by plane or helicopter [1,5]. Air transportation services are operated under air ambulance and private aviation services such as Ornge, the largest supplier, or others operated under air ambulance and private aviation. Despite this disparity in emergency health services, our team was unable to locate scholarly work that systematically described the state of emergency care systems and services in remote NAN communities. The purpose of this study was to better understand the available first response emergency care services and systems in remote NAN First Nations primarily from the beliefs and perspectives of community health leaders. Rather than relying solely on government assertions of existing regional or national service provision, we were interested in local perceptions of available care. We defined emergency care as any service that evaluates and/or treats critical medical emergencies to those who are ill and injured, including mental health emergencies. We were guided in our approach by principles of community-based participatory research under a transformative-emancipatory paradigm [12], which posits that the purpose of this project is to improve societal equity for First Nations and addresses power and privilege during the entire research process [13]. We used an environmental scanning (ES) approach to consolidate information from community leaders, frontline practitioners, and publically available sources [14,15]. The first phase of our ES employed an active approach by gathering information from primary sources such as perspectives of First Nations health leaders and relevant stakeholders [15]. The second phase employed a passive approach by gathering information from secondary sources, such as publically available information, to supplement the results obtained from the active approach [15]. This paper provides the only systematic account of local beliefs and perceptions on the status of emergency response capacity, systems, and training in NAN communities.

Methods

Phase I: primary sources

The active approach of the ES consisted of two parts conducted sequentially (1): structured telephone interviews with a group of community health leaders from NAN and (2) a roundtable with an interdisciplinary group of stakeholders relevant to emergency services in NAN communities. Both the interviews and roundtable process constituted an active approach because the research team interacted with the people and organisations involved in emergency care to both collect data and take action [15]. Both components received ethical approval from Lakehead (#128 12–13/RMEO 1463141) and Laurentian (#2013–02–11). University. Structured interview questionnaires were developed to assess the status of emergency care within the member communities of each tribal council (Table 1). Ten key informants from the NAN Health Advisory Group agreed to participate in telephone interviews. These informants were invited to participate because they had the collective knowledge of the emergency response systems across NAN communities. Only two of 49 NAN communities were not represented by these informants. Nine informants were community health leaders and one informant was a representative from a local emergency response organisation. Questionnaires were sent to informants prior to each interview. Three team members conducted semi-structured interviews and follow-up phone calls between August and November 2013 using telephone scripts and a data collection template based on the question guide in Table 1. We member-checked our findings by sharing the interview notes with participants and reviewing their responses during follow-up phone calls to confirm accuracy.

Quantitative descriptive analyses were conducted using Microsoft Excel. Question-specific response rates (QSSR) differed substantially between questions, as key informants did not always have access to or know relevant information about a particular community they were responsible for. Qualitative content analyses were conducted using NVivo 9.0 to identify: (1) issues related to emergency response systems and training in NAN communities; and (2) essential elements of an effective emergency response system for a remote NAN community. Provisional themes were reviewed and revised by the research team for each analysis to increase reliability [16].

Our team held a two-day multi-jurisdictional meeting in October 2013 with a range of health stakeholders in Sioux Lookout, Ontario (Table 2). The meeting was convened to confirm and interpret the interview data, and to collaboratively develop solutions to improve emergency service limitations and gaps. This included the development of a vision, key recommendations, and guiding principles to improve emergency care services in NAN communities.

Table 1. Sample of informant interview questions from telephone scripts

<table>
<thead>
<tr>
<th>Question</th>
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<tbody>
<tr>
<td>1. Who responds to health emergencies, like heart attacks, accidental injuries or mental health emergencies, and provides first aid services in the communities you represent?</td>
</tr>
<tr>
<td>2. Who trains people to provide emergency first aid in each of the communities you represent?</td>
</tr>
<tr>
<td>3. How satisfied are the people of this community/these communities with their emergency response system?</td>
</tr>
<tr>
<td>4. Have first response services or training changed in any of your communities in the past 10 years? If yes, can you describe how?</td>
</tr>
<tr>
<td>5. Considering the funding, travel, and human resource constraints, what do you believe are the essential elements of an effective emergency response system for a remote NAN community?</td>
</tr>
<tr>
<td>6. Do you have anything else you would like to share about pre-nursing station emergency care in the communities you represent?</td>
</tr>
</tbody>
</table>

Figure 1. Map of Nishnawbe Aski Nation member communities, road access and nearest emergency care services. (Reproduced with permission from Jil E. Sherman)
Phase II: secondary sources

The passive approach of the ES consisted of two parts conducted sequentially: (1) reviewing the literature related to emergency response services in NAN communities; and (2) targeted Internet searches of known service providers to identify publicly available information regarding services that were previously not mentioned or identified in Phase I. Phase II did not require ethical approval.

We conducted a literature review in February 2016 to identify published and grey literature. The following electronic bibliographic databases were searched: ProQuest, Web of Science, MEDLINE, and Scopus. Inclusion criteria included: (1) NAN community context or authorship; and (2) content primarily related to the delivery and/or access to emergency response services. Citations involving emergency and environmental emergency-preparedness initiatives were excluded. This search was further supplemented with two independent Google searches including: “nishnawbe aski nation” emergency services and “first nations” emergency services remote Ontario. EM retrieved and reviewed all websites and citations sequentially until saturation. This review also included documents acquired from correspondence between the research team and stakeholders who attended the roundtable meeting.

From the key informant interviews, 12 programmes and services were identified that aimed to provide some degree of emergency care in NAN communities. Targeted website searches were completed in July 2016 to identify publicly available information regarding these 12 programmes.

Table 2. List of representative organisations who attended the multi-jurisdictional roundtable.

- Dignitas International
- Health Canada
- Independent First Nations Alliance
- James Bay Ambulance Services (Winnipeg)
- Area Health Authority
- Kwasinatwok Chukkmakak
- Malata First Nations
- Mushkegowuk Council
- Nishnawbe Ask Nation
- Northwest Statistical School of Medicine
- Ontario Ministry of Aboriginal Affairs
- Ontario Ministry of Health and Long-Term Care
- Omge
- Sachigo Lake First Nation
- Sandy Lake First Nation
- Shibogama First Nations Council
- Sioux Lookout First Nations Council
- Sioux Lookout Meno Ya Win Health Centre
- Sioux Lookout Regional Physicians’ Services Incorporated
- Windigo First Nations Council

NAN health leader interviews

The majority of NAN communities have limited emergency response resources and services. Although there were ambulance or medical transportation vehicles in 35 (78%) communities (92% QSRR), the condition of vehicles was often unknown and some were believed to be in poor or unusable mechanical condition. Many of these vehicles are regular passenger vehicles not designed for patient transport and medical services, and therefore may be inadequate for the intended role despite being in serviceable condition. It was also outside the scope of practice for Health Canada nurses to respond to emergencies outside of a nursing station, as stated by one informant: “Nurses are now stuck in the nursing station because of the memo.” Although some nurses may not act according to this memo, the policy has nevertheless led to challenges, as another informant indicated “that a patient died on the road in the front of the nursing station, and during this incident the nurse could not leave the nursing station”. Despite a lack of permanent road access, the James Bay Ambulance Service operates five paramedic bases in five remote communities in northeastern Ontario: Attawapiskat, Fort Albany, Kashkewatan, Moose Factory, and Moosonee. There are no paramedic services in 28 (61%) remote NAN communities (98% QSRR). Informants identified 12 local programmes, training organisations, health service providers, and political organisations that are involved in emergency care training and response (Table 3). Even when formal emergency response services were available, informants identified a strong community response in attempts to fill service gaps: “there is a reliance on the community to respond to emergencies.” Lay community members such as friends, family and chief and council were known to routinely transport patients to the nursing station in response to all types of emergencies. In communities without access to an ambulance, ill or injured community members are often left to “find their own transportation” to care at the nursing station. The operation of formal programmes is fragmented and heterogeneous. Thirty (79%) communities reported having crisis response teams (78% QSRR) who respond to situations involving suicide attempts and family violence (17). Only 18 (50%) of communities reported that Canadian Rangers in their community respond to emergencies (73% QSRR) and 18 (39%) of communities reported that paramedical services respond to emergencies (94% QSRR). Communities reported that the provincial Emergency First Response Team (EFRT) programme was active in six (13%) communities (94% QSRR). This programme recruits volunteers from the community to be trained in emergency first response, first aid, and cardiopulmonary resuscitation (CPR) based on provincial first responder standards.

There is limited first aid and CPR training in NAN communities. Three (7%) communities had no first aid or CPR training; the remaining 43 (93%) communities had at least one first aid and CPR training session (98% QSRR). St. John’s Ambulance provided training in 31 (78%) communities (85% QSRR), Canadian Red Cross in 12 (33%) communities (66% QSRR), and the Ontario Ministry of Health and Long-Term Care in seven (16%) communities (91% QSRR). Onge did not provide training in any communities (79% QSRR). Eight (17%) communities had first aid and CPR training from at least two sources, of which six (75%) received services from St. John’s Ambulance and the Red Cross. Other sources of training cited by informants included: the Aboriginal Health and Wellness Strategy, the Canadian Ranger Program, James Bay Emergency Medical Services, and the Regional Long-Term Care Emergency Response Educational Initiative. First aid and CPR training frequency ranged from “twice per year” to every “three to four years”. Estimated training frequency averaged once every 2 years (81% QSRR), although many comments indicated that training frequency varied significantly or was irregular with many years between training cycles. Average length of training was 2.7 days (87% QSRR) ranging from “two to three days” to “five days plus two day training in Sioux Lookout”. An estimated average number of 18 people per community were trained with each training session, ranging from two to 200 people. Forty-two (91%) communities identified that trained were from outside the communities (98% QSRR).

Four themes emerged related to the issues surrounding emergency response systems and training in NAN communities (Table 4):

1. Inconsistent and inadequate response capacity and services. There is a wide variety of emergency response capacity and services across NAN communities, as different communities have different emergency response systems available to them. Some communities have access to paramedic services, such as five communities serviced by James Bay Ambulance Service, or have road access and are served by local emergency medical response system; however, many smaller remote communities have limited, if any, response capacity and services: “the community doesn’t have a program to address emergency response [nor]...an ambulance response service, and that is required. They make use of what they have. They’ve been lucky so far.”
2. No formalised emergency service dispatch system. There is a lack of consistent, reliable and standardised communication. Many communities lack 911 services, cell services, reliable landlines, and street names or household identifiers. Often the communication system is unclear, requiring two or three different phone calls during times of emergency: “when there is an issue or emergency in a community, community members call at least two or three different numbers. At times, there is no...
24 hours per day coverage, so the calls go unanswered, and it is then the responsibility of the community members to get the sick/injured person to the nursing station.”

(2) Support for volunteers. Existing volunteer emergency response teams need to be trained, equipped, and supported to enhance continuity to prevent burnout and turnover. Life expectancy of a team member is directly proportional to the call volume, and “turn-over is problematic” since the new person arrives at scale one again.”

One respondent summarised the challenge facing the use of EFRT programmes: “People are willing to dedicate themselves to the training and find the long-term commitment far too extensive, or find this is something they pursue as a career and leave to acquire the education needed to become a member of the medical field. In our region, emergency response teams will have cycled out a complete membership after 2 years with the exception usually of one or two people who are truly committed and suited to emergency work.”

In summary, “The proper support and coordination of a team is required to ensure any measure of longevity.” Volunteer emergency response positions must be supported by paid professional or para-professional roles.

(3) Reliable and responsive transportation. There needs to be a safe, reliable and timely transportation system for patient preparation and transition to the nursing station or health centre. “Each community should have an emergency transport vehicle or ambulance.” In addition, the transport system may need to include “boat, motor, skidoo and sled for winter.” Considering the geographical context of large tracts of wilderness surrounding remote communities, one respondent summed this need succinctly: “safe transfer to a vehicle and safe transport to the nursing station.”

(4) Context-relevant system infrastructure. The emergency response system needs to be adapted and standardised for small remote communities, and this requires infrastructure funding and support for resources, training, and equipment. One respondent stated: “Each community should be outfitted with the resources (equipment and people) necessary to be able to respond to emergencies in the community.” Patient transition to the nursing station and health centres need to reflect the reality of the community context with strong working relationship between nurses and first responders: “There should be a strong working relationship and system in place with the nursing station so the transition occurs smoothly and effectively.”

(5) Training that is reliable and context appropriate. Training needs to be longer than 3 days, more frequent, and more consistent: “There needs to be consistency in trained people that are able to respond to emergencies” and “regular refresher courses in the communities as a preventative measure, perhaps once a year to keep people fresh and up-to-date”. The curriculum needs to be adapted to deal with relevant contextual health emergencies and adjusted to non-urban contexts without typical emergency response systems: “First aid & CPR deal with physical health, but communities need mental health first aid as well to deal with abusive situations, suicide and situations involving drugs and alcohol.” Community members should be encouraged to participate in training because they are a valuable first response resource in each community as “training is key and this includes training for lay community members”.

Multi-jurisdictional roundtable
Representatives of this roundtable included an interdisciplinary group of 33 partners including 16 (48%) representatives from First Nations governance and community organisations, seven (21%) representatives from Ontario Provincial and Canadian Federal governments, seven (21%) representatives from nursing and paramedical services, and three (9%) representatives from non-governmental organisations.

Representatives confirmed the accuracy of results from the interviews and interpreted the results to identify improvement opportunities for NAN communities. There were two main outcomes from this meeting: (1) a shared vision for the future of emergency medical services in NAN communities; (2) guiding principles that are central for implementation of the vision. The shared vision is: “people in remote and isolated First Nation communities should have access to excellent community-based first response emergency care” [5]. The six guiding principles for advancing solutions in pre-nursing station care in remote NAN communities are: community-based, sustainable, capacity-building, collaboration, integration, and excellence (Table 5). The roundtable meeting also led to the identification of two recommended actions including: (1) collaboration between NAN and Federal and Provincial governments; and (2) plan and test a community-based approach to emergency care in partnership with a selection of NAN communities. This approach has been described elsewhere [18]. The meeting report “Community-Based Emergency Care: An Open Report for Nishnawbe Aski Nation” is a public summary of this meeting and it is available at wwwناسمناسبي.cbc [5].
We could not locate significant amounts of publicly available information for the majority of programmes and services. These could be that were located provided no novel information. Documents from professional correspondence revealed that the Canadian Red Cross developed a partnership with Moose Cree First Nation in 2012 called the Strength & Spirit Campaign to develop and deliver existing and novel Red Cross programmes and services to better meet community needs [24].

**Discussion**

Existing emergency response systems, efforts, and programmes are inadequate in NAN communities. Given the small population size and a variety of other contextual, historical, and geographical factors, many communities do not have 911 services or other essential emergency prevention and response systems. There are several programmes and services that address pre-nursing station care; however, the operation of these programmes is heterogeneous and fragmented. Many existing programmes depend on volunteers for operation, leading to burnout, turnover, and unreliable care. These challenges often place the burden on community members to translate Canadian communities; however, there is also lack of equitable, frequent, and effective training opportunities to ensure that lay responders are adequately prepared to manage the medical emergencies that occur in rural and remote NAN communities.

Themes related to issues in emergency care that were identified from interviews with NAN health leaders included limited capacity, services, formalised dispatch systems, and contextually appropriate models of emergency medical service delivery. The expansion of conventional ambulance, first responder, and first aid programmes in these isolated and remote First Nations may not meet the unique geographical, epide- miological, cultural, and social needs of communities [18]. Standard first aid protocols and equipment in such contexts, the expansion of conventional ambulance or first responder programmes are grossly insufficient in NAN communities.

As these communities operate in isolated and remote contexts, the expansion of conventional ambulance or first responder programmes may not be an appropriate or realistic solution. Remote communities are the most vulnerable, and transformation in health care to improve equity is needed. It is therefore paramount that novel, sustainable, and community-based innovations and programmes are developed, particularly those addressing pre-nursing station care. The results of this paper can empower NAN communities with the information to advocate for improved emergency services and systems, which will then result in healthier, stronger, and more resilient communities.

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**Conflict of Interest**

AOD and DV declare a non-financial conflict of interest through their affiliation with Remote Health Initiative, a non-profit entity dedicated to enhancing care in remote settings. The remaining authors declare no conflicts of interest.

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**References**


10. LaVaeux D, Christopher S Contextualizing CBPR. key principles of CBPR meet the indigenous research context. PinatSinas. 2005;71(1).


