VOLUME 3

ANISHINAABE BIMAADIZIWIN RESEARCH PROGRAM

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

Research Compilation

2013-2015

Northern Ontario School of Medicine

École de médecine du Nord de l'Ontario

ANISHNAABE BIMAADIZIWIN Research Compilation 2013-2015

This is our third Research Compilation, each of which spans 3 years of clinical and community-based peer-reviewed research. The Sioux Lookout Meno Ya Win Health Centre has integrated research into its healthcare mandate and program development. It has partnered with the Sioux Lookout First Nations Health Authority to develop a research unit: the "Anishnaabe Bimaadziwin Research Program" which both initiates and collaborates on relevant clinical and community research projects in our region. As well as regional and cross-cultural research, we engage in rural community-based studies of interest nationally and internationally. These peer-reviewed articles are reproduced with the permission of the authors.

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Prevalence of *Helicobacter pylori* in a First Nations population in northwestern Ontario

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Abstract

Objective To assess prevalence of *Helicobacter pylori* infection, reasons for referral for gastroscopy, and clinical findings of gastroscopy in a symptomatic First Nations population in northwestern Ontario from 2009 to 2011.

Design Three hundred four hospital charts of symptomatic patients who underwent upper endoscopy between June 2009 and March 2011 were reviewed.

Setting Meno Ya Win Health Centre in Sioux Lookout, Ont.

Participants First Nations patients with dyspepsia undergoing gastroscopy.

Main outcome measures Reason for referral, and clinical and histologic findings on gastroscopy.

Results The most common reasons for referral for gastroscopy were dyspepsia (59.2%) and undiagnosed anemia (18.1%). Overall, 66.8% of patients underwent biopsies; 37.9% of these patients tested positive for *H pylori*. Gastritis was encountered the most often, in 46.1% of patients; gastric ulcers in 6.9% of patients; and normal gastric mucosa was seen 36.8% of the time. The rate of *H pylori* infection is higher than in urban Canadian populations, but lower than in previous aboriginal prevalence estimates, particularly those based on seroprevalence values.

Conclusion This study raises the clinical question of how eradication testing and treatment protocols should be addressed in remote regions with high disease prevalence. As more is learned about the role *H pylori* infection plays in serious gastrointestinal diseases, rural and aboriginal populations might need a special focus on testing availability and treatment close to home.

EDITOR'S KEY POINTS

- In this study, the *Helicobacter pylori* histologic prevalence among 203 patients who underwent biopsies during upper endoscopies was 37.9%. This figure is slightly higher than previous estimates of 23% to 32% from studies in Canada's urban centres, and lower than previous estimates of 50% to 95% from studies in aboriginal communities across Canada.
- Variables that might confound direct comparison of prevalence figures include the designated tests used to estimate prevalence, symptomatic versus cross-sectional volunteer patients, and use of suppressive medications.
- Additional research, including social determinants of health (sanitation and housing), might clarify the evolving prevalence of *H pylori* among First Nations populations in northern Canada. This study raises the clinical question of how eradication testing and treatment protocols should be addressed in remote regions.

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Little is known about the prevalence of upper gastrointestinal (GI) diseases among aboriginal Canadians. Previous community-based studies have demonstrated that the rates of peptic ulcer disease, gastric cancer, and seropositivity for *Helicobacter pylori* are all elevated among aboriginal groups across Canada.

Helicobacter pylori, a Gram-negative bacterium that colonizes human gastric mucosa, was first described in 1984 for its role in chronic antral gastritis and peptic ulcer disease.[1] It has subsequently been shown to be associated with serious diseases including gastric cancer and gastric mucosa–associated lymphoid tissue lymphoma.[2] Globally, it remains one of the most common infections, as an estimated 50% of the world's population are carriers of the bacterium.[3]

While the prevalence of *H pylori* infection has declined in many parts of North America and western Europe, no such decline has been noted in the developing world. In countries such as Nigeria and Bangladesh, the prevalence of *H pylori* infection reaches 50% by the age of 5, and exceeds 90% in adulthood.[4] The prevalence in Canada is considerably lower. A 2007 urban Ontario study found a seroprevalence as low as 23.1% among 1306 adults aged 50 to 80.[5] Other cross-Canada statistics identified prevalence rates of 30% to 38%.[3,6-8]

The relatively low *H pylori* prevalence in developed countries is related to improved standards of living. Although an exact source of *H pylori* infection has not yet been found, studies from Latin America have shown that contaminated water might act as a reservoir for the bacterium.[4] It is therefore not surprising that the development of modern water-purification systems might be associated with decreased *H pylori* prevalence. The mode of transmission for *H pylori* is also not definitively known; however, epidemiologic studies strongly support person-to-person transmission, with fecal-oral or oral-oral routes being the most likely.[9] Therefore, the other important risk factors for transmission include overcrowding and lack of modern sanitation infrastructure.[3,4,9]

Prevalence in aboriginal populations

Despite a relatively low *H pylori* prevalence in Canada, in 2006, the Canadian Helicobacter Study Group identified 3 groups of Canadians who were still at higher risk of *H pylori* infection: elderly people, immigrants, and aboriginal populations.[3,10] Data on *H pylori* prevalence in Canadian aboriginal populations are sparse. A 2008 review by Goodman et al identified only 4 studies documenting *H pylori* prevalence among Canadian aboriginal populations: 3 studies in Inuit communities and 1 study in a First Nations community.[3] A study of the Wasagamack First Nation in northern Manitoba found 95% of residents were seropositive for *H pylori* in 1999. The incidence of hospitalizations associated with peptic ulcer disease was twice that of nonaboriginal populations (394.3 per 100 000 vs 203.8 per 100 000).[11] Follow-up studies in the Wasagamack First Nation in 2002 and 2004 found the prevalence of *H pylori* among children aged 6 weeks to 12 years to be 56%, and the incidence to be increasing 16% annually.[12,13]

Studies from Inuit communities across the Canadian arctic region have also found high prevalence of *H pylori*. A 1999 study in the communities of Chesterfield Inlet and Repulse Bay found a seroprevalence of 50.8%.[14] The Canadian North *Helicobacter pylori* Working Group, investigating a high prevalence of gastric cancer in the community of Aklavik in the Northwest Territories, found a prevalence rate of 55% in 2006 based on urea breath testing (UBT) results.[15] A follow-up study in the same community found an *H pylori* prevalence rate of 67% on gastric biopsy in a subset of individuals undergoing endoscopy.[16]

Testing for *H pylori* can be performed through both invasive and noninvasive techniques. Common noninvasive techniques include serology, UBT, and stool antigen testing. Invasive techniques include upper endoscopy with gastric biopsy. Serology-based evaluation of *H pylori* status is limited by a 30% false-positive rate, as immunoglobulin G testing reveals both previous (treated) and present infections.[17] For example, a 2011 study in Alaska found a 50% prevalence on biopsy in a population previously noted to have a 75% seropositive rate of *H pylori*.[18] To avoid detection of previous (treated) *H pylori* infections, UBT and stool antigen testing are useful. The latter test has yet to be validated in community-based settings; UBT is available in many urban hospital laboratories but not in rural communities across northern Ontario. It is also not currently performed by the Public Health Ontario Laboratories.[19] The criterion standard test for the detection of *H pylori* remains histology from gastric biopsy.

Aim

The aim of our study was to determine the prevalence of *H pylori* infection among patients who underwent gastroscopies at the Meno Ya Win Health Centre in Sioux Lookout, Ont, from 2009 to 2011. This centre is the primary referral centre for the 29 First Nations communities north of Sioux Lookout, and has a catchment population that is 83% First Nations.[20] Secondary aims of this study were to review common reasons for upper endoscopy referral, the frequency of "alarm features," and endoscopic findings.

METHODS

We reviewed 304 hospital charts of patients who underwent upper endoscopy in Sioux Lookout between June 2009 and March 2011. This included a review of

referral letters, anesthetic records, nursing records, and operative notes. Charts were assessed for basic demographic information, medications, reasons for initial referral, alarm features at the time of referral, endoscopic findings, and *H pylori* status. In patients with suspected GI pathology on endoscopy, *H pylori* status was determined based on histologic analysis of multiple gastric, antral, and body biopsies. A diagnosis of *H pylori* infection was confirmed when any single biopsy tested positive for the bacterium. All gastric biopsies were assessed at a single referral laboratory with 2 senior pathology staff reporting the material. The laboratory participates in internal quality control and review to ensure consistency of reporting practices between the 2 pathologists.

Alarm features included age older than 50 years, active GI bleeding, anemia, melena, vomiting, unexplained weight loss, dysphagia, family history of colon cancer, and abdominal mass. These were identified from referral notes and histories, and are thought to be associated with clinically important GI pathologies such as malignancy, ulcer, or stricture.[21,22] Current guidelines suggest prompt endoscopy for all patients older than 50 presenting with new-onset dyspepsia, or younger patients presenting with alarm features.[21] The value of alarm features in predicting malignancy, however, remains unclear.[22]

Data were compiled in an Excel file and imported into SPSS, version 20.0, for statistical analysis. Data were analyzed descriptively, including means and standard deviations for continuous data, and frequencies and percentages for categorical data. Chi-square (χ^2) testing (Pearson correlation or Fisher exact tests as appropriate) was used to examine the association between endoscopy findings and presence of *H pylori* on biopsy.

Ethics approval for this study was obtained from the Sioux Lookout Meno Ya Win Health Centre Research Review Committee.

RESULTS

Demographic and clinical characteristics

Among the 304 upper endoscopies reviewed, 170 (55.9%) were performed on women and 134 (44.1%) were performed on men; patients had a mean (SD) age of 52.7 (15.9) years. **Table 1** provides the demographic and clinical information for the 304 patients. Alcohol and tobacco consumption were common, with 36.8% being current alcohol consumers, and 36.8% being current smokers. The most common comorbidities included hypertension (57.6%) and type 2 diabetes mellitus (40.5%). The percentage of patients taking gastric-acid suppression medication was also high, as 44.7% were taking proton pump inhibitors (PPIs) and 10.2% reported taking histamine-2 receptor antagonists.

Table 1. Demographic characteristics of 304 patients who underwent upper endoscopy: *Percentages might not add to 100% because of missing data or patients having multiple entries.*

CHARACTERISTIC	VALUE
Age, y	
• Mean (SD)	52.7 (15.9)
• Range	3-92
Weight, kg	
• Mean (SD)	82.1 (18.9)
• Range	42-162
Men, n (%)	134 (44.1)
Cigarette consumption, n (%)	
• Never	123 (40.5)
• Current smoker	112 (36.8)
• Past smoker	57 (18.8)
Alcohol consumption, n (%)	
• Never	131 (43.1)
• Current drinker	112 (36.8)
• Past drinker	22 (7.2)
Comorbidities, n (%)	
• Hypertension	175 (57.6)
• Type 2 diabetes mellitus	123 (40.5)
• Hypercholesterolemia	79 (26.0)
• History of coronary artery disease	37 (12.2)
Medications, n (%)	
• PPIs	136 (44.7)
• NSAIDs (including acetylsalicylic acid)	107 (35.2)
• Histamine-2 receptor antagonists	31 (10.2)
• Warfarin	7 (2.3)

NSAID—nonsteroidal anti-inflammatory drug, PPI—proton pump inhibitor.

Reasons for referral and alarm features

Table 2 provides the reasons for referral and the prevalence of alarm features. The most common reason for referral was a complaint of dyspepsia (59.2%), followed by not-yet-diagnosed anemia (18.1%) and a positive fecal occult blood test result (6.3%). Isolated complaints such as recent rectal bleeding, upper GI bleeding, or melena stool were less common. The most common alarm feature present at the time of referral was age older than 50 years (58.9%). Other common alarm features included active upper or lower GI bleeding (33.6%), anemia (28.3%), and melena (17.1%).

Endoscopic findings and *H pylori* prevalence

Table 3 provides the endoscopic findings and the prevalence of *H pylori* in the subgroup of 203 patients who underwent biopsies. Gastritis was the most common endoscopic finding, present in 140 patients (46.1%). The second most common finding was normal upper endoscopy results (36.8%). Esophagitis, gastric ulcer, and

Table 2. Reasons for referral and alarm features reported at time of referral: *N = 304; percentages might not add to 100% because of missing data or patients having multiple entries.*

VARIABLE	N (%)
Reason for referral	
• Dyspepsia	180 (59.2)
• Anemia not yet diagnosed	55 (18.1)
• Positive fecal occult blood test result	19 (6.3)
• History of rectal bleeding	18 (5.9)
• History of change in bowel habits	12 (3.9)
• History of upper GI bleeding	8 (2.6)
• History of melena	5 (1.6)
• Other	7 (2.3)
Alarm features	
• No alarm feature	47 (15.5)
• Age > 50 y	179 (58.9)
• Active GI bleeding	102 (33.6)
• Anemia	86 (28.3)
• Melena	52 (17.1)
• Vomiting	47 (15.5)
• Unexplained weight loss	34 (11.2)
• Dysphagia	25 (8.2)
• Family history of colon cancer	16 (5.3)
• Abdominal mass	2 (0.7)

GI—gastrointestinal.

Table 3. Frequency of endoscopic findings and *Helicobacter pylori* prevalence: *N = 304; percentages do not add to 100% because some patients had multiple findings.*

FINDINGS	N (%)
Normal upper endoscopy	112 (36.8)
Gastritis	140 (46.1)
Esophagitis	21 (6.9)
Gastric ulcer	21 (6.9)
Duodenitis	21 (6.9)
Duodenal ulcer	10 (3.3)
Malignancy	2 (0.7)
Other	43 (14.1)
Gastric or duodenal biopsy	203 (66.8)
H pylori–positive biopsy*	77 (37.9)

*Biopsies were conducted for 203 patients.

duodenitis were all equally common (6.9%). Duodenal ulcers and malignancy were less common, present in only 10 (3.3%) and 2 (0.7%) patients, respectively.

Biopsies were obtained in 203 (66.8%) endoscopies when deemed clinically necessary at the time of the procedure. The overall *H pylori* prevalence, based on histology, was 37.9%. No specific endoscopic finding was significantly associated with *H pylori* status. On χ^2 testing, the significance levels ranged from $P = .45$ (gastritis) to $P = .84$ (esophagitis).

DISCUSSION

Prevalence of *H pylori*

In this study, the histologic prevalence of *H pylori* among 203 patients who underwent biopsies during upper endoscopies was 37.9%. This figure is slightly higher than previous estimates of 23% to 32% from studies in Canada's urban centres.[5,8,23] Conversely, the prevalence is lower when compared with previous estimates of 50% to 95% from studies in aboriginal communities across Canada.[11,12,14-16]

However, it is difficult to make direct comparisons among the findings from these studies. Each study used different methods for detecting *H pylori*. Apart from this study, only 2 previous Canadian studies have documented *H pylori* prevalence based on histology. One urban study by Thomson et al, focusing on patients with uninvestigated dyspepsia referred for gastroscopy, found a prevalence of 30% based on histology.[8] Another study by Cheung et al, focusing on the Inuit community of Aklavik, found an *H pylori*–positive biopsy rate of 67% among asymptomatic volunteer patients.[16] In the Aklavik study, all gastroscopy patients underwent biopsies. Our study involved biopsies done for clinical reasons.

In the study by Thomson et al, patients were not permitted to use PPIs within 30 days of their enrolment in the study.[8] In our study, 44.7% of patients were taking PPIs at the time of their upper endoscopies. This might have had a considerable effect on the sensitivity of histology in detecting *H pylori*. The use of PPIs is associated with decreased density of *H pylori* in the gastric antrum, as well as migration of the bacterium into deeper tissue.[24] Together, this might cause a 10% rate of false-negative biopsies, underestimating *H pylori* prevalence.[25]

Additional variables that might confound direct comparison of prevalence figures include levels of household overcrowding, quality of water and sanitation, and previous use of *H pylori* eradication therapies. Although not consistently recorded in hospital records, approximately 10% of patients in this study reported at the time of endoscopy referral that they had previously taken *H pylori* triple therapy. This too would have decreased *H pylori* prevalence among gastric biopsies taken at the time of endoscopy.

Endoscopic findings

The frequency of endoscopic findings is relatively high in this study population. In particular, the rate of gastric ulcer (6.9%) is more than double the rate found in other studies. In the urban study by Thomson et al in 2003, only 3% of patients undergoing endoscopy were found

to have gastric ulcers.[8] Similarly, in the Aklavik study, 3.1% of patients were found to have gastric ulcers.[16] Additionally, the rate of gastritis in our study population (46.1%) is more than 3 times higher than the rate found in the Inuit study (13.9%).[16] The rates of duodenitis (6.9%), duodenal ulcer (3.3%), and malignancy (0.7%) are comparable with the rates found in both the urban and Inuit studies.

Comorbidities

The prevalence of current cigarette smoking (36.8%) among the endoscopy patients was higher than the average for patients of the Thunder Bay District Health Unit (26.6%).[26] The alcohol use estimated from our retrospective chart analysis was noteworthy at 36.8%, but far lower than the 57% found by Thomson et al in their 2003 urban Canadian study.[8] Current alcohol use did not appear to explain the greater prevalence of gastritis or gastric ulcers, as current alcohol consumers in our study had the lowest rate of gastritis (33.9%, $P=.02$). The prevalence of comorbidities was also high, with 57.6% of patients having hypertension, and 40.5% having type 2 diabetes mellitus. The prevalence of diabetes among the endoscopy patients in this study is more than 8 times higher than the national prevalence of 4.9%.[26]

Limitations

As a retrospective cohort study, data collection was limited to the information available in hospital records. The records did not include information on risk factors for *H pylori* infection (eg, number of household members, type of sanitation facility used, source of water, level of education). Information on previous *H pylori* testing and eradication was also not always available. A retrospective study is also not adequate for the evaluation of rare outcomes, such as gastric cancer.

Conclusion

The Canadian Helicobacter Study Group has identified aboriginal populations as being at higher risk of *H pylori* infection and its associated diseases. The *H pylori* prevalence, based on histology among 203 patients undergoing upper endoscopy at the Meno Ya Win Health Centre was 37.9%. This figure is higher than estimates from studies in Canadian urban centres.

However, the prevalence is lower than in previous studies in aboriginal communities in northern Manitoba and the Canadian arctic region. This might be owing to variations in study design, the designated tests used to estimate prevalence, symptomatic versus cross-sectional volunteer patients, or use of suppressive medications.

Additional research, including social determinants of health (sanitation and housing), might tell us more about the evolving prevalence of *H pylori* among First Nations populations in northern Canada. Our study raises the clinical question of how eradication testing and treatment protocols should be addressed in remote regions.

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Contributors
All authors contributed to the concept and design of the study; data gathering, analysis, and interpretation; and preparing the manuscript for submission.

Competing interests
None declared

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Descriptive Article
Article descriptif

The changing face of cellulitis and MRSA in rural Canada: a clinical update

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The empiric treatment of cellulitis in northwestern Ontario used to be relatively straightforward. The choice of antibiotic was typically cephalexin, which provided reasonable coverage for staphylococcus and streptococcus, if systemic treatment was required. However, several recent studies and regional bacterial surveillance have altered the options for empiric treatment.[1–5]

Because superinfections can affect even small rural hospitals, rural clinicians have to consider their role in antibiotic stewardship. For example, do good wound hygiene and follow-up suffice? Evidence now demonstrates that incision and drainage (I&D) of uncomplicated abscesses is sufficient without concomitant antibiotic coverage.[2–5] If antibiotics are needed, does our choice of medication cover for increasing rates of community-associated methicillin-resistant *Staphylococcus aureus* (CA-MRSA) seen in soft tissue infections?

Community-associated MRSA

In the past 5 years, northwestern Ontario has experienced increasing rates of CA-MRSA. More than 56% of the staphylococcus isolates processed at the Sioux Lookout Meno Ya Win Health Centre were CA-MRSA in 2011; this was up from 38% in 2008.[1] This centre provides bacteriology services for a geographically dispersed population of 28 000 that mostly comprises First Nations people.

The incidence of CA-MRSA has traditionally been high in remote areas of northern Canada, particularly those with large Aboriginal populations.[6–8] A study in northern Saskatchewan found 51% of *S. aureus* infections to be CA-MRSA.[3] Risk factors for such high rates of CA-MRSA infections include poor housing, sanitation, overcrowding and recent antibiotic use.[9]

Our knowledge of CA-MRSA has dramatically evolved since it was first diagnosed in Canada in 1981.[10] The initial classification in the 1950s used the term "community-acquired." Since then, increasing rates of CA-MRSA are found in hospital settings, so the nomenclature now reflects less certainty about the location of the onset of infection.

Community- versus health care–associated MRSA

Community-associated MRSA differs from health care–associated (HA; previously called "hospital-acquired") MRSA in several important ways. Community-associated MRSA affects the young and previously healthy, and is susceptible to many common antibiotics (e.g., trimethoprim–sulfamethoxazole, clindamycin and doxycycline). Developments in epidemiology and genetic testing have identified CA-MRSA as molecularly distinct from HA-MRSA.[11] Community-associated MRSA did not "escape" from the hospital setting; rather, it developed in the antibiotic-rich environment that community

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settings now have become. Both are resistant to methicillin and oxacillin, but HA-MRSA is highly resistant to most antibiotics, is found in intensive care units (ICUs) in tertiary care centres and may require vancomycin.

TREATING CA-MRSA

In northwestern Ontario, CA-MRSA is most commonly associated with soft tissue infections, but it occasionally presents as life-threatening sepsis or community-acquired pneumonia. Our regional antibiograms show that trimethoprim–sulfamethoxazole, clindamycin and doxycycline (or tetracycline) all have 99% susceptibility rates.[1] Erythromycin susceptibility is low, at 58%.[1] All MRSA strains are, by definition, resistant to all penicillins and cephalosporins.

ERADICATION THERAPY FOR CA-MRSA

Eradication (decolonization) of CA-MRSA is not recommended by the Canadian Infectious Disease Society; however, 25% of CA-MRSA infections in northwestern Ontario are reinfections.[1,12] The theoretical risk of eradication therapy is the development of resistant strains. First Nations communities in northern Ontario are known to have inadequate and overcrowded housing.[13] Possible regimens for initial infections might therefore include nasal mupirocin daily for 2 weeks for all household contacts.[14] The reinfected patient who requires repeat antibiotic treatment might, however, consider a 2-week course of doxycycline, together with rifampin, nasal mupirocin and daily chlorhexidine baths, as well as attention to household contacts.[14]

STAPHYLOCOCCUS VERSUS STREPTOCOCCUS

Along with regional changes of increasing CA-MRSA rates, several recent North American studies also contribute to the changing face of antibiotic stewardship. In 2010, Jenkins and colleagues[15] found that most (65%) soft tissue infections requiring hospital admission were commonly *S. aureus* and most of those were CA-MRSA. The remaining 35% were streptococcal. Jeng and colleagues[16] examined clinical presentations and culture results, and noted that nonpurulent cellulitis was typically streptococcal. Moran and colleagues[17] in 2006, and Talan and colleagues[18] in 2011 have statistically associated purulent cellulitis with staphylococcal MRSA infections.

Three randomized controlled trials and a 2012 meta-analysis verified that uncomplicated abscesses requiring I&D had equivalent healing and fewer recurrences if no antibiotic administration accompanied the I&D.[2–5]

ANTIBIOTIC STEWARDSHIP

Antibiotic stewardship is a developing awareness in rural and urban hospitals. We have just initiated a hospital committee to address it in our rural setting. With the possible exception of repatriated patients from tertiary care centre ICUs, most of the MRSA we encounter will be CA-MRSA. These can be distinguished by the resistance pattern and do not need genetic testing. Other than the rare patient with severe infection or sepsis, patients with CA-MRSA will not need vancomycin and can be safely treated with common antibiotics (e.g., trimethoprim–sulfamethoxazole, clindamycin and doxycycline). Overuse of vancomycin raises the spectre of establishing vancomycin-resistant enterococcus in rural hospitals. Infections that require antibiotics, whether staphylococcus and streptococcus, will likely respond to clindamycin. Uncomplicated abscesses requiring I&D need no antibiotic coverage.

CONCLUSION

Antibiotic stewardship and public education will be required to counter the public's expectation that effective treatment of benign upper respiratory infections and otitis media require systemic antibiotics. Treatment of infectious diseases will always be a moving target, and regional laboratory susceptibility information will be useful in guiding the use of antibiotics.

Competing interests: None declared.

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Community-associated methicillin-resistant *Staphylococcus aureus* in northwest Ontario: A five-year report of incidence and antibiotic resistance

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J Muileboom, M Hamilton, K Parent, et al. Community-associated methicillin-resistant *Staphylococcus aureus* in northwest Ontario: A five-year report of incidence and antibiotic resistance. Can J Infect Dis Med Microbiol 2013;24(2):e42-44.

BACKGROUND: The incidence of community-associated methicillin-resistant *Staphylococcus aureus* (CA-MRSA) is traditionally high in remote areas of Canada with large Aboriginal populations. Northwestern Ontario is home to 28,000 First Nations people in more than 30 remote communities; rates of CA-MRSA are unknown.
OBJECTIVE: To determine the CA-MRSA rates and antibiotic susceptibilities in this region.
METHODS: A five-year review of laboratory and patient CA-MRSA data and antibiotic susceptibility was undertaken.
RESULTS: In 2012, 56% of *S aureus* isolates were CA-MRSA strains, an increase from 31% in 2008 (P=0.06). Reinfection rates have been increasing faster than new cases and, currrently, 25% of infections are reinfections. CA-MRSA isolates continue to be susceptible to many common antibiotics (nearly 100%), particularly trimethoprim/sulfamethoxazole, clindamycin and tetracycline. Erythromycin susceptibility stands at 58%.
DISCUSSION: Rates of CA-MRSA, as a percentage of all *S aureus* isolates, were higher than those reported in other primary care series. The infection rate per 100,000 is one the highest reported in Canada. Antibiotic susceptibilities were unchanged during the study period; the 99% susceptibility rate to clindamycin differs from a 2010 Vancouver (British Columbia) study that reported only a 79% susceptibility to this antibiotic.
CONCLUSION: There are very high rates of CA-MRSA infections in northwestern Ontario. Disease surveillance and ongoing attention to antibiotic resistance is important in understanding the changing profile of MRSA infections. Social determinants of health, specifically improved housing and sanitation, remain important regional issues.

Key Words: *Aboriginal; Antibiotic susceptibility; CA-MRSA; Northwest Ontario*

Le *Staphylococcus aureus* résistant à la méthicilline d'origine non nosocomiale au nord-ouest de l'Ontario : un rapport quinquennal d'incidence et d'antibiorésistance

HISTORIQUE : L'incidence de *Staphylococcus aureus* résistant à la méthicilline d'origine non nosocomiale (SARM-ONN) est généralement élevée dans les régions éloignées du Canada aux fortes populations autochtones. Ainsi, 28 000 membres des Premières nations habitent dans plus de 30 communautés éloignées du nord-ouest de l'Ontario. On n'y connaît pas le taux de SARM-ONN.
OBJECTIF : Déterminer le taux de SARM-ONN et les susceptibilités aux antibiotiques dans cette région.
MÉTHODOLOGIE : Les chercheurs ont effectué une analyse quinquennale des données de laboratoire et des données des patients à l'égard du SARM-ONN ainsi que de leur susceptibilité aux antibiotiques.
RÉSULTATS : En 2012, 56 % des isolats de *S aureus* étaient des souches de SARM-ONN, soit une augmentation par rapport aux 31 % de 2008 (P=0,06). Le taux de réinfection augmentait plus rapidement que le taux de nouveaux cas : 25 % des infections sont désormais des réinfections. Les isolats de SARM-ONN continuent d'être susceptibles à de nombreux antibiotiques courants (près de 100 %), notamment le triméthoprim-sulfaméthoxazole, la clindamycine et la tétracycline. La susceptibilité à l'érythromycine est de 58 %.
EXPOSÉ : Le taux de SAMR-ONN, à titre de pourcentage de tous les isolats de *S aureus*, était plus élevé que celui déclaré dans d'autres séries de soins de première ligne. Le taux d'infection sur 100 000 habitants est l'un des plus élevés à être signalé au Canada. Les susceptibilités aux antibiotiques demeuraient inchangées pendant la période de l'étude. Le taux de susceptibilité de 99 % à la clindamycine diffère de celui de seulement 79 % obtenu dans une étude de 2010 menée à Vancouver, en Colombie-Britannique.
CONCLUSION : Les chercheurs ont constaté un taux très élevé d'infections par le SARM-ONN au nord-ouest de l'Ontario. Il est important de surveiller la maladie et de demeurer attentif à l'antibiorésistance pour comprendre l'évolution du profil des infections par le SARM. Les déterminants sociaux de la santé, particulièrement l'amélioration des logements et des mesures d'assainissement, continuent de représenter d'importants problèmes régionaux.

The incidence of community-associated methicillin-resistant *Staphylococcus aureus* (CA-MRSA) has traditionally been high in remote areas of Canada with large Aboriginal populations (1-11). *S aureus* infections are increasingly found to be CA-MRSA, rendering beta-lactam therapy ineffective (12-14).

In northern Saskatchewan, 51% of *Staphylococcus* infections are CA-MRSA (2); in southern Manitoba, the rate is 40% (5). These infections most often affect children <10 years of age (30.4% of all CA-MRSA infections in northern Saskatchewan) and typically result in soft tissue infections (2). Associated risk factors for such high rates in these populations include overcrowding, inadequate housing and poor sanitation (1).

The purpose of the present study was to document the incidence of CA-MRSA in northwestern Ontario (2008 to 2012), examine the pattern of antibiotic resistance and review the seasonality of these infections.

METHODS

First-time infection rates from laboratory and infection control records from 2004 to 2012 were examined, with special attention to the recent five-year period in which data were most complete. Chart and laboratory records were retrospectively analyzed for 2986 CA-MRSA isolates; 2451 first-time infections were identified. Patient demographics, season of infection and antibiotic susceptibility were documented. The

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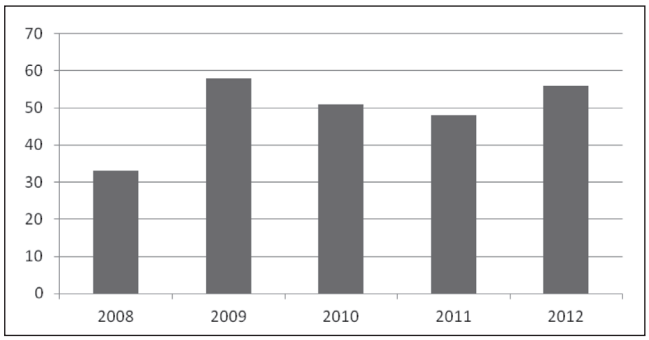

Figure 1) *Per cent of methicillin-resistant* Staphylococcus aureus *isolates according to year of study*

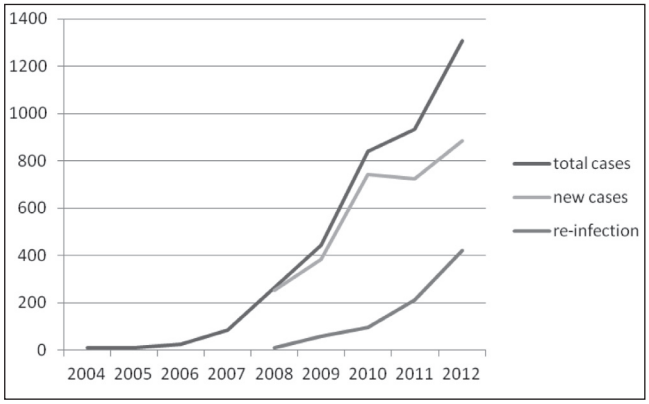

Figure 2) *Number of new cases, reinfections and total cases of methicillin-resistant* Staphylococcus aureus *infection according to year of study*

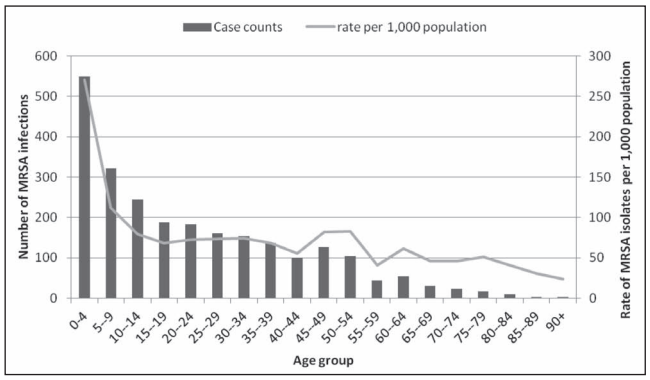

Figure 3) *Number of methicillin-resistant* Staphylococcus aureus *(MRSA) infections and rates of MRSA isolates in Northwest Ontario between January 2006 and June 2012 according to age (years) (n=2447)*

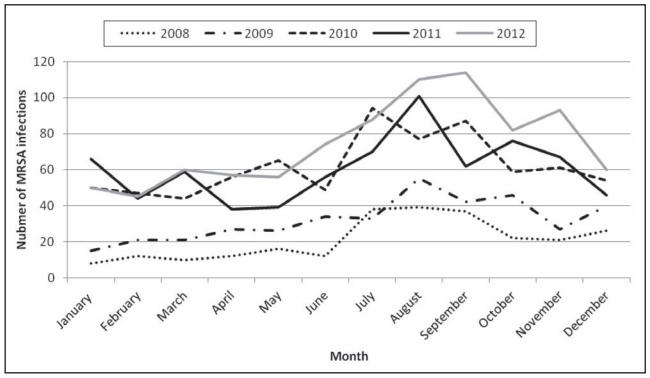

Figure 4) *Seasonal variation of methicillin-resistant* Staphylococcus aureus *(MRSA) infections*

results of a 2010 six-month MRSA screening program of nasal swabs taken from all patients entering the hospital (emergency and inpatients) were also reviewed.

Statistics were analyzed using Excel (Microsoft Corporation, USA), and linear regression was performed using SPSS version 17 (IBM Corporation, USA). Ethics approval was granted by the Sioux Lookout Meno Ya Win Health Centre Research Review Committee, Sioux Lookout, Ontario.

Participants

The region is home to 28,000 First Nations people (Ojibway and Cree), most of whom lived in 28 remote, fly-in communities with populations between 400 and 2400 in northwestern Ontario. Regional inpatient and outpatient bacteriology was processed through the Sioux Lookout Meno Ya Win Health Centre. Population age grouping was ascertained by combining Indian and Northern Affairs Canada and Ontario Local Health Integration Network information in 2011.

RESULTS

The laboratory recorded 2451 MRSA isolates (new infections) from January 2008 to July 2012. The majority of the isolates (82%) were from soft tissue infections. The number of tissue swabs remained constant over the time period of the study (6000 to 8000 annually).

In 2012, 56% of the *S aureus* isolates were CA-MRSA strains as determined by antibiograms, which was an increase from 31% in 2008 (Figure 1).

In 2010, a six-month in-hospital program screened registered inpatients or patients visiting the emergency department and found that 5% of nasal swabs tested positive for CA-MRSA. Other than this screening, all samples were taken for clinical management of infections.

The number of MRSA infections increased over the past five years and the increasing trend over the four years of complete data was borderline significant (P=0.06). Serious cases of sepsis and necrotizing pneumonia were rare but were also rising; one fatality from necrotizing pneumonia was recorded. Over the five-year period, skin and soft tissue infections increased by a factor of 2.4, while bacteremias, typically seen only once a year, were occuring almost monthly. The rate of CA-MRSA infection in the last year of complete data (2011) was 2482 per 100,000 population. Reinfections accounted for approximately 25% of infections (Figure 2).

The infections were most commonly found in soft tissue and were more common in younger patients, with 35% of infections occurring in patients <10 years of age; the highest number of infections appeared in those zero to four years of age (Figure 3). Between 2008 and 2012, there was a seasonal trend to CA-MRSA infections, with the peak number of infections occurring in July and August (Figure 4).

CA-MRSA isolates were susceptible to many common antibiotics (nearly 100%), particularly trimethoprim/sulfamethoxazole, clindamycin and tetracycline. Erythromycin susceptibility was 58% (Figure 5).

DISCUSSION

The rates of CA-MRSA as a percentage of all *S aureus* isolates in the present study was higher than those reported in other primary care series (2,5,6,9,10,13). This may be due to the absence of running water in many of our regional communities, as well as inadequate housing (15). Our increasing reinfection rate may be a reflection of this reality because reinfections would more likely occur in an unchanged, high-risk environment. Additionally, the infection rate per 100,000 is one the highest reported in Canada and comparable with the 2011 northern Saskatchewan study (2), which showed a community range from 1460 infections per 100,000 to 4820 infections per 100,000.

Most of the infections in the present study were diganosed in soft tissue and this is consistent with most CA-MRSA studies (2). The

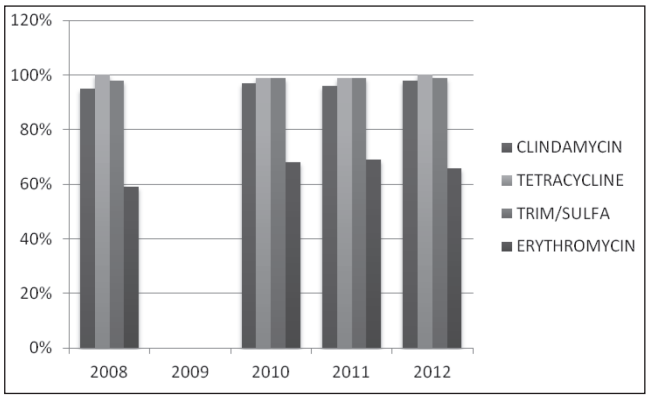

Figure 5) *Antibiotic sensitivity of methicillin-resistant* Staphylococcus aureus *isolates (2009 data not available). TRIM/SULFA Trimethoprim/sulfamethoxazole*

reason for the high rate of reinfection in our study is not apparent. It is not clear whether these represent failure of therapy, persistent carriage or reinfection. We also identified a recent increase in bacteremia but it is too early to know whether this trend will continue.

Regarding seasonality, the number of infections increased during summer months when insect bites and perspiration are most prevalent in our region. Insect bites have been identified as an associated risk (40%) in a study by Golding et al (1).

Our regional antibiotic susceptibilities were unchanged during the study period. Trimethoprim/sulfamethoxazole, tetracycline and clindamycin all remained effective antibiotic choices. This differs from a study conducted in Vancouver (British Columbia) hospitals in 2010 (16), which showed only a 79% susceptibility to clindamycin. We continue to prospectively track antibiotic resistance through our hospital laboratory system.

Limitations of our study include difficulties in manually accessing information records in different formats by different hospital departments and outside agencies, whose protocols changed during the study period. Some data were not present and are recorded as such. Other than site tissue swab, gathering clinical information was beyond the scope of the study.

CONCLUSION

There are high rates of CA-MRSA infections in northwestern Ontario. Ongoing disease surveillance is important, as is continued attention to antibiotic resistance and stewardship to understanding the changing profile of MRSA infections. Social determinants of health; specifically, improved housing and sanitation, remain issues in many communities.

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Bronchiolitis and Pneumonia Requiring Hospitalization in Young First Nations Children in Northern Ontario, Canada

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Background: High rates of lower respiratory tract infection (LRTI), including bronchiolitis and pneumonia, have been reported in Inuit infants living in arctic Canada. We examined rates of LRTI in First Nations Canadian infants living in the Sioux Lookout Zone, in Northern Ontario.

Methods: A retrospective review of hospital admissions for LRTI during a 5-year period, in patients <1 year of age was carried out at the Sioux Lookout Meno Ya Win Health Centre, an acute-care hospital that provides secondary care to 31 mainly isolated communities and the town of Sioux Lookout. Admission rates were compared with those in the province of Ontario, as a whole.

Results: One-hundred and seventeen subjects were identified. The annualized rate of admission for nonbacterial LRTI was 44 per 1000 infants <1 year of age per year. This rate was significantly higher than for the whole province ($P = 0.011$). Admission rates also varied significantly between communities ($P < 0.001$).Thirteen percent of subjects required transfer to a tertiary care center. A virus was identified in 55% (36/65) of subjects tested for respiratory viruses, and respiratory syncytial virus and parainfluenza virus were identified most often. Of patients who had a blood culture performed, bacteria were found in 10% (6/59) of subjects. Many patients had radiographic evidence of consolidation, consistent with pneumonia.

Conclusions: Rates of LRTI are significantly elevated in First Nations infants living in the Sioux Lookout Zone. Varying rates between communities suggest that environmental factors may be contributing to rates of LRTI in this population.

Key Words: bronchiolitis viral, pneumonia, Indians, North American, infant

(*Pediatr Infect Dis J* 2014;33:1023–1026)

Inuit children living in Nunavut, Canada have been reported to have exceptionally high rates of severe lower respiratory tract infection (LRTI) with respiratory syncytial virus (RSV) requiring hospitalization.[1] RSV LRTI appears to be unusually severe in indigenous children living in the arctic, with a substantial portion of admitted infants requiring admission to a pediatric intensive care unit,[1] and repeated hospitalizations, even in the same winter season, are common.[2] In this population, severe LRTI early in life has been associated with subsequent chronic lung damage and disease, including bronchiectasis.[3]

Lower respiratory tract viral infection often involves spread to adjacent lung parenchyma, and bronchiolitis and pneumonia are best considered together, as LRTI.[4] Rates of RSV LRTI and *Streptococcus pneumoniae* pneumonia are also elevated in indigenous children living in the continental United States and Alaska.[5,6]

The incidence of LRTI requiring hospital admission in young Canadian First Nations children has not been examined for nearly 2 decades.[7–9] Sioux Lookout is a town located in Northern Ontario, approximately 400 kilometers northwest of Thunder Bay. It serves as a regional hub for 31 remote First Nations communities, known as the Sioux Lookout Zone (SLZ). Apart from several nearby First Nations reserves, these communities are accessible only by airplane. We retrospectively examined rates of LRTI requiring hospitalization in children <1 year of age in the SLZ and recorded the clinical characteristics of admitted infants. We hypothesized that the incidence of LRTI requiring hospitalization would be higher than in the general population in the province of Ontario, but lower than in Inuit infants living in Nunavut.

MATERIALS AND METHODS

This study was a retrospective review of hospital admissions because of LRTI in patients <1 year of age at Sioux Lookout Meno Ya Win Health Centre (SLMHC) in Sioux Lookout, Ontario, Canada. SLMHC includes a 60-bed, acute-care hospital and 20-bed extended care facility, including an emergency department. It is supported by a group of full-time physician staff. The SLMHC provides secondary care services to the 31 communities in the SLZ and to Sioux Lookout itself. Patients are transported from community health centers staffed by nurses by small fixed-wing aircraft and helicopter. The primary outcome was the rate of LRTI in infants <1 year of age in the SLZ. Secondary outcomes were clinical characteristics of LRTI in this population and the distribution of LRTI between communities in the SLZ.

A search in the hospital records for ICD-10 codes related to pneumonia, bronchitis and bronchiolitis in infants <1 year of age over the 5-year period from April 1, 2007, to April 1, 2012, identified relevant charts for review (codes available on request). One of the authors (S.M.) conducted a review of these patients' charts and included patients in the study if they met the inclusion criterion of at least 1 admission to SLMHC in the first year of life with a discharge diagnosis of LRTI. Data were collected on all admissions for LRTI in the first year of life for each patient. Diagnostic criteria were cross validated with a pediatric respirologist (T.K.). For the rate calculation portion of the study, an additional inclusion criterion was residence in 1 of the communities serviced by SLMHC. Two charts were excluded from only this portion of the study because the patients resided outside this zone.

Data collected included basic demographics, comorbidities and birth history and details of each hospital admission for LRTI including reports on: viral and bacterial cultures, chest radiographs, discharge diagnoses, transfers to tertiary care centers, hematology and blood oxygen saturation. Rapid screening of respiratory viral specimens at the SLMHC was performed using an immunochromatography assay by REMEL (Thermo Scientific, Lenexa, KS). All respiratory viral specimens were then sent to Ontario Public Health Laboratory in Thunder Bay, Ontario, Canada for confirmatory testing by viral culture. White blood cell counts were compared with SLMHC's age-specific normal ranges. Chest radiograph reports

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were coded as being consistent with pneumonia when 1 or more areas of consolidation were reported. Chest radiograph reports were coded as being consistent with bronchiolitis when only bronchial wall thickening and/or hyperinflation was reported. Actual films were not reviewed. These data were collected in Microsoft Access and analyzed in IBM SPSS Statistics (version 21 for Windows).

The rate of LRTI in Ontario as a whole was obtained from the Canadian Institute for Health Information[10] and is based on admissions before the first birthday; admissions before 6 months of age were not available. The population at risk was calculated using publicly available census data from the Statistics Canada 2011 census[11] or from the 2006 census[12] where the former was not available. The reported population aged 0–4 years was divided by 5 (as Statistics Canada defines the 0–4 age group as children aged up to their 5th birthday) to estimate the number of children under age 1 in each community. For comparison with previously determined rates of LRTI in Inuit infants,[1] this figure was also halved to estimate the population <6 months of age. Two-sided Pearson's χ^2 statistics were calculated to evaluate the null hypotheses that there were no differences in rates between communities and no difference between the rate for SLZ and for the province of Ontario as a whole.

RESULTS

There were 117 infants included in the study. Sixty-four percent (75/117) were male, 68% (79/117) were born at term or were post-term and 93% (108/117) had no known underlying medical conditions (apart from prematurity). Sixty percent (70/117) of the infants were <6 months of age on admission (mean age on admission of 22 weeks). The annualized rate of admission to SLMHC for LRTI in patients resident in the SLZ was 44 per 1000 infants <1 year of age per year. This does not include admissions directly to other tertiary care centers. Rates were highest in communities other than Sioux Lookout: the rate for all 31 remote northern communities other than Sioux Lookout was slightly higher, at 47 per 1000 infants per year. Between communities in the SLZ, admission rates for LRTI varied widely; 4 communities had rates over 100 per 1000 infants per year. Annualized rates of admission varied significantly between communities ($P < 0.001$) and this remained true even if the town of Sioux Lookout was excluded ($P < 0.001$; data not presented). Annualized admission rates were significantly higher in the SLZ than in the province of Ontario [4.4% (23/527) vs. 2.5% (3512/140,600), $P = 0.011$]. Similarly, at least 1 community that was large enough to evaluate statistically had rates significantly higher than the province of Ontario (11.1% vs. 2.5%; $P = 0.006$; data not presented). When only infants <6 months of age were included in the analysis, all rates are higher: the annualized rate of admission for LRTI in the SLZ was 56 per 1000 infants <6 months of age per year. Comparator data for the province as a whole are not available.

Among infants hospitalized at least once, the mean number of hospital admissions for LRTI in the first year of life was 1.27 per infant ($\sigma = 0.59$): 79% (92/117) were admitted once, 18% (21/117) twice, 3% (3/117) thrice and 1 patient 5 times. Thirteen percent (15/117) of infants admitted to SLMHC were transferred to a tertiary care center outside the Sioux Lookout Zone on discharge from SLMHC. In addition to their admissions at SLMHC, 13% (15/117) of the infants in this sample had chart records indicating admission to a tertiary care center directly from their communities for LRTI in the first year of life. In total, 26% (30/117) of infants in this sample were transferred to a tertiary care center, either from SLMHC or directly from a community health center in a remote northern community. The mean length of stay at SLMHC was 3.2 days (range 0–14, $\sigma = 2.3$).

Fifty-six percent of subjects had respiratory viral testing performed, and a virus was isolated in 55% (36/65) of specimens. Thirty-four percent of specimens were positive for RSV (21/65), 11% for parainfluenza viruses (7/65), 7.5% for influenza viruses (5/65) and 6.2% for rhinovirus (4/65). Fifty-nine patients had blood cultures done during 1 or more admissions. Four patients (6.8%) had positive results over the course of 6 admissions. One patient had a positive culture for methicillin sensitive *Staphylococcus aureus* and also grew influenza virus. One patient grew *Staphylococcus aureus* and *S. pneumoniae* during 2 separate admissions, and single patients had positive blood cultures for *Haemophilus influenzae*, *S. pneumoniae* and Group A *Streptococcus*; none of these patients were tested for respiratory viruses concurrently. Surveillance cultures were positive for methicillin-resistant *S. aureus* in 3% (3/117) of subjects. Compared with Ontario as a whole (2010–2011 data), SLZ patients <1 year of age hospitalized with a LRTI were more likely to have a bacterial infection [5.1% (6/117) vs. 0.9% (23/2698), $P = 0.001$] or parainfluenza infection (6.0% (7/117) vs. 0.4% (10/2698), $P < 0.001$) and were less likely to have evidence of an RSV infection [17.9% (21/117) vs. 35.8% (965/2698), $P < 0.001$].

Several radiographic patterns were observed in this group of infants with LRTI. Sixty-six percent (77/117) had consolidation reported, consistent with pneumonia, whereas 34% (40/117) had changes consistent with bronchiolitis. Among those cases with pneumonia, the commonest affected lobes were the right upper lobe (27/77; 35%) and the right lower lobe (25/77; 33%). Rates of involvement of the other lobes were: left lower lobe 27% (21/77), right middle lobe 21% (16/77), left lingula 12% (9/77) and left upper lobe 4% (3/77). The lobar distribution was biased toward the right lung and the lower lobes.

Infants admitted to the SLMHC were acutely ill. Eleven percent (12/105) had an oxygen saturation <90%, and saturations were <95% in 42% (44/105); the mean blood oxygen saturation on admission was 95% ($\sigma = 3.8$). The mean white blood cell count on admission was 14.9×10^9 cells/L per mL ($\sigma = 7.4$) and was above age-adjusted normal limits in 30% (29/96) of subjects.

DISCUSSION

Our findings indicate that LRTI is a substantial problem for First Nations children living in Northern Ontario. The rate of admission for LRTI in subjects <1 year of age was 44 per 1000 infants and was 56 per 1000 for infants <6 months of age. These rates are lower than those reported for Inuit children <6 months of age living in Nunavut, Canada, where hospitalization rates as high as 484 per 1000 have been reported,[1] or among Yu'pik Eskimo children <1 year of age living in the Yukon-Kuskokwim region of Alaska, where rates of 53–249 per 1000 infants have been reported.[2] However, these Northern Ontario rates are approximately double the overall rates for the Province of Ontario. Moreover, rates in some communities were approximately 4 times the provincial average. Morbidity in this population was high, with 30% of these infants having had at least 1 transfer to a tertiary care pediatric center for advanced care.

At present, there is very little current data on rates of LRTI in Canadian First Nations children. Young et al[13] reported hospitalization rates for LRTI in the first year of life in predominantly First Nations children in the Northwest Territories, Canada, ranging from 63 to 371 per 1000. A small proportion of this population was Inuit.[13] American data suggest trends that were broadly similar to our observations. Lowther et al[5] reported that annual hospitalization rates for bronchiolitis in infants <1 year of age were 61.8 per 1000 for American Indian and Alaska Native infants, compared with 34.2 per 10000 for all American infants. Liu et al[14] found that in Washington State, hospitalization rates for American Indian and Alaska Native infants were 2.5 times the state average. In addition, these rates did not appear to be influenced by diagnostic overlap

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with asthma, as asthma admission rates in this age group were 5 times lower. Historical data from the SLZ nursing station reported rates of pneumonia of 31.8 per 100 person-years for infants <1 year of age.[9] Similarly, 45% of First Nations children were reported to have experienced 1 or more LRTI's in the first year of life at a health center in southwestern Ontario between 1974 and 1981, although these studies did not report hospitalization rates.[7] Unfortunately, previous Canadian reports did not specifically examine hospitalization rates, so we have been unable to find compare the hospitalization rates we observed with historical data. Bacterial LRTI also appears to be commoner in children of indigenous origin. Davidson et al[15] reported that pneumonia because of *S. pneumoniae* was 10 times commoner in Alaska Native children than Alaska nonnative children. We found that bacterial infections accounted for a significantly higher proportion of LRTI than was the case for Ontario as a whole, although this is probably biased by regional differences in testing for respiratory pathogens.

We found that lung consolidation tended to involve the right lung and particularly the right upper lobe. Reasons for this finding are unclear. However, early studies reported disproportionate involvement of the right upper lobe in cases of pneumonia in indigenous children in Australia[16] and Northern Canada.[17] First Nations children from Manitoba, Northwestern Ontario and Nunavut have been reported to have abnormal frequencies of swallowing dysfunction and oral aspiration, and this may also contribute to disproportionate involvement of the right lung—particularly the right upper lobe.[18]

Premature birth is a known risk factor for severe LRTI requiring hospitalization.[19] The proportion of admitted patients with LRTI born prematurely in SLZ was higher than that has been reported in Canadian children as a whole, where 21% of children below 2 years of age admitted with RSV LRTI were premature.[19] Data on rates of preterm birth in First Nations communities are conflicting. Studies from rural British Columbia suggest rates of preterm birth are 1.8 times higher in the First Nations population.[20] However, research from Quebec suggests that rates of preterm births among First Nations individuals are similar to the non-indigenous Quebec population (6.0 vs. 5.8%).[21] Hospitalization among First Nations children born prematurely in this region may partly account for the elevated hospitalization rate for LRTI, compared with the province as a whole.

We found significant disparities in hospitalization rates between communities, suggesting that social[13] and environmental factors may play a significant role in increasing the risk of severe LRTI requiring hospitalization.[22] Overcrowding is associated with an increased risk of LRTI in Inuit children.[23] Twenty-six percent of First Nations Canadian children living on reserve live in crowded homes,[24] compared with 3% of Canadian children, in general.[22] Similarly, homes in need of major repair has been associated with risk of wheezing illness in indigenous children.[25] Forty-four percent of First Nations children residing on reserve live in houses in need of major repair.[24] Other risk factors for LRTI in young children include environmental tobacco smoke exposure,[26] indoor mold exposure,[27] wood-burning stoves,[28] lack of indoor potable water[29] and reduced indoor ventilation.[23] Over 80% of First Nations youth living on reserve in Saskatchewan report at least 1 caregiver who smokes.[30] A small study in First Nations homes on reserve in Manitoba reported a mean small particulate concentration ($PM_{2.5}$) to 42.5 mcg/m^3. It was associated with environmental smoke exposure, which occurred in 73% of these 20 houses.[31] In contrast, mean indoor $PM_{2.5}$ in houses not containing smokers in a wood smoke-impacted non-First Nations reserve community with high rates of wood stove use was 11.2 mcg/m^3.[32] Indoor mold contamination associated with poorly maintained or constructed housing, wood-burning stoves and absence of in-home potable water[33] are likely common in SLZ. However, the precise frequency of these risk factors in this region is currently unknown, and systematic assessment of indoor air quality contaminants has not been performed. First Nations children have not been shown to have a high frequency of underlying chronic lung disease or immunodeficiency to account for elevated rates of LRTI. Recent data, for example, has demonstrated normal responses to pandemic H1N1 influenza vaccine,[34] despite high rates of severe H1N1 LRTI in First Nations individuals in Northern Manitoba.[33]

The study had a number of limitations. The small sample sizes present in northern communities limits the validity of interregional comparisons. The high rate (13%) in this study population of transfers directly from the home community to tertiary care centers suggests that a significant portion of morbidity may not be captured by a survey of admissions to SLMHC alone. An important limitation of the study is that admission criteria for pediatric pneumonia may differ from urban centers in the province. It is possible that children with pneumonia were less likely to be airlifted from their home communities for hospitalization in SLMHC given the distance, expense, disruption to family and potential hazards of flight in adverse weather conditions. However, we believe that admission is probably somewhat more likely than in urban centers, as health care workers working in isolated communities probably tend to transfer patients relatively early in the course of the illness, before the child worsens in a remote setting. A longer and/or prospective study may help to better capture the diverse patterns of illness in these small communities and provide information on potential risk factors we were unable to measure, such as tobacco smoke exposure, overcrowding and lack of breast-feeding.[35] Similarly, the data obtained regarding white blood cell counts and oxygen saturation may over- or underestimate disease severity in our population as this data could not be identified in all the patients' health records. In some cases, this data were potentially not obtained because subjects appeared too well or, conversely, were too critically ill. The precise frequency of respiratory pathogens, including the number of patients coinfected with bacterial and viral pathogens could not be determined, as microbiologic investigations were not consistently performed.

In conclusion, hospitalization rates for First Nations children who are <1 year of age, living in the SLZ, are approximately double the provincial average, and significant intercommunity variability appeared to be present.

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Invasive CA-MRSA in northwestern Ontario: a 2-year prospective study

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Introduction: Northwestern Ontario has a documented high rate of skin and soft-tissue infections due to community-associated methicillin-resistant *Staphylococcus aureus* (CA-MRSA). Recently, invasive illness from this common pathogen has become a serious clinical problem in the region. We sought to better understand this trend of invasive CA-MRSA.
Methods: We prospectively studied cases of positive CA-MRSA bacteremia in 2012 and 2013. We examined genetic typing, comorbidities and outcomes.
Results: Twenty-three cases of CA-MRSA bacteremia were treated during the 2-year study period. Intravenous drug use accounted for only 17% of cases. One death and 2 cases of endocarditis occurred.
Conclusion: High rates of CA-MRSA in skin and soft-tissue infections, combined with poor living conditions and poor access to potable water, may account for most of these cases of CA-MRSA bacteremia. Social determinants of health are relevant when common resistant bacterial isolates become associated with life-threatening illness.

Introduction : La région du Nord-Ouest de l'Ontario présente un taux élevé et documenté d'infections de la peau et des tissus mous causées par une souche de *Staphylococcus aureus* méthycillinorésistante d'origine communautaire (SARM-C). La maladie invasive causée par cet agent pathogène commun est récemment devenue un problème clinique grave dans la région. Nous avons voulu mieux comprendre cette tendance du SARM-C invasif.
Méthodes : Nous avons étudié de manière prospective des cas de bactériémie positive à SARM C en 2012 et 2013. Nous avons analysé le typage génétique, les comorbidités et l'issue des infections.
Résultats : Vingt-trois cas de bactériémie à SARM-C ont été traités au cours de la période de 2 ans. L'utilisation de drogues injectables a pu être incriminée dans seulement 17 % de cas. On a enregistré 1 décès et 2 cas d'endocardite.
Conclusion : Des taux élevés de SARM-C dans les infections de la peau et des tissus mous alliées à de piètres conditions de vie et à un accès limité à de l'eau potable pourraient expliquer la plupart de ces cas de bactériémie à SARM-C. Il faut tenir compte des déterminants sociaux de la santé lorsque des isolats bactériens communs et résistants deviennent associés à des maladies gravissimes.

INTRODUCTION

Community-associated methicillin-resistant *Staphylococcus aureus* (CA-MRSA) is generally acknowledged to be increasing in community and hospital settings.[1–4] It typically is associated with skin or soft-tissue infections. Northwestern Ontario, home to many remote First Nations communities, has recently documented one of the highest rates of CA-MRSA in Canada; 56% of all *S. aureus* isolates were found to be CA-MRSA.[1] The region has also experienced a recent rise in invasive illness, including bacteremia, caused by CA-MRSA. The purpose of this study was to document this trend of invasive CA-MRSA and identify the related strains in our catchment area of 28 000 people, most of whom are living

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on remote reserves and served by the Sioux Lookout Meno Ya Win Health Centre.[5]

METHODS

We prospectively gathered clinical information regarding cases of sepsis and pneumonia from CA-MRSA infections during 2012 and 2013. We identified 23 cases over this 2-year period. Type and source of infection, demographics, comorbidities, treatment and outcomes were compiled for this study. We sent bacteremic CA-MRSA isolates for genetic and Panton–Valentine leukocidin (PVL) testing. The study was approved by the Sioux Lookout Meno Ya Win Health Centre Research Review and Ethics Committee.

RESULTS

Among the approximately 100 annual positive blood cultures in our region, 8 cases of CA-MRSA bacteremia were diagnosed in 2012, and 15 cases were diagnosed in 2013. One death involving sepsis with renal failure was ascribed to a CA-MRSA infection (Table 1).

Osteoarticular infections accounted for 26% of the cases of bacteremia, followed by respiratory and abdominal sources (i.e., pancreatitis, cholecystitis, pyelonephritis) at 22% each. Two cases of endocarditis were diagnosed (Table 2). Only 4 known intravenous drug users were among the 23 cases. About half of infected patients had type 2 diabetes mellitus (Table 1).

Sixteen of the 23 cases of MRSA bacteremia were genetically typed. Canadian epidemic strain MRSA (CMRSA) 10 and 7 were the common pathogens in 8 and 6 cases of the 16 known strains, respectively. Nine of these 16 strains tested positive for PVL. All CA-MRSA isolates were identified by their antibiotic susceptibilities, as well as genetic typing where available (16/23) (Table 3).

In addition to the 23 cases of CA-MRSA bacteremia reported here, there were 14 other patients with CA-MRSA invasive infections. During the study period, 8 urine, 4 sputum and 2 synovial fluid infections occurred.

DISCUSSION

Invasive MRSA has long been noted as a serious health care issue. In the past, health care–associated (HA)–MRSA was implicated in serious and invasive infections, and CA-MRSA infections were generally non–life-threatening soft-tissue infections. Bacteremia from CA-MRSA was a rare event.

In the Canadian Ward Surveillance Study (CANWARD) involving more than 12 Canadian

Table 1. Characteristics of 23 patients with CA-MRSA bacteremia diagnosed in 2012 and 2013

Characteristic	No. (%) of patients*
Age, mean, yr	39.3
Age category, yr	
0–10	1
11–20	3
21–60	15
> 60	5
Comorbidities	
Type 2 diabetes mellitus	11 (48)
Hepatitis B or C, or HIV	0
Intravenous drug use	4 (17)
Investigations	
Echocardiography	11 (48)
Viral serology	9 (39)
Treatment	
Vancomycin	18 (78)
Outcome	
Died	1 (4)
Transferred care	3 (13)
Treated locally	19 (83)

CA-MRSA = community-associated methicillin-resistant *Staphylococcus aureus*.
*Unless stated otherwise.

Table 2. Diagnoses and sources of infection in 23 patients with CA-MRSA bacteremia

Variable	No. (%) of patients
Diagnosis	
Osteoarticular disease	6 (26)
Respiratory disease	5 (22)
Abdominal organ infection	5 (22)
Endocarditis	2 (9)
Simple bacteremia	3 (13)
Skin or soft-tissue infection	1 (4)
Source of infection	
Central line	1 (4)

CA-MRSA = community associated methicillin-resistant *Staphylococcus aureus*.

Table 3. Genetic typing of 23 cases of CA-MRSA bacteremia

Variable	CMRSA 7	CMRSA 10	Other CMRSA	NA
Genetic typing	6	8	2	7
PVL positive	4	5	0	1

CA-MRSA = community-associated methicillin-resistant *Staphylococcus aureus*; CMRSA = Canadian epidemic strain of MRSA; NA = not available; PVL = Panton–Valentine leukocidin.

hospitals during a 5-year period (2007–2011), only 89 bacteremic isolates of the 8245 positive blood cultures were found to be CA-MRSA,[6,7] for a rate of 1.08% of all positive blood cultures. Our region has about 100 patients with positive blood cultures annually, and CA-MRSA constituted 12% of them during the 2-year study period. In 2012 at the Ottawa Hospital, only 12% of all cases of *S. aureus* bacteremia were CA-MRSA, and a slightly larger percentage was found in the 12 tertiary care hospitals participating in CANWARD in 2011, at 19%.[7] Since 2010, we have encountered an annual doubling of CA-MRSA bacteremia: 2, 4, 8 and 15 cases annually. Of the 19 patients with *S. aureus* bacteremia, 58% (11/19) were CA-MRSA isolates.[1]

In a study done in Calgary from 2000 to 2006, Laupland and colleagues[8] found 2.2 cases of MRSA bacteremia per 100 000 population annually, and most of these were HA-MRSA. Only 11% were CA-MRSA, for an estimated rate of 0.24 per 100 000 population annually. Our incidence of 23 cases in 2 years in a catchment area of 28 000 gives us an annual population rate of 41.1 per 100 000 population, almost 20-fold the rate in Calgary.

Of the 16 cases with genetic typing, we had 8 isolates that were CMRSA 10, the most common Canadian strain and generally the cause of most hospital-related CA-MRSA infections.[6] The second most common genetic type was CMRSA 7, which is the most common strain seen in northern Manitoba and Saskatchewan, our neighbouring provinces.[2,9]

Panton–Valentine leukocidin was initially thought to be universally present in CA-MRSA strains and to be responsible for much of its pathogenesis.[10] Now, only about 85% of CA-MRSA strains are usually positive for this marker, and other genetic attributes may be more closely associated with virulence.[11,12] In our study, 9 of the 16 samples (56%) that were genetically typed were positive for PVL.

Issues with on-reserve housing such as overcrowding, poor sanitation and access to potable water are health risks associated with CA-MRSA infections.[13–16] Our catchment area is made up of remote First Nations populations, which have documented deficiencies in these areas.[17] Seventeen of Ontario's First Nations communities with boil water advisories are in our region.[18] In one community with a population of more than 2000, 90% of the homes are not connected to a water source at all.[19]

We have previously documented high rates of CA-MRSA in our region.[1] Although illicit drug use is a serious issue, these cases do not appear to be primarily related to intravenous drug abuse. We may be seeing a common isolate associated with skin or soft-tissue infections causing a high rate of invasive disease related to other factors. These factors may include the high burden of chronic illness, such as diabetes mellitus and skin disease, combined with overcrowding and limited access to potable water.

Clinicians in our region will need to be alert to concomitant cardiac or osteogenic infections, as well as viral pathogens associated with intravenous drug use (e.g., hepatitis B and C, and HIV) when faced with CA-MRSA bacteremia.

Limitations

The genetic typing was done on an ad hoc basis for CA-MRSA bacteremia isolates, and we were able to document the genetics on only 16 of our 23 samples. Our hospital, like most, could not automatically give us antibiotic susceptibilities on CA-MRSA isolates, and we had to manually determine these. Many similar studies were based in urban settings, where HA- and CA-MRSA values were combined into general MRSA estimates, limiting what studies we could use as comparators.

CONCLUSION

Our population in northwestern Ontario is experiencing a dramatic increase in invasive disease from CA-MRSA infections, particularly bacteremic sepsis, with at least one fatal outcome. The social determinants of health, long identified as problematic, take on greater importance when common, resistant organisms become life-threatening.

Competing interests: None declared.

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In most issues of *CJRM* an ECG is presented and questions are asked.

On another page, the case is discussed and the answer is provided.

Please submit cases, including a copy of the ECG, to Suzanne Kingsmill, Managing Editor, *CJRM*, 45 Overlea Blvd., P.O. Box 22015, Toronto ON M4H 1N9; cjrm@cjrm.net

Cardiogrammes ruraux

Avez-vous eu à décrypter un ECG particulièrement difficile récemment?

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ORIGINAL ARTICLE
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Hospital admission for community-acquired pneumonia in a First Nations population

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Introduction: Northwestern Ontario is a large rural area with a high concentration of remote First Nations communities. In Ontario, the highest hospital admission rates for pneumonia are reported from northern and rural regions. However, data are lacking on the epidemiology of community-acquired pneumonia in northwestern Ontario. We sought to characterize cases of community-acquired pneumonia requiring admission at the Sioux Lookout Meno Ya Win Health Centre, which serves a primarily First Nations population of 28 000.

Methods: We undertook a 3-year review of cases of community-acquired pneumonia requiring hospital admission at the centre. We used multivariable logistic regression to identify independent variables predictive of adverse outcomes.

Results: The annual incidence of hospital admissions related to community-acquired pneumonia was 3.42 per 1000 population. Of the 287 patients, 87% were First Nations and 52% were female. There was a high prevalence of diabetes, and chronic cardiovascular, renal and pulmonary diseases. Hospital admissions for community-acquired pneumonia were most prevalent among young children and older adults; both age groups had low coverage with recommended pneumococcal vaccines. Adverse outcomes included 10 deaths (3%) and 35 transfers to an intensive care facility (12%). Chronic renal disease and nonreceipt of azithromycin at initial presentation were identified as 2 independent predictors of an adverse outcome; there was a trend toward an increased risk of an adverse outcome in individuals with chronic obstructive pulmonary disease.

Conclusion: Our findings emphasize the importance of preventing pneumonia in First Nations communities in northwestern Ontario. Research focusing on the distinct epidemiology of community-acquired pneumonia in this population is needed.

Introduction : Le Nord-Ouest de l'Ontario est une vaste région rurale où se trouve une forte concentration de communautés éloignées des Premières Nations. En Ontario, les taux les plus élevés d'hospitalisation en raison d'une pneumonie sont observés dans les régions du Nord et en milieu rural. On manque cependant de données sur l'épidémiologie de la pneumonie extrahospitalière dans le Nord-Ouest de l'Ontario. Nous avons cherché à caractériser les cas de pneumonie extrahospitalière nécessitant une admission au Centre de santé Sioux Lookout Meno Ya Win, qui dessert une population de 28 000 habitants principalement composée de membres des Premières Nations.

Méthodes : Nous avons entrepris une revue répartie sur 3 ans des cas de pneumonie extrahospitalière ayant nécessité une admission à ce centre. Nous avons utilisé une méthode de régression logistique à variables multiples pour identifier des variables indépendantes permettant de prévoir la survenue d'événements défavorables.

Résultats : L'incidence annuelle des hospitalisations reliées à la pneumonie extrahospitalière était de 3,42 pour 1000 habitants. Parmi les 287 patients, 87 % étaient des membres des Premières Nations et 52 % étaient de sexe féminin. On a enregistré une prévalence élevée de diabète, de maladie cardiovasculaire chronique, de maladie rénale et de maladie pulmonaire. La prévalence des hospitalisations en raison d'une pneumonie extrahospitalière était particulièrement élevée chez les jeunes enfants et les adultes âgés; dans ces deux groupes d'âge, le taux de couverture par les vaccins recommandés contre

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le pneumocoque était faible. Les événements défavorables ont été 10 décès (3 %) et 35 transferts vers l'unité de soins intensifs (12 %). Deux variables indépendantes relevées chez les patients au moment de l'hospitalisation ont été prédictives d'événements indésirables : la maladie rénale chronique et la non-réception d'azithromycine; on a observé une tendance à un risque accru d'événements indésirables chez les personnes atteintes de maladie pulmonaire obstructive chronique.

Conclusion : Nos observations soulignent l'importance de la prévention de la pneumonie dans les communautés des Premières Nations du Nord-Ouest de l'Ontario. Il faudrait mener des études sur les particularités épidémiologiques de la pneumonie extrahospitalière dans cette population.

INTRODUCTION

Northwestern Ontario is a large geographic area with distinct environmental, socioeconomic and demographic characteristics that may challenge the maintenance of optimal health and health care services. The area shares many social determinants of health and negative health-related factors typical for rural Canada, such as higher prevalence of people with low income and lower education, less healthy dietary practices and lower levels of physical activity, compared with urban Canadians.[1] The health status of the northwestern Ontario population is also influenced by the vast geography of remote First Nations communities, with challenging access to comprehensive medical services and adverse social determinants of health (e.g., overcrowding, poverty, limited access to potable water).[2–4]

First Nations people in Canada experience a disproportionate burden of numerous health problems, including infectious and respiratory diseases.[5] Previous studies identified increased rates of hospital admission for community-acquired pneumonia among First Nations people in Alberta and Labrador, compared with the non–First Nations population.[6,7] In Ontario, the highest reported admission rates for pneumonia and influenza were found in northern and rural regions;[8] however, data are lacking on the epidemiology of community-acquired pneumonia in northwestern Ontario. We sought to characterize cases of community-acquired pneumonia requiring hospital admission in a primarily First Nations population.

METHODS

This 3-year retrospective population-based study examines all cases of community-acquired pneumonia requiring hospital admission at the Sioux Lookout Meno Ya Win Health Centre, in Ontario. The centre serves a primarily First Nations population of 28 000 in 28 remote communities[9] (Fig. 1).

We specifically identified the medical risk factors and comorbidities associated with community-acquired pneumonia and those associated with an unfavourable clinical course of the disease, such as all-cause mortality associated with the admission or transfer to a tertiary care centre with an intensive care unit (ICU). We compared our centre's admission rates and lengths of stay with provincial averages.

All cases of pneumonia involving admission for at least 24 hours between January 2007 and December 2009 were retrospectively identified by the International Classification of Diseases, 9th revision (ICD-9) codes. The patients' charts were reviewed to exclude health care–associated or hospital-acquired pneumonia. We excluded any patients who had been admitted within the preceding 30 days or transferred to the hospital from a long-term care facility. We also excluded any nosocomial infections with onset of the symptoms more than 72 hours after admission. All discharge diagnoses of pneumonia were included in the study. Data on 41 variables were collected, including patient demographics, medical conditions, current medications and clinical course of disease. Pneumococcal vaccination status as well as microbiology data (blood and sputum culture) were also recorded where available.

Outcomes of interest included all-cause mortality, transfer to another hospital (for admission to intensive care facilities) or a summary outcome of death or transfer. We evaluated the association between patient characteristics and outcome risk, using univariable logistic regression models. Because of the relatively small number of specific outcomes (deaths and transfers) models were built to assess risk of summary outcomes. Candidate covariates ($p \leq 0.15$) were used to build a multivariable logistic regression model, with covariates removed in a stepwise fashion to maximize Akaike information criterion.

The Meno Ya Win Research and Ethics Review Committee gave ethics approval for the study.

RESULTS

Patient characteristics

During the study period, 287 cases of community-acquired pneumonia resulted in admission at the

Sioux Lookout Meno Ya Win Health Centre, for an annual incidence of 3.42 per 1000 population. Of these, 91.3% had radiographic confirmation of the clinical diagnosis. The mean age of patients was 37.2 years with a clear bimodal distribution; 126 patients were under 20 years of age (mean 2.8 yr) and 161 patients were over 20 years of age (mean 64.1 yr) (Figs. 2 and 3). Of the patients, 52% were female, 87% were First Nations, and 71% were obese (body mass index [BMI] > 30) or overweight (BMI > 25). Among adults, 41% smoked or formerly smoked, 47% had diabetes, 31% had chronic obstructive pulmonary disease (COPD), 46% had either congestive heart failure or coronary artery disease, and 20% had chronic renal disease. A total of 40% of patients had received treatment or been admitted for a previous case of pneumonia. The largest number of cases of community-acquired pneumonia were in children aged 1–24 months (n = 80) and in adults aged 70–79 years (n = 42).

Vaccination status was low. Of the whole cohort, 22% had received a pneumococcal vaccine. Of the children aged 2 months to 14 years, 25% had received the 7-valent conjugate pneumococcal vaccine, and 41% of adults aged 65 years or older had received the 23-valent pneumococcal polysaccharide vaccine.

The mean length of hospital stay was 5.32 (95% confidence interval [CI] 4.68–5.96) days. Ten patients (3%) died as a direct result of pneumonia (either in hospital or within 30 days of discharge);

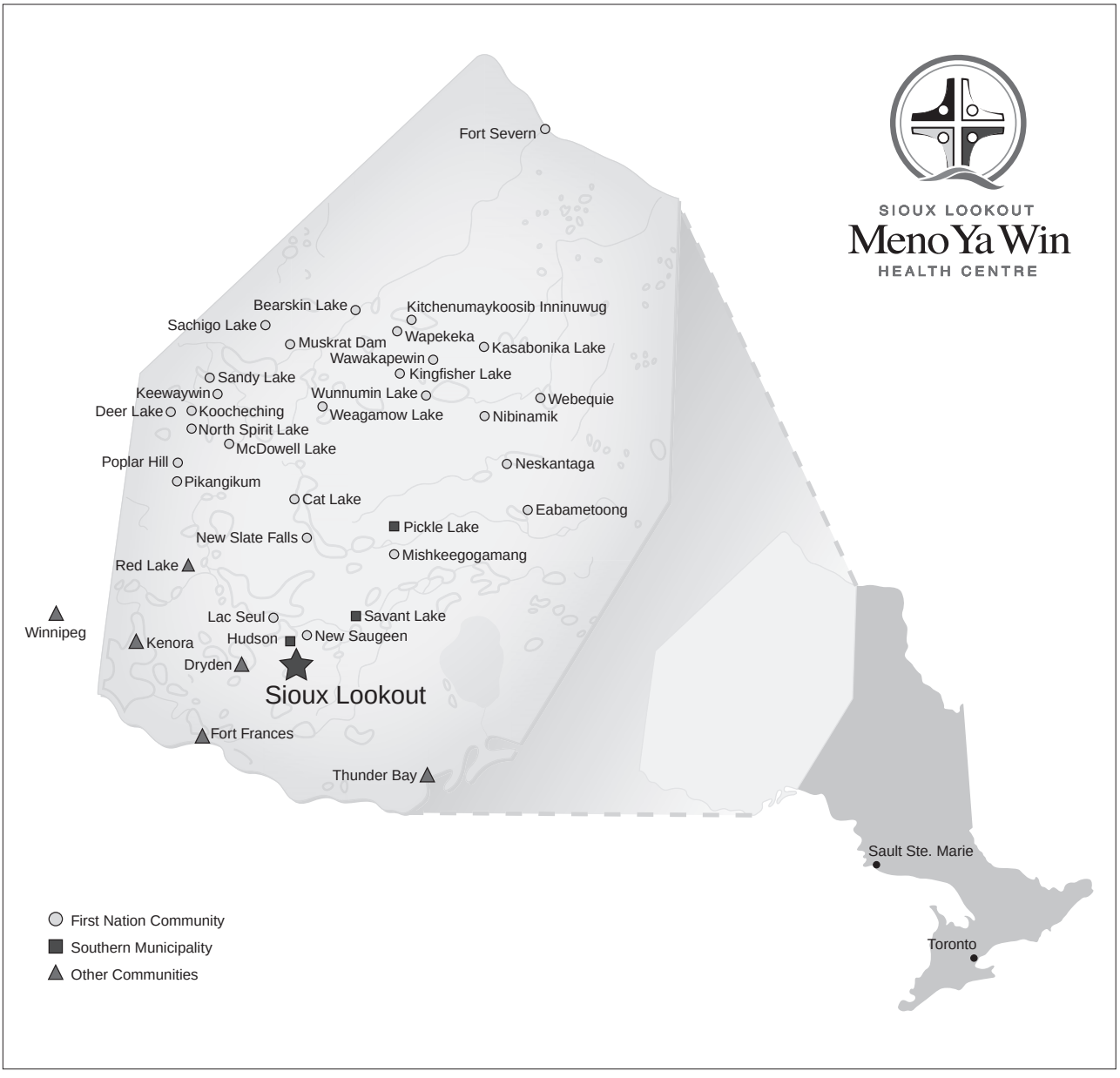

Fig. 1. The service area of the Sioux Lookout Meno Ya Win Health Centre (www.slmhc.on.ca/service-area; reproduced with permission from the Sioux Lookout Meno Ya Win Health Centre).

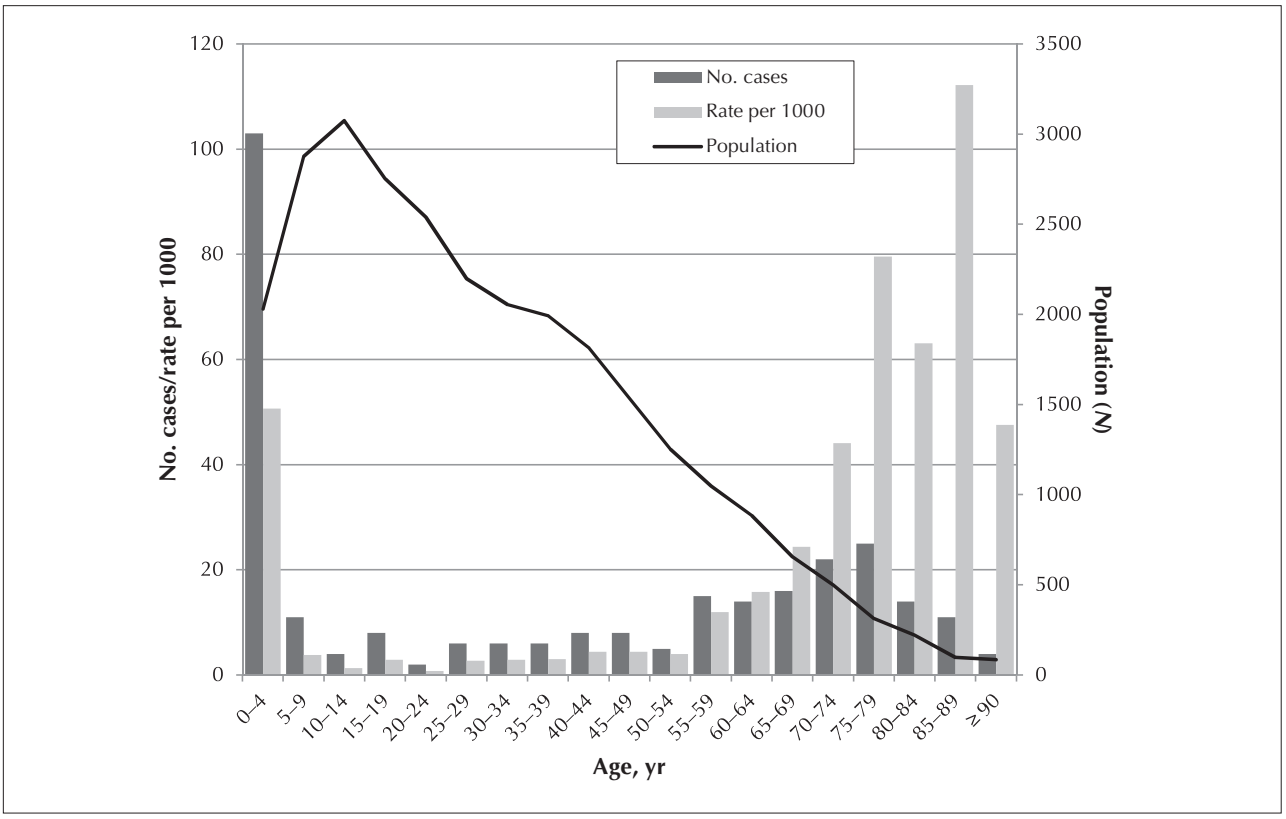

Fig. 2. Distribution of cases and incidence rates of community-acquired pneumonia involving hospital admission, by patient age.

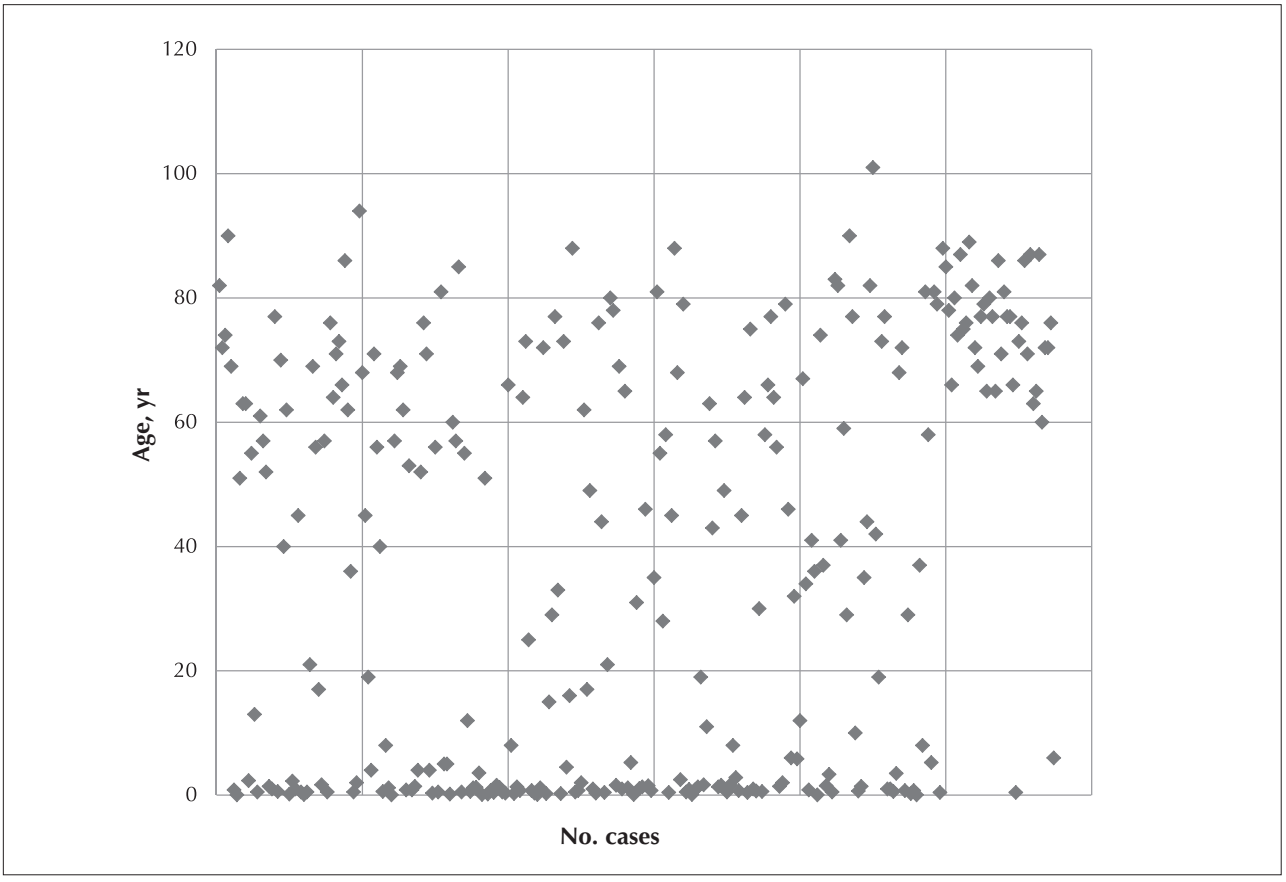

Fig. 3. Age distribution in 287 hospital admissions for community-acquired pneumonia.

35 patients (12%) were transferred to a tertiary care centre for admission to the ICU. The most common treatment courses were cefuroxime, azithromycin, or levofloxacin, with 9% of the patients receiving antibiotics before the hospital admission. Microbiological information from sputum samples were almost universally absent.

Risk factors for unfavourable outcomes

Our analysis identified 2 independent predictors of adverse outcomes: chronic renal disease (odds ratio [OR] 3.14, 95% CI 1.37–7.25, $p = 0.007$) and nonreceipt of azithromycin at the initial presentation (OR 2.17, 95% CI 1.10–4.30, $p = 0.03$). In addition, we found a trend toward an increased risk of adverse outcomes in patients with COPD (OR 1.95, 95% CI 0.90–4.16, $p = 0.09$). Other factors that have been previously identified as predictive of poor outcomes in individuals with community-acquired pneumonia, including nonreceipt of a pneumococcal vaccine and advanced age, were not found to be predictors of poor outcome in this analysis.

DISCUSSION

During the 3 years of this study, the annual incidence of pneumonia-related hospital admission at the Sioux Lookout Meno Ya Win Health Centre was 3.42 per 1000 population. In comparison, the provincial rate for 1992–2001 was 2.42 per 1000 population.[8,10] Our catchment area population constitutes 10% of the population of Local Health Integration Network no. 14, which also has high rates of hospital admission for pneumonia (3.38/1000 v. provincial rates of 1.82/1000 for 2008–2012).[11]

High rates of hospital admission for community-acquired pneumonia in northwestern Ontario may be due to several factors. Canadian and American studies have found community-acquired pneumonia to be more common among Aboriginal populations, with higher admission rates than the general population.[6,7,12–14] In 1995–2001, the admission rate due to pneumonia for the Innu and Inuit communities in Labrador was 11.6 per 1000 population compared with 3.0 per 1000 population in non-Aboriginal communities on the Northern Peninsula of Newfoundland.[7]

Unsatisfactory living standards in rural Aboriginal communities due to poverty, overcrowding, indoor pollution from smoking and wood-burning, poor ventilation and shortage of clean water are recognized as major determinants of increased morbidity in Aboriginal Canadians.[15,16] Limited access to primary care is also a characteristic factor among many rural Aboriginal communities.[17] Indeed, community-acquired pneumonia is considered an ambulatory care–sensitive condition (i.e., a disease that can be effectively managed in an ambulatory setting).[3] A 2003 study by Shah and colleagues[3] addressed the frequencies of preventable hospital admissions in northern Ontario and found a high admission rate for ambulatory care–sensitive conditions in Aboriginal populations compared with non-Aboriginal populations residing in the same geographic area, even when matched by socioeconomic status.

Although pneumonia is the leading cause of admission to the Sioux Lookout Meno Ya Win Health Centre, the proportion of patients whose hospital stay was 2 days or less was about 6 times the provincial average.[11] More frequent admissions for community-acquired pneumonia with shorter hospital stays have also been reported from rural hospitals in Alberta and in Innu and Inuit patients in Labrador, in comparison with non-Aboriginal patients.[7,18] In addition, studies have found that non-Aboriginal patients have less severe pneumonia, with lower in-hospital mortality, than non-Aboriginal patients.[6,7] In a 2004 study from Alberta, Marrie and colleagues[6] found that in-hospital mortality in First Nations patients was 3.1%, compared with 6.9% in age-matched non–First Nations patients.

Mortality from pneumonia varies by study. Recently short-term mortality as high as 9% has been reported in patients admitted to hospital with community-acquired pneumonia.[19] In our study, 30-day mortality was 3.5%, which suggests that pneumonia had a less severe course in our patients. Limited access to primary care follow-up and outpatient supports may lead to admission of patients who present with less severe disease, because patients often live hours away by air travel from the hospital.

Age is recognized as a major risk factor for community-acquired pneumonia, with higher incidence rates in people aged 65 years or older.[20] However, children under the age of 4 years are also at an increased risk.[7,21] Aboriginal infants have the highest rate of hospital admission, whereas non-Aboriginal patients with pneumonia are primarily older adults.[7] The bimodal age distribution in our study is consistent with these previous studies. In our study, the largest number of cases ($n = 80$) was found in children aged 1–24 months, and the second largest group ($n = 42$) consisted of adults aged 70–79 years. Because of the large number of childhood cases, the mean age of patients in our study was lower than that from another

Canadian report of community-acquired pneumonia in First Nations populations (37 yr v. 53.5 yr).[6]

Typical comorbidities of community-acquired pneumonia as well as medical risk factors described in the literature were present in our study: a high prevalence of diabetes, cardiovascular disease, COPD, chronic renal disease, previous episodes of pneumonia and smoking.[22–24]

Chronic renal failure is a recognized risk factor for community-acquired pneumonia.[25–28] In Canada, the prevalence of severe chronic kidney disease is almost twofold higher among First Nations than non–First Nations people.[29] The First Nations population of northwestern Ontario is disproportionately affected by chronic renal failure.[30,31] In our study, it was found to be an independent risk factor associated with an unfavourable outcome of pneumonia. The presence of diabetes and COPD is known to have a negative impact on the immune system[32,33] and was seen in 47% and 31% of our participants, respectively. A trend to an increased risk of an unfavourable outcome of pneumonia was observed in patients with COPD, but not in patients with diabetes.

Microbiological data were absent from most of the patient charts in our study, as is often the case in pneumonia studies. In our study participants, coverage of children and older adults with recommended pneumococcal vaccines was low (the 7-valent pneumococcal conjugate vaccine, Pneu-C-7; and the 23-valent pneumococcal polysaccharide vaccine, Pneu-P-23, respectively).[34] The Pneu-C-7 vaccine recommended by the Public Health Agency of Canada for all children under 2 years of age has been part of the routine Ontario vaccination program since 2005.[35] In our cohort, the average vaccination rate in children between 2 months and 14 years of age was only 25%, whereas 35% would have been eligible by age given the timing of the introduction of the vaccine in Ontario.

Pneu-P-23 is recommended for all adults older than 65 years in Canada.[36] Although there is conflicting evidence that the administration of the Pneu-P-23 vaccine reduces rates of pneumonia, the administration of this vaccine in at-risk populations is supported by data demonstrating improvement in clinical outcomes, including shorter hospital stays, reduced occurrence of bacterial sepsis or transfer to intensive care, and reduced mortality.[37–39] Our vaccination rate in this population was 41%; improved vaccination practices might decrease infection rates and hospital admissions in the older portion of our population.

We also found that nonreceipt of azithromycin at the initial presentation was a predictor of a negative outcome. This may speak to the possibility of high rates of susceptible organisms, including atypical causes of pneumonia, but also may be indicative of the immune-modulating properties of this antibiotic.[40] In 2012, a meta-analysis of 23 studies found a 22% reduction in mortality with this antibiotic; the authors hypothesized that some of the benefit may be due to its anti-inflammatory properties.[40] The Canadian Paediatric Society has recently recommended against its use in pneumococcal pneumonia (the cause of 25%–50% of community-acquired pneumonia in some studies) due to the association with the development of resistance.[35,41] The absence of microbiological data inhibit us from speculating on whether we are encountering more atypical causes of community-acquired pneumonia.

Short hospital stays are often seen as unnecessary or "social" admissions. In our setting, with patients travelling long distances back to their home community, prudent management may lead to short admissions to ensure the patient is safe to travel and to receive treatment back in their distant home community. Hospital admission and length of stay aside, the standardized mortality for respiratory disorders (excluding neoplasms) in northwestern Ontario is almost twice that of the rest of the province (0.7/1000 v. 0.4/1000, respectively).[10] More research is needed to understand the role that social determinants of health, vaccination status and treatment play.

Limitations

Community of origin was not noted in our study. Therefore, we could not distinguish between members of the population who had easier access to the hospital and local clinics, and those in more remote areas. Sputum culture results were rarely available on the charts, particularly in the pediatric population.

CONCLUSION

Medical and socioeconomic risk factors for community-acquired pneumonia exist in rural First Nations populations. The etiology of community-acquired pneumonia in this population requires further study for better prevention. Increased microbiological surveillance, as well as community-specific variables (e.g., housing and air quality) would enhance our understanding of risk factors and best treatment options for community-acquired pneumonia in this region. Renal failure and nonreceipt of azithromycin were independently associated with poor outcomes of community-acquired pneumonia

in our study population. Pneumococcal vaccination in our region should be made a priority.

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Vancomycin use in a rural hospital: a 3-year retrospective study

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Introduction: Urban centres often perform audits of vancomycin use as they face outbreaks of resistant organisms. We undertook this study to understand the indications and duration of intravenous vancomycin in a rural setting.
Methods: We conducted a retrospective chart audit for all patients who received intravenous vancomycin over a 3-year period at a rural hospital in northwestern Ontario.
Results: Vancomycin was used intravenously in 180 patients during the study period. It was used for short courses (median 3 d), and serum levels were below target 72% of the time.
Conclusion: High rates of invasive methicillin-resistant *Staphylococcus aureus* bacteremia and limited antibiotic choices in the field likely contributed to short courses of this antibiotic. Further study on clinical severity and antibiotic choice is needed. Additionally, weight-based dosing may result in target serum levels being achieved more frequently.

Introduction : Les centres urbains effectuent souvent des vérifications de l'utilisation de la vancomycine en raison du risque d'éclosions d'infections causées par des agents pathogènes résistants. Nous avons entrepris cette étude pour comprendre les indications et la durée de l'antibiothérapie par vancomycine intraveineuse en région rurale.
Méthodes : Nous avons procédé à une analyse rétrospective des dossiers de tous les patients qui ont reçu de la vancomycine intraveineuse sur une période de 3 ans dans un hôpital rural du Nord-Ouest de l'Ontario.
Résultats : La vancomycine a été administrée par voie intraveineuse chez 180 patients durant la période de l'étude. Elle a été utilisée pendant de courtes périodes (durée médiane 3 jours) et les taux sériques étaient inférieurs aux taux ciblés 72 % du temps.
Conclusion : Les taux élevés de bactériémie invasive à *Staphylococcus aureus* méthicillinorésistant et le choix limité d'antibiotiques sur le terrain ont probablement contribué à la brièveté des antibiothérapies avec cet agent. Des études plus approfondies sur la gravité des cas cliniques et le choix des antibiotiques s'imposent. De plus, l'établissement de la dose en fonction du poids corporel pourrait favoriser l'atteinte plus fréquente des taux sériques cibles.

INTRODUCTION

Antibiotic stewardship is an increasing prerogative in all clinical settings. The discussion often focuses on tertiary care centres. However, rural hospitals face their own inherent issues concerning available antibiotics, diagnostic resources, and patient and geographical factors. In clinical practice, the initial choice of antibiotic is usually empiric. Also, in settings without an on-site laboratory facility, there may be delays in receiving microbiological results, thereby requiring clinicians to use local bacterial prevalence to guide therapy.

In northwestern Ontario, there has been a dramatic increase in community-associated methicillin resistant *Staphylococcus aureus* (CA-MRSA) infections.[1] These infections, which are most often in skin or soft tissue, are almost universally susceptible to sulfamethoxazole–trimethoprim, clindamycin or doxycycline, but

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more invasive infections of suspected MRSA are often treated with vancomycin.[2] We have documented a rise in life-threatening invasive CA-MRSA bacteremia, with cases occurring monthly in our region.[3] A 6-week course of vancomycin is the treatment of choice for these invasive infections, which can have a death rate as high as 23%.[4–6] Vancomycin is an effective antibiotic in certain life- and limb-threatening infections. However, its widespread use is implicated in an increasing incidence of vancomycin-resistant enterococcus,[7] and it has inherent toxicities.

The Meno Ya Win Health Centre in Sioux Lookout serves a primarily First Nations population of 28 000 people in northwestern Ontario. The population lives in 31 remote communities that are distributed across 385 000 km^2 (an area half the size of Ontario) and linked by fixed-wing air transportation and seasonal winter roads.[8] Communities typically receive their medical services from in-community nurses, with monthly physician visits. Poor housing, overcrowding, food and water insecurity, and a pandemic of intravenous drug use are contributing factors to high rates of illness due to infectious diseases.[3] Patients are often triaged "at a distance" by telephone communication between a community nurse and a Sioux Lookout physician. Antibiotic therapy can be started in the community by physician order and blood samples drawn but then shipped to the hospital for processing. Without road access, community nurses "medevac" patients in the case of serious illness. Ornge, which manages the air ambulance service, stocks only vancomycin and ceftriaxone as antibiotics. The Sioux Lookout Meno Ya Win Health Centre has an on-site microbiology laboratory, but until recently was not capable of on-site testing of vancomycin trough levels.

We undertook a 3-year retrospective clinical audit of our use of vancomycin to assess what clinical diagnoses were being treated with the antibiotic, to evaluate our dosing and monitoring, and to examine what eventual culture results were obtained to tailor the antibiotic regimen.

METHODS

Chart audit

A retrospective chart audit was conducted for all patients who received intravenous vancomycin at the Sioux Lookout Meno Ya Win Health Centre between June 1, 2010, and June 1, 2013. Audit information included patient demographics, clinical diagnosis, and specific information regarding vancomycin dose and course. Concurrent antibiotics; monitoring parameters, including vancomycin trough level (before the fourth dose) and serum creatinine; culture results; sensitivities; and patient disposition were also included. Initial serum trough levels were the only ones recorded in our audit, because the research focus was on antibiotic initiation. Target vancomycin levels were deemed to be 15–20 mg/L. There are 3 common dosing methods for vancomycin for adult patients with normal renal function: 1) 1 g intravenously every 12 hours; 2) 15 mg/kg intravenously every 12 hours; 3) loading dose of 25–30 mg/kg, followed in 12 hours by one of the above doses every 12 hours. We typically used the first method.

Data analysis

Data were collected in a Microsoft Excel spreadsheet and imported into IBM SPSS (version 21.0 for Windows) for statistical analysis. The data were analyzed descriptively, including means and standard deviations (SDs) for continuous data, and frequencies and percentages for categorical data. Analysis was done for the entire sample in subsets, as appropriate.

The research review committee of the Sioux Lookout Meno Ya Win Health Centre and the Lakehead University's Research Ethics Board gave ethics approval.

RESULTS

Between June 2010 and June 2013, intravenous vancomycin was ordered for 180 inpatients, all of whom were included in this chart audit. Half of the patients were male (50.8%). Patient age ranged from 8 days to 93 years, with a mean of 45.4 (SD 19.8) years. The frequency of β-lactam allergies was 15.0% (27 patients), with only one being a documented anaphylactic reaction.

Most of the infections treated with vancomycin were skin and soft tissue infections (34.4%), followed by bone and joint infections (Table 1).

Prior and concomitant antibiotic use

Antibiotics had been used in the preceding 24 hours in 43.2% of patients. The most commonly used antibiotics were ceftriaxone (19.2%) and clindamycin (11.4%). Another antibiotic was used concomitantly with vancomycin in 77.6% of cases, most commonly ceftriaxone (33.3% of total cases).

Dosing and length of treatment

In the initial dosing of the 104 adults with normal renal function, the vancomycin dose was empiric in 77.6% of cases, with 1 g given intravenously every 12 hours. Weight was recorded or estimated 43.3% of the time (78/180 patients). Weight-based dosing in adults occurred in 27 patients but was not statistically associated with achieving the target range of vancomycin levels (3 patients had levels within the target range, 8 had levels below the target range and 3 had levels above the target range) because many of these patients did not have vancomycin levels listed in their charts (13/27). Serum creatinine values were recorded in most charts (89.4%, 161/180), and 13.7% (22/161) had a degree of renal failure (estimated glomerular filtration rate < 90 mL/min).

The duration of treatment with vancomycin ranged from 1 to 90 (mean 6.59, SD 10.16) days. Data were skewed because 1 patient received treatment for 90 days; the median length of treatment was 3 (interquartile range 2–7) days. For skin and soft tissue infections, half of the patients took vancomycin for 3 days or less (Fig. 1). Patients transferred to other facilities were not counted.

Drug monitoring

Serum vancomycin trough levels were reported for 60.0% (108/180) of patients receiving intravenous vancomycin. The levels of 13.3% (24/180) of patients could not be accessed because they had already discontinued the medication before the timing of the fourth dose. Of the patients with trough levels, only 12.0% (13/108) of those levels fell within the ideal target range, whereas 72.2% (78/108) were suboptimal. There was no record of trough levels in the chart in 30.8% (48/156) of patients who received at least 4 doses (Table 2).

Culture results

Of patients given vancomycin, 65.6% had blood cultures done. Blood cultures were performed for all cases of endocarditis and most cases of respiratory and central nervous system infection. Blood cultures were not done for 53.2% of cases of skin and soft tissue infection (Table 3).

In the 35 patients with positive results on blood culture, methicillin-resistant *S. aureus* (MRSA) was grown with a frequency of 31.4% (11/35), methicillin-susceptible *S. aureus* was found in 14.3% of cases (5/35), and group A *Streptococcus* in 20.0% of cases (7/35) (Tables 3 and 4).

More than half (58.3%) of the patients had a nonblood culture. These cultures were positive 62% of the time, showing a greater frequency of a positive culture result from a source other than blood (30%) (Table 5).

Culture results were stratified by syndrome into the following categories: skin and soft tissue, bone and joint, diabetic foot, respiratory, endocarditis, central nervous system and other infections.

Table 1: Suspected infection as indication for vancomycin, *n* = 180

Infection site	No. (%) of patients
Skin and soft tissue*	62 (34.4)
Bone and joint†	30 (16.7)
Respiratory	41 (22.8)
Diabetic foot	18 (10.0)
Central nervous system‡	6 (3.3)
Endocarditis	6 (3.3)
Other§	17 (9.4)

*Included cellulitis, abscess and necrotizing fasciitis.
†Included osteomyelitis and septic arthritis.
‡Included meningitis and suspected brain abscess.
§Included gastrointestinal and genitourinary infections, febrile neutropenia, dialysis line infections, bacteremia without a known source, septic otitis media, pancreatitis and some postoperative treatment.

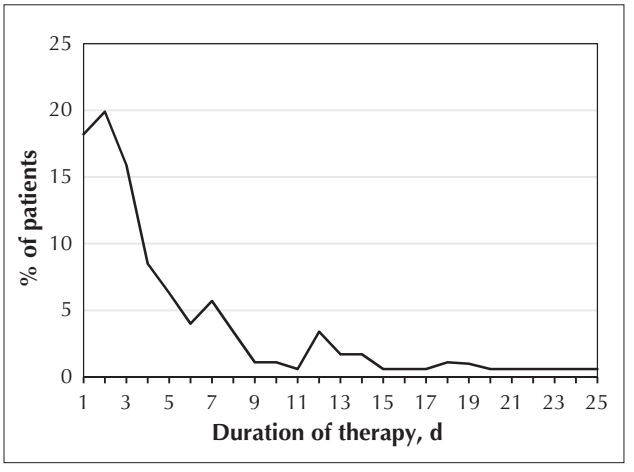

Fig. 1. Duration of therapy in 180 inpatients given intravenous vancomycin.

Table 2: Measured trough levels, *n* = 108*

Initial trough level, mg/L	No. (%) of patients
< 5	16 (14.8)
5–10	44 (40.7)
10.1–15	18 (16.7)
15.1–20 (target range)	13 (12.0)
> 20	17 (15.7)

*Levels were not measured in 72 patients.

There was considerable variability in the frequency of cultures performed, including 31.7% of respiratory cultures, likely reflecting the limited utility of sputum cultures in a non–intensive care setting. In suspected infections of the central nervous system, cerebrospinal fluid was sent for culture in 83.3% of cases; 1 patient with known lung cancer and bone metastases was transferred with headache for advanced imaging before lumbar puncture in a tertiary care centre. A substantial number of swabs were done for diabetic foot infections, all of which showed positive results for a wide variety of potential pathogens. This may demonstrate colonization rather than true infection due to these organisms.

We had no reported cases of resistance to vancomycin for gram-positive organisms from any source in these 180 patients.

Table 3: Results of blood cultures, by site of infection

Infection site	% (no.) of patients: Blood culture performed	Positive result	Most frequent culture isolates
Bone and joint	60.0 (18/30)	44.4 (8/18)	MSSA (2/8)
Skin and soft tissue	46.8 (29/62)	24.1 (7/29)	MRSA, group A *Streptococcus* (3/7 each)
Respiratory	82.9 (34/41)	26.5 (9/34)	MRSA (4/9)
Diabetic foot	66.7 (12/18)	25.0 (3/12)	MRSA, viridans streptococci, group B *Streptococcus* (1/3 each)
Endocarditis	100.0 (6/6)	33.3 (2/6)	MSSA, *Streptococcus salivarius* (1/2 each)
Central nervous system	83.3 (5/6)	33.3 (2/6)	MSSA, group A *Streptococcus* (1/2 each)
Other	76.5 (13/17)	30.8 (4/13)	—
Total	65.6 (117/180)	29.7 (35/118)	—

MRSA = methicillin-resistant *Staphylococcus aureus*; MSSA = methicillin-susceptible *Staphylococcus aureus*.

Table 4: Bacterial isolates from positive blood cultures, *n* = 35

Bacteria isolated	% (no.) of patients
MRSA	31.4 (11)
MSSA	14.3 (5)
Group A *Streptococcus*	20.0 (7)
Streptococcus viridans	8.6 (3)
Streptococcus pneumoniae	8.6 (3)
Group B *Streptococcus*	2.9 (1)
Gram-negative bacteria	5.7 (2)
Bacillus species (likely contaminant)	2.9 (1)
Coagulase-negative *Staphylococcus*	8.6 (3)

MRSA = methicillin-resistant *Staphylococcus aureus*; MSSA = methicillin-susceptible *Staphylococcus aureus*.

Table 5: Results of nonblood cultures, by site of infection

Infection site	% (no.) of patients: Culture performed	Positive result	Most frequent culture isolate(s)
Bone and joint	76.7 (23/30)	65.2 (15/23, 3 mixed)	MRSA (7/18)
Skin and soft tissue	61.3 (38/62)	60.5 (23/38, 9 mixed)	MRSA (14/32), group A *Streptococcus* (11/32)
Respiratory	31.7 (13/41)	27.3 (3/11 sputum), 0.0 (0/2 pleural fluid)	1/3 each MRSA, MSSA and *Haemophilus influenzae*
Diabetic foot	83.3 (15/18)	100.0 (15/15, 6 mixed)	Gram-negative (7/21), MRSA (6/21)
Endocarditis	0.0 (0/6)	NA	—
Central nervous system	83.3 (5/6)	60.0 (3/5)	1/3 each MSSA, group A *Streptococcus*, *Bacillus*
Other	64.7 (11/17)	36.4 (4/11)	Gram-negative (2/4)
Total	58.3 (105/180)	63.0 (66/107)	—

MRSA = methicillin-resistant *Staphylococcus aureus*; MSSA = methicillin-susceptible *Staphylococcus aureus*; NA = not applicable.

Disposition

Most patients (73.2%) were eventually discharged home, and 20.8% were transferred to a facility with an intensive care unit. Three patients died of their infection: a neonate with invasive group A streptococcal meningitis, a 19-year-old with pneumonia without positive cultures and a 73-year-old with osteomyelitis who later had respiratory failure secondary to aspiration pneumonia. Three patients with bone and joint infections required amputations of the infected site.

After culture results were returned, vancomycin was discontinued in 28.4% of cases. Of 101 patients with a positive result on blood or tissue culture, excluding those who died or were transferred, 38.2% of patients were stepped down to another antibiotic and 61.8% continued taking vancomycin. Severity of infection was not assessed in our study, so it is unknown whether daptomycin or a more commonly used antibiotic such as sulfamethoxazole–trimethoprim, tetracycline or clindamycin would have been acceptable alternatives. The high incidence of MRSA in tissue cultures (42.4% [28/66]) demonstrates the need for one of the above therapies, including vancomycin, where antibiotics were clinically warranted.

Toxicity

Nephrotoxicity (a serum creatinine increase of > 50%) occurred in 3.9% of patients (7/180). Of those 7 patients, 3 had trough levels above the therapeutic range (> 20 mg/L), 2 had levels below the range and for 2 patients the trough levels were unknown. The initial mean dose for patients who had nephrotoxicity was 1021.43 (SD 107.46) mg. One patient had a possible case of red man syndrome (a vancomycin-related dermatologic reaction requiring a slowing of the infusion rate). There were no reports of ototoxicity found in this audit. There was 1 case of possible vancomycin-induced neutropenia; the patient's medication was then changed to cefazolin for coverage of postoperative endocarditis following pacemaker insertion.

DISCUSSION

Four main findings arise from this clinical audit of vancomycin use: below-target dosing, short duration of use, inadequate monitoring of serum trough levels and blood cultures done for 65.6% of cases with vancomycin use.

Dosing

Serum levels were subtherapeutic 72% of the time in our audit.

Initial doses should be based on actual body weight, even for obese patients, to achieve target therapeutic concentrations. Weight was recorded or estimated in only 43.3% of patients. This is not a standard procedure in our hospital, and it provides an additional barrier to ordering a weight-based dose. The traditional dose of 1 g every 12 hours is likely inadequate for an adult patient with normal renal function and serious MRSA infections. This has been reinforced by several large American studies.[9–11]

Even use of a larger loading dose (25–30 mg/kg) appears to be safe and potentially leads to faster achievement of therapeutic levels, according to a guideline by the Infectious Diseases Society of America (IDSA).[10] There are no data to support that this improves clinical outcomes, but this might be considered for seriously ill patients (Grade B recommendation: moderate evidence to support use).[10] Vancomycin is primarily excreted unchanged in the urine; therefore, initial adjustments of dose (or time) intervals must be made for renal insufficiency.[12–14] For patients with serious MRSA infections, vancomycin serum trough concentrations of 15–20 mg/L are recommended, and this is the target range in our facility. If the strain has a higher resistance, measured as a minimum inhibitory concentration of 2 or greater, then higher doses are needed, which increases the risk of toxicity. This may prompt the use of an alternate antibiotic such as linezolid or daptomycin.[9]

Duration of use

Ideally, antibiotic selection should be tailored based on culture results. Exposing infectious organisms to multiple inappropriate antimicrobial agents may increase the potential development of resistance. In this audit, those with severe skin and soft tissue infections were commonly given vancomycin for several days, and then switched to another agent. This was sometimes done before serum vancomycin trough levels were assessed. This practice may be a function of the availability of vancomycin in northern nursing stations and medical transportation services, or of physician preference. Initial patient triaging is often done at a distance, and patient transportation can take hours or days depending on weather, perceived acuity and transportation availability. Our clinical setting also has high rates of CA-MRSA, including cases of life-threatening invasive bacteremia,[1,3] and

this finding will have to be balanced with use of very short courses of vancomycin identified in this audit.

In cases of sepsis or severe skin and soft tissue infection, a short course of vancomycin, pending culture results, might be the best practice in our setting. The audit did not rate clinical severity due to the retrospective nature of the study, and it would be prudent to be aware of this usage pattern. More research will be needed to understand whether vancomycin is the best initial choice and why it is often stopped after a short course. It is not clear whether the initial choice of antibiotic reflects available drugs at the nursing station and the transportation service, and the distant "over-the-phone" assessment, which is a fact of life in our region. Vancomycin requires several half-lives to reach therapeutic levels when dosed in the manner most commonly seen in this audit; such practice may lead to the development of resistance without establishing effective serum levels and duration of treatment.

Monitoring

Monitoring of vancomycin has a dual purpose in guiding maintenance dosing to achieve therapeutic serum concentrations and assessing the risk of nephrotoxicity. According to the IDSA guideline, trough levels of greater than 10 mg/L are needed to prevent resistance, whereas a level of 15–20 mg/L is targeted for treatment of pathogens with complicated infections, including endocarditis, osteomyelitis, meningitis and hospital-acquired pneumonia.[10] Samples should be drawn to assess trough concentrations before the fourth dose, when steady state levels are likely achieved. Frequency of trough-level testing depends on the patient's status and clinical course; more frequent monitoring is recommended for patients with fluctuating renal function. For prolonged courses, vancomycin levels should be checked weekly in hemodynamically stable patients.[10,12] Available evidence does not support the monitoring of peak serum vancomycin concentrations.[10] Monitoring of vancomycin to prevent ototoxicity is not supported by the literature because this toxicity is often due to concomitant use of other ototoxic medications (particularly aminoglycosides) and does not correlate with serum concentrations of vancomycin.[10] Our audit found trough levels missing in 40% of the charts. Trough measurement is particularly important in our population, because we do see high rates of renal failure,[15] even though we saw very little nephrotoxicity in this audit. The missing trough levels are partly explained by the antibiotic often being stopped early, but we will need to be more focused on appropriate trough levels particularly if we move to increased dosing. Interestingly, an IDSA guideline from 2011[16] allowed that serum levels may not be needed in stable patients who are given the 1 g every 12 hours. Because we had a majority of patients with initial trough levels below the target range and our patient population already has a high rate of renal failure, attention to monitoring serum levels needs to continue in our facility.

Cultures

We have high rates of skin and soft tissue infections with CA-MRSA in our region[1] as well as increasing rates of life-threatening invasive disease. Of the positive blood cultures, 31.4% (11/35) were MRSA (Table 4), as were 40.9% (27/66) of the positive tissue cultures (Table 5). Because bacteremia from CA-MRSA is often secondary to soft tissue or bone infections, serological surveillance with blood cultures is prudent and should likely be commonplace if vancomycin is initiated in our population. Our audit noted a 65.6% rate of clinicians ordering blood cultures concomitant with vancomycin institution. As the gravity of the diagnosis increased, blood culture results were more likely to be recorded in the charts (i.e., 100% of endocarditis cases and 82% of both respiratory and central nervous system infections). Gathering appropriate deep swabs, rather than superficial swabs, after debriding wounds also should become routine practice.

Comparison with other studies

Data are lacking for comparison with other vancomycin audits conducted in rural hospitals. Urban-based audits have focused on clinical indications to use vancomycin. A nearby centre demonstrated 60% "inappropriate vancomycin use" most often associated with empiric use for treatment of sepsis.[17] Our setting differs from a tertiary care centre's use of vancomycin audits, where outbreaks of both vancomycin-resistant enterococcus and health care–associated methicillin-resistant *S. aureus* are major concerns.

Limitations

Our communities and hospital are now experiencing a shifting pattern of MRSA infections with very high rates of CA-MRSA, for which alternative antibiotics are available.[2] The exception is the

recently rising incidence of invasive CA-MRSA bacteremias for which a prolonged (2–6 wk) course of intravenous vancomycin is one of the recommended choices of treatments. Our data set was collected before the increased incidence of CA-MRSA bacteremias. We suspect that longer courses of vancomycin will become increasingly common in future audits.

The audit occurred during the introduction of electronic medical laboratory reporting. Although paper charts were considered to be complete, the transition may have left some data off the paper charts. To the best of our ability, we checked electronic charts as well. Additionally, serum vancomycin laboratory samples at the time of the audit needed to be shipped to another centre, which potentially affected the timing and integrity of the results.

Because the regional air ambulance service stocks only vancomycin and ceftriaxone, these antibiotics might be favoured as initial antibiotic choices for patients with sepsis being transported from remote communities. This may also be a factor in the audit findings of early cessation of this antibiotic, once patients were triaged and reassessed on admission to hospital. Pharmaceutical limitations in northern nursing stations and air ambulance presently also preclude the choice of newer (and less cost-effective) agents such as linezolid or daptomycin (also effective against MRSA) as agents of first choice where they may be needed.[18]

CONCLUSION

Most courses of vancomycin were brief, and more work is required to assess the appropriateness of vancomycin use and duration of therapy in rural and remote settings. In a region with increasing rates of invasive CA-MRSA bacteremia, we will need to be familiar with vancomycin's indication, dosing, monitoring and toxicity. Our antibiotic use and infectious disease surveillance can also inform the appropriateness of antibiotic supplies in remote communities and regional air ambulance services for northwestern Ontario. Our results show areas in which further education can be done in our hospital to improve dosing strategies and monitoring, and to encourage reflection on antibiotic choices. Empiric dosing may deliver subtherapeutic serum levels in our population, and weight-based dosing may be more appropriate.

Competing interests: None declared.

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AN ISSUE WITH PROXIMITY: A CLINICAL AUDIT OF OPTIC LENS INVOLVEMENT IN CT HEAD

Benvenuto P, Panu N.

Audit Location: Meno Ya Win Health Centre, Sioux Lookout, Ontario

BACKGROUND: Computed tomography (CT) of the head is one of the most commonly used diagnostic tools. However, examination of the optic lens usually only plays a minuscule role in patient management and outcome. Unnecessary exposure of the lens to radiation can result in cataract formation.

AIM: To minimize the involvement and resulting radiation of the optic lens during CT head studies.

METHODOLOGY: All CT head images performed at our institution between February to May 2013 were examined. Lens involvement meant partial or complete visualization of either lens or, in cases of cataract surgery; the area of the lens was in the field of examination. Images where the orbits were requested were excluded. Re-audit occurred between November and December 2013.

RESULTS: There were 101 studies in the initial audit, of which 78.2% (n=79) involved the lens. Re-audit included 61 studies, with lens involvement in 22.9% (n=14).

ACTION PLAN: Study results and recommendations were brought to the attention of the technologists. By angling the gantry above the level of the orbits and having patients tuck their chin, lens exposure to radiation can effectively be minimized. Re-audit results demonstrated a significant reduction in the number of cases with lens involvement. Of the 14 studies with lens involvement, 71.4% (n=10) were documented as trauma or c-spine mobility issues. Going forward, this study will help save the lens from unnecessary radiation and lens pathology. It is also suggested that clinical reasoning for desired lens involvement be documented.

NORTHERN ONTARIO THE NEW TROPICS? CASES OF TROPICAL PYOMYOSITIS FROM REMOTE NORTHERN ONTARIO FIRST NATIONS COMMUNITIES

PRESENTED AT CANADIAN ASSOCIATION OF RADIOLOGISTS, 2015

***Institution Affiliation*:** Sioux Lookout Meno Ya Win Health Centre, Ontario.
Authors: Paul S. Benvenuto, Neety Panu, Michael Kirlew, Anukul Panu

LEARNING OBJECTIVES:

1. Gain an appreciation of the clinical presentation of Tropical pyomyositis
2. Review the radiological presentations of Tropical pyomyositis
3. Illustrate the importance of multidisciplinary approach to disease detection

BACKGROUND: Pyomyositis is a purulent muscular infection, commonly by *Staphylococcus aureus*, hypothesized to arise through hematogenous spread. Found mostly in tropical environments, an increasing incidence has been described in temperate climates, affecting those immunocompromised and associated with Methicillin-Resistant *Staphylococcus aureus* (MRSA). Diagnosis is often early missed due to disease unfamiliarity. Imaging modalities such as Ultrasound, Computed Tomography and Magnetic Resonance Imaging are useful in narrowing the differential diagnosis. Aspiration or muscle biopsy culture and tissue staining are gold standards for diagnosis.

CONCLUSION: Tropical pyomyositis was once thought to originate only from tropic environments. The discussed cases demonstrate that its incidence is beginning to be seen in Northern Ontario, largely due to its association with illicit drug injection, muscular traumas and with the prevalence of MRSA and immunocompromised conditions such as diabetes mellitus.[1-4] We look to review the imaging features, while highlighting the important role imaging has in patient management. Collaborative care amongst physicians is key to identification and treatment of this potentially life threatening but curable disease.

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Advance directives

Survey of primary care patients

Rory O'Sullivan MD CCFP(EM) **Kevin Mailo** MD CCFP(EM) **Ricardo Angeles** MD MPH MHPEd PhD **Gina Agarwal** MB BS MRCGP CCFP PhD

Abstract

Objective To establish the prevalence of patients with advance directives in a family practice, and to describe patients' perspectives on a family doctor's role in initiating discussions about advance directives.

Design A self-administered patient questionnaire.

Setting A busy urban family medicine teaching clinic in Hamilton, Ont.

Participants A convenience sample of adult patients attending the clinic over the course of a typical business week.

Main outcome measures The prevalence of advance directives in the patient population was determined, and the patients' expectations regarding the role of their family doctors were elucidated.

Results The survey population consisted of 800 participants (a response rate of 72.5%) well distributed across age groups; 19.7% had written advance directives and 43.8% had previously discussed the topic of advance directives, but only 4.3% of these discussions had occurred with family doctors. In 5.7% of cases, a family physician had raised the issue; 72.3% of respondents believed patients should initiate the discussion. Patients who considered advance directives extremely important were significantly more likely to want their family doctors to start the conversation (odds ratio 3.98; $P<.05$).

Conclusion Advance directives were not routinely addressed in the family practice. Most patients preferred to initiate the discussion of advance directives. However, patients who considered the subject extremely important wanted their family doctors to initiate the discussion.

EDITOR'S KEY POINTS

- Formal advance directives protect patient autonomy and reduce the use of health care resources, but most patients do not hold them. Previous studies have suggested that patients might prefer to discuss advance directives in an outpatient setting, and might prefer that their primary care doctors initiate the discussion.
- Patients with advance directives were not prevalent (19.7%) in this study. Most of the patients surveyed would prefer to initiate the discussion of advance directives themselves. The preference to have a family doctor initiate the discussion correlated strongly with patients' higher ranking of the importance of advance directives.
- Discussions of advance directives are happening more widely than anticipated (43.8%), although they occur largely outside the purview of the family doctor—usually with family or friends, or with a lawyer.

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Advance directives are widely considered to be essential tools in protecting patient autonomy, particularly at the end of life. The term *advance directive* has multiple definitions in the literature, but a reasonable working definition is "a person's oral and written instructions about his or her future medical care, in the event he or she becomes unable to communicate."[1] In some jurisdictions, this is referred to as an *advance care plan* or a *living will*. Although they might be applicable in any clinical scenario, advance directives are typically invoked in situations of terminal illness and end-of-life care. In an age of sophisticated management of critical illness, and in the face of an aging population,[2] advance directives have substantial implications for effective patient care and for use of health care resources.

Despite their increasing importance, advance directives remain an apparently underused tool. Various population estimates from the United States suggest that the proportion of adults who hold advance directives is between 5% and 25%, although this might increase with age and hospitalization.[3,4] A 1993 survey of 304 Canadian outpatients by Sam and Singer found that no participants held advance directives.[5] In our own Canadian urban practice, an unpublished chart review of 142 randomly selected patients in 2009 established that 8 patients had documentation of their wishes at the end of life. Public awareness and tools for the development of advance directives were identified as priorities by the Quality End-of-Life Care Coalition of Canada in their 2010 *Blueprint for Action*.[6]

The primary care office visit is a potentially useful setting for advance care discussions. Past studies have established that many patients would prefer to hold these discussions in the outpatient setting,[7] and many would prefer that their primary care doctors initiate the discussion.[5,8,9] To date, many of the studies regarding advance directives in primary care have been small, retrospective in nature, or limited to elderly or palliative care populations.

Our study aimed to establish the prevalence of advance directives in our patient population, and to elucidate our patients' expectations regarding the role of their family doctors.

METHODS

This was a cross-sectional analytical study. A voluntary, anonymous, self-administered questionnaire was developed, informed by review of relevant literature and by the authors' clinical experience. Ethics approval was obtained from the Hamilton Health Sciences–Faculty of Health Sciences Research Ethics Board. The survey was offered to each adult patient (aged 18 years or older) who attended our (at the time of the study, R.O., K.M., and J.A.) urban family medicine teaching clinic during the course of a typical business week in November 2011.

Data were compiled and analyzed initially using descriptive and nonparametric statistics. Logistic regression was used to determine factors associated with the likelihood of patient preference in having family doctors initiate discussions regarding advance directives.

RESULTS

A total of 1104 patients attended our clinic during the selected week (mean age 53 years), of whom 800 completed the survey (a response rate of 72.5%). The participants' demographic characteristics are shown in **Table 1**. Most of the participants were women (61.0%). There was a broad age distribution except for a low number of participants aged 80 years and older, which probably represents the actual population distribution of clinic patients.

Table 1. Patient demographic characteristics: *N = 800.*

VARIABLE	N (%)*
Sex	
• Male	312 (39.0)
• Female	488 (61.0)
Age, y	
• 18-34	191 (23.9)
• 35-49	234 (29.3)
• 50-64	188 (23.5)
• 65-79	147 (18.4)
• ≥ 80	40 (5.0)

*Some values do not add to 100% owing to rounding.

Of the 800 participants, 19.7% had written advance directives and 43.8% had previously discussed advance directives. Of the total population, 16.2% reported that they had recently undergone an important surgery or hospitalization. Patients had most commonly discussed the issue with family and friends (39.5%), followed by with their lawyers (10.9%), in the context of important surgery (6.8%), in the context of an important hospital stay (4.9%), with their family doctors (4.3%), or in another setting (3.1%) (**Table 2**). Other settings included after the birth of a child, with a midwife, with a funeral director, and with clergy or a spiritual leader.

Overall, 21.4% of the survey population rated advance directives as not important, 37.9% as somewhat important, 26.0% as quite important, and 14.7% as extremely important. Family physicians had raised this issue with 5.7% of the patients. When asked who should raise the subject of advance directives, 72.3% indicated that the patient should, and 28.1% indicated that the family doctor should.

Table 2. Context in which survey respondents discussed advance directives: *N* = *800*.

CONTEXT	N (%)
With their family or friends	316 (39.5)
With their lawyers	87 (10.9)
Before an important surgery	54 (6.8)
During an important hospital stay	39 (4.9)
With their family doctors	34 (4.3)
In another setting	25 (3.1)

A logistic regression model was used to determine whether age, sex, or perceived importance of advance directives were associated with the participants' preference to have discussions initiated by themselves or their family doctors. The results showed that age and sex did not affect participant preference. However, participants who perceived advance directives as somewhat, quite, or extremely important were significantly ($P<.05$) more likely to prefer that their family doctors initiate the conversation about advance directives (odds ratios 1.79, 1.74, and 3.98, respectively, using the "not important" group as a reference standard).

DISCUSSION

Patients with advance directives were not prevalent in our study population (19.7%). This is consistent with previous studies across North America. In a 2013 Canadian study of elderly patients and family members, Heyland et al identified that, although 76.3% had thought about end-of-life care and 47.9% had completed an advance care plan, only 30.2% had discussed their wishes with their family doctors.[10] This study focused on an acute-care hospital population at risk of dying. The gap between consideration of advance care and discussion with a family doctor seems to widen in our more general outpatient survey population. The initial phase of the SUPPORT (Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatments) trial in 1995 found that 46% of do-not-resuscitate orders were written within 2 days of death.[11] Literature suggests that the physician-patient relationship is a key element in patient satisfaction at the end of life,[12,13] and at least 1 study found that discussing advance directives in primary care increased global patient satisfaction.[14]

Our study examined patient impressions regarding planning for end-of-life care. It appears that these discussions are happening more widely than we had anticipated (43.8% in our study), although they occur largely outside the purview of the family doctor. It is not routine practice in our clinic to raise the issue with our patients. However, it is also apparent that most patients prefer some control over how and when these issues are approached. As advance directives were rated as more important, having a family doctor initiate the discussion became more desirable. Past studies have found higher rates (up to 62% to 72%) of patients desiring that their physicians initiate the discussion, although the study populations were stratified differently.[5,9,14]

Limitations

We studied a sample of patients attending a busy urban teaching practice during a typical week. This practice population in a small Canadian urban centre is in close proximity to a relatively impoverished inner city, an industrial area, and a large university. Our study includes a social spectrum from inner-city patients of low socioeconomic status, new immigrants, and refugees to university students and associated professionals. Further study might focus on patients with substantial comorbidities and patients who will soon require palliative care for terminal illness. We did not control for issues of competence, cognitive impairment, or literacy, which might have interfered with accurate study completion. It is important to note that those aged 80 and older in our study were less well represented than other groups were. We are also unable to generalize our results to the patient population that does not typically attend the clinic, either because they do not require medical services or because they are institutionalized or require care at home. These are groups that would merit in-depth study in the future.

Conclusion

Our results show that advance directives are not widely discussed with patients in our practice. Most of those surveyed preferred to retain control of the context of this discussion. The preference to have a family doctor initiate the discussion correlated strongly with patients' higher ranking of its importance. Topics for future study might include patient-identified barriers to these discussions, and a correlation of patient perspectives with physician beliefs and expectations. We hope that our study might facilitate the development of frameworks for patient-centred end-of-life discussions in primary care.

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Contributors
All authors contributed to the concept and design of the study; data gathering, analysis, and interpretation; and preparing the manuscript for submission.

Competing interests
None declared

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ARTICLE

Length of Stay and Achievement of Functional Milestones in a Rural First Nations Population in Northwestern Ontario during Acute-Care Admission after Total Hip Replacement: A Retrospective Chart Review

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ABSTRACT

Purpose: To understand the postoperative acute-care physiotherapy course for First Nations people returning after total hip replacement (THR) to remote communities with limited rehabilitation services and to evaluate length of stay and attainment of functional milestones after THR to determine to what extent an urban-based clinical pathway is transferrable to and effective for First Nations patients in a rural setting. ***Methods:*** Data were collected retrospectively by reviewing charts of patients who underwent THR in the Northwest Ontario catchment area from 2007 through 2012. ***Results:*** For the 36 patient charts reviewed, median length of stay (LOS) at the Sioux Lookout Meno Ya Win Health Centre (SLMHC) was 7.5 days (range 2–335); median LOS from time of surgery at the regional hospital (Thunder Bay Regional Health Centre) to discharge from SLMHC was 13.5 days; and median time for mobilizing and stairs was 9 days (range 1–93). ***Conclusion:*** Commonly accepted urban clinical pathways are not a good fit for smaller rural hospitals from which First Nations patients return to remote communities without rehabilitation services. LOS in a rural acute-care facility is similar to LOS in an urban rehabilitation facility.

Key Words: arthroplasty, hip replacement; osteoarthritis; postoperative care; rural health

RÉSUMÉ

Objet: Comprendre le parcours de soins de physiothérapie postopératoires de courte durée pour les membres des Premières Nations qui retournent dans des collectivités éloignées offrant des services de réadaptation limités après une arthroplastie totale de la hanche (ATH); évaluer la durée du séjour et l'atteinte des jalons fonctionnels à la suite d'une ATH afin de déterminer dans quelle mesure et avec quelle efficacité le cheminement clinique de patients des Premières Nations effectué en milieu urbain peut être transféré en milieu rural. ***Méthodes:*** Les données ont été recueillies de façon rétrospective en examinant les dossiers de patients qui ont subi une arthroplastie totale de la hanche dans la circonscription hospitalière du nord-ouest de l'Ontario entre 2007 et 2012. ***Constatations:*** Pour les 36 dossiers de patient examinés, la durée du séjour (DDS) médiane au centre de santé Meno Ya Win de Sioux Lookout était de 7,5 jours (étendue: de 2 à 335); la DDS médiane à compter du moment de l'intervention chirurgicale à l'hôpital régional (Centre régional des sciences de la santé de Thunder Bay) jusqu'au départ du centre de santé Meno Ya Win de Sioux Lookout était de 13,5 jours; et le temps médian de recouvrement de la capacité à marcher et à monter des escaliers était de 9 jours (étendue: de 1 à 93). ***Conclusion:*** Les cheminements cliniques en milieu urbain généralement reconnus ne conviennent pas aux petits hôpitaux ruraux à partir desquels les patients des Premières Nations retournent dans des collectivités éloignées qui n'offrent pas de services de réadaptation. La DDS dans un centre de soins actifs en milieu rural est semblable à la DDS dans un centre de réadaptation en milieu urbain.

Total hip replacement (THR), one of the most common orthopaedic procedures performed in the province of Ontario, Canada,[1] has been shown to be a valuable and cost-effective surgical procedure for people with severe hip osteoarthritis (OA) and other related hip musculoskeletal disorders.[2–6] The rate of THR in Northwest Ontario, which has a population of more than 45,000 First Nations patients in its catchment area, is 27% higher than the overall rate for Ontario.[7,8] Our study evaluated in-hospital physiotherapy after THR in this catchment area.

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Contributors: All authors designed the study; collected, analyzed, and interpreted the data; drafted or critically revised the article; and approved the final draft.

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BACKGROUND

OA is responsible for more pain, long-term disability, and functional limitations than any other chronic disease and accounts for 75%–95% of THR.[9–11] According to the Canadian Joint Replacement Registry, the incidence of THR increased by 59% from 1997 to 2007.[12]

Among First Nations adults in Canada, arthritis is the number-one self-reported medical condition, according to the national First Nations Regional Longitudinal Health Survey.[13] In another regional health survey, 30% of respondents identified it as a major health concern.[14] Arthritis produces greater rates of disability among First Nations people than among other Canadians; First Nations people with arthritis experience a greater burden of illness, which is linked to economic and social conditions.[15,16] First Nations people with arthritis are more likely to have unfavourable health profiles, with a higher incidence of smoking, obesity, and other comorbidities than non–First Nations populations.[15] Postoperative physiotherapy is particularly important for this population because after discharge they return to remote settings with few, if any, in-community rehabilitation services. Many communities in the region have no public transportation, paved sidewalks, or roads and are accessible only by plane.

Physiotherapy has been identified as a standard and vital intervention for optimizing function and independence while minimizing the risk of hip dislocation, wound infection, deep vein thrombosis, and pulmonary embolism after THR.[1] As well as lowering total cost of care and increasing the probability of discharge home, physiotherapy in acute care has been found to be directly related to functional improvements in patients with lower extremity issues, including total joint replacement (TJR).[9] Early and more intensive rehabilitation has also been shown to result in earlier attainment of functional goals, decreased long-term disability, and decreased cost of care after surgery.[6,17–19]

Functional milestones after THR include transfers, ambulation with or without an assistive device, and negotiating stairs;[5] these activities are categorized as either assisted or unassisted.[5] More specific functional milestones include supine-to-sit transfer, sit-to-stand transfer, ambulation of 30 m (100 ft), and ability to climb stairs.[3]

In 2011, a large urban study in Toronto undertook identification of factors that affect systemwide performance for primary elective unilateral hip and knee TJR.[20] Integral to its approach was the development of clinical pathways: structured care plans within an institution, based on best practice and team experience, which act as a means of standardizing treatment. Use of clinical pathways after THR reduces hospital length of stay (LOS), facilitates effective use of resources, and maintains quality of care without compromising patient safety.[4,21–23] One result of this Toronto initiative was an increased rate of discharge from acute care to home, as opposed to an inpatient rehabilitation facility, after surgery. A key expectation of the Toronto study was that THR patients would have adequate and timely access to appropriate rehabilitation services in the community.[20]

Although these advances provide evidence of the importance of physiotherapy to early attainment of functional milestones and shorter in-hospital LOS, evidence as to whether these findings are relevant in medically and rehabilitation-underserved rural settings and among First Nations patients is still lacking.

The Sioux Lookout Meno Ya Win Health Centre (SLMHC) is a unique rural acute-care facility serving a largely First Nations population of 28,000, the majority of whom live in remote communities in which community-based rehabilitation and physiotherapy services are not typically available.[24] SLMHC serves as a base for primary care services that fly in to remote First Nations communities. The hospital also provides both initial referrals to the Thunder Bay Regional Health Centre (where orthopaedic services are available) and postoperative rehabilitation services before patients return home. LOS and attainment of functional milestones after THR in these unique circumstances have not previously been studied. To design clinical pathways appropriate to the rural setting and cultural needs of the population served by SLMHC, we need regional information and benchmarks; our study was therefore designed to evaluate LOS and attainment of functional milestones after THR at SLMHC, with the goal of providing valuable data for use in developing clinical pathways appropriate to rural care settings and care involving First Nations people.

METHODS

Through a 5-year retrospective review of our medical records (2007–2012) and Canadian Institute for Health Information postal code–specific data, we identified 36 patients admitted for rehabilitation after THR or partial hip replacement (PHR), most of whom underwent surgery at Thunder Bay Regional Hospital, approximately 300 km away, and were transferred to the SLMHC for postoperative rehabilitation.

We collected data on 25 variables pertaining to patient demographics, functional milestones, LOS, comorbidities, and surgical interventions. To ensure cultural appropriateness, we consulted with the Special Advisor for First Nations Healthcare at SLMHC; ethics approval was granted by the SLMHC Research Review and Ethics Committee, which includes First Nations representation. Data were entered into an Excel spreadsheet and imported into IBM SPSS Statistics Version 21.0 for Windows (IBM Corp., Armonk, NY) for analysis. Data were analyzed descriptively, including means, standard deviations, quartiles, and medians for continuous data and frequencies and percentages for categorical data.

Table 1 Characteristics of Patients with Total Hip Replacement ($n = 36$)

Characteristics	No. (%) of participants
Sex	
Female	26 (72.2)
Male	10 (27.8)
First Nations status	
Yes	34 (94.4)
No	2 (5.6)
Comorbidities	
OA	25 (69.4)
RA	5 (13.9)
Smoking	11 (30.6)
Diabetes	17 (47.2)
Pre-surgery living situation	
Home alone	6 (16.7)
Home with others	25 (69.4)
Data not available	5 (13.9)
Home location	
On reserve	29 (80.6)
Local township	7 (19.4)
Stairs in home	
Yes	25 (69.4)
No	4 (11.1)
Data not available	7 (19.5)
Operated side	
Left	15 (41.7)
Right	21 (58.3)
Postoperative WB status	
Full WB	21 (58.3)
Partial WB	3 (8.3)
Toe touch WB	6 (16.7)
Non-WB	3 (8.3)
Data not available	3 (8.4)

OA = osteoarthritis; RA = rheumatoid arthritis; WB = weight-bearing.

RESULTS

We collected data from a total of 36 patient charts; 34 patients (94.4%) had First Nations status. Mean age was 62.0 (SD 16.0) years, and all 36 had OA preoperatively. Demographic and surgical intervention characteristics of the study sample are shown in Table 1.

Length of Stay

LOS at SLMHC was preceded by a short postoperative stay in the regional surgical hospital for immediate care and some initial rehabilitation; LOS at the regional hospital also depended on availability of air ambulance transfer services. From the date of surgery at the regional hospital, median overall LOS was 13.5 days (range 6–338), including a median 6-day postoperative period before transfer to SLMHC. The LOS of interest in our study began at inpatient admission to SLMHC and ended at discharge from inpatient physiotherapy services. Median LOS was 7.5 days (range 2–335); 25% of patients were discharged by day 5, and 75% were discharged by day 17.8.

Table 2 Level of Achievement of Functional Milestones ($n = 36$)

Functional milestone	No. (%) of participants
Supine to sit	
Achieved, assisted	3 (8.3)
Achieved, unassisted	28 (77.8)
N/A	5 (13.9)
Sit to stand	
Achieved, assisted	4 (11.1)
Achieved, supervision	0 (0)
Achieved, unassisted	27 (75.0)
N/A	5 (13.9)
Ambulate $\geq$30 m	
Not ambulatory	0 (0)
$<$30 m, $>$3 m	13 (36.1)
Achieved, assisted	1 (2.8)
Achieved, unassisted	20 (55.6)
N/A	2 (5.6)
Negotiate stairs	
Achieved	18 (50)

N/A = not available.

Table 3 Days Taken for Patients to Achieve Functional Milestones after Surgery

	No. of days		
Functional milestone	25th percentile	Median	75th percentile
Supine to sit	6.0	8.0	11.0
Sit to stand	6.0	8.0	11.0
Ambulate $\geq$30 m	7.0	9.0	16.0
Stairs	6.0	9.0	13.0
LOS, SLMHC only	5.0	7.5	17.75
LOS, surgery to discharge	10.0	13.5	23.5

Note: The LOS in this study was defined as the time of inpatient admission to the SLMHC to the time of discharge from inpatient physiotherapy services.
LOS = length of stay; SLMHC = Sioux Lookout Meno Ya Win Health Centre.

Functional milestones

Of the functional milestones measured (see Table 2), negotiating stairs was the least frequently achieved, at 40%. Five patients had a ramp to access their home and did not use stairs as their functional baseline; one patient was deemed unsafe to climb stairs and was transferred to an extended care facility. For both ambulation for more than 30 m (100 ft) and safely climbing stairs, the median time to achieve milestones from date of surgery was 9 days (see Table 3).

DISCUSSION

LOS and clinical pathway

The purpose of our study was to evaluate the LOS and achievement of functional milestones to determine the transferability and effectiveness of urban-based clinical

pathways for First Nations patients who access services in a rural acute-care setting. We found that median LOS from time of surgery to discharge home was 13.5 days and that median time from admission to SLMHC to discharge was 7.5 days—both longer than the median LOS for rehabilitation hospitals in urban settings. In the Toronto Central Local Health Integration Network, the median rehabilitation hospital LOS is 7 days, and 73% of patients are discharged within 13 days;[25] the Provincial Orthopaedic Expert Panel's recommended best-practice care for primary unilateral TJR would include an average acute-care LOS of 4.4 days.[25] Although SLMHC is designated as an acute-care facility, its LOS numbers are more comparable to (and longer than) those of an urban rehabilitation facility.

A prerequisite for achieving urban-generated best-practice goals is ready access to outpatient or community-based rehabilitation services.[20] Meeting this need is a challenge for most remote communities in Northwest Ontario, which do not have access, or have only limited access, to rehabilitation services. The majority of patients in our study sample lived in such remote communities, and their geographic location thus directly affected their health status and access to services—an identified problem for remote First Nations communities.[26]

For rehabilitation facilities, current clinical care pathways suggest a 7-day LOS.[25] However, this LOS is directly influenced by patient goals, patient needs, and the availability of adequate supports in the patient's home environment.[27] Although receiving rehabilitation through community rehabilitation services is ideal for the typical patient in an urban setting, it is likely not ideal for the typical patient in an underserved rural setting. When most of a facility's patients are from a remote location, a 4.4- or 7-day clinical care pathway is inadequate. Patients at SLMHC during the period studied received, on average, less than 1 hour of physiotherapy services per day, 5 days per week; as in many rural hospitals, rehabilitation services were not available on weekends.

Patients in this study achieved most or all of their functional milestones within 10 days after surgery, which suggests that patients' rehabilitation LOS depends on additional factors beyond the achievement of functional milestones, including limited availability of rehabilitation services in the community, transportation arrangements, management of comorbidities, access to equipment, and other socio-economic factors that affect discharge needs. More research is required to determine what these factors are and what role they play in patients' LOS.

All patient charts in our sample had an indication of OA; the average age was 62.0 years, whereas the Canadian average for people undergoing THR is 66 years.[28] Whether First Nations people experience OA at an earlier age or experience greater related disability remains to be studied; a larger study will be required to assess this because our sample included only 2 non-Aboriginal patients.

Other implications

Partly because of its location and the population it serves, SLMHC, an acute-care facility, provides inpatient rehabilitation care in a time frame comparable to that of designated rehabilitation centres in urban settings. The situation is unique in that THR patients have their surgery in another facility and are then transferred to SLMHC for continued care and discharge. Because transportation in our region is by aeroplane—and aeroplanes are also used for emergency patient transfers—elective transfers are subject to triaging and consequent delays; the development of a clinical pathway for this population must take this unique transportation situation into account. In addition, clinical pathways in more rural facilities must identify what best practice means for patients, giving due consideration to other factors such as socio-economic status, geographic location, and availability of community-based rehabilitation.

The possibilities of telerehabilitation require additional evaluation to determine whether it can become a viable treatment option to decrease LOS among First Nations patients in rural settings after THR or PHR.

LIMITATIONS

Our pilot study has several limitations. First, the sample size was relatively small. Second, our analysis did not include data on occupational therapy because access to this service was inconsistent during the period under study. Finally, this pilot study was not designed to determine pre-surgical functional status of patients or its association with outcomes.

CONCLUSION

The application of clinical pathways developed for urban populations may not be appropriate for more rural populations, including First Nations populations. Other factors beyond achievement of functional milestones must be considered in creating a physiotherapy-specific clinical pathway. Taking into account socio-economic factors and available community resources, a clinical pathway should be developed in the context of the population and location it is intended to serve. In particular, First Nations patients returning to remote communities with limited rehabilitation and public transportation services will need relevant benchmarks established before they return home. Ontario's Senior Strategy in 2013 identified the need for Aboriginal senior adults to access culturally appropriate care and for community consultation in developing such services; rehabilitation services for the management of chronic diseases may be a good place to start.[29]

KEY MESSAGES

What is already known on this topic

In urban centres, clinical pathways for postoperative care of patients after THR include LOS recommendations of 4.4 days in an acute-care facility and 7 days in a rehabilitation facility.

What this study adds

Rural acute-care facilities that serve patients returning to remote communities without access to rehabilitation services need to configure their clinical pathways to reflect their needs and realities.

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Clostridium difficile infection in rural Ontario: a retrospective multisite population-based study

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Introduction: We conducted a retrospective, population-based study to assess the prevalence of *Clostridium difficile* infections and the associated risk factors among inpatients and outpatients in our region.
Methods: We used laboratory data over a 2-year period to identify inpatient and outpatient cases of *C. difficile* infection. Data were collected from 3 local catchment areas for rural hospital laboratories in Sioux Lookout, Mount Forest and the South Huron Hospital Association in Exeter. We gathered demographic data and infection-specific information, including recent antibiotic use and recent or current hospital admission or nursing home stay.
Results: During the study period, 34 cases of *C. difficile* infection occurred in 29 patients, with an estimated crude annual rate of 24.3/100 000 population. Of the cases, 47.1% were diagnosed in outpatients. Most patients (76.5%) had taken antibiotics within the previous 90 days, and antibiotic use and hospital admission accounted for 47.1% of cases. Clindamycin was more commonly associated with *C. difficile* infections at the northern site and ciprofloxacin at the southern sites. There were 2 deaths from comorbidities.
Conclusion: The estimated annual incidence of *C. difficile* infection in our study is similar to urban-based estimates. Almost half of the cases involved outpatients, indicating a need to recognize this illness as a serious outpatient condition. Antibiotic stewardship is an ongoing consideration, as most patients were exposed to antibiotic use before infection.

Introduction : Nous avons effectué une étude rétrospective basée dans la population pour évaluer la prévalence des infections à *Clostridium difficile* et les facteurs associés chez les patients hospitalisés et non hospitalisés de notre région.
Méthodes : Nous avons utilisé les données de laboratoire sur une période de 2 ans pour recenser les cas d'infections à *C. difficile* chez les patients hospitalisés et non hospitalisés. Les données ont été recueillies à partir de 3 bassins de population locaux pour les laboratoires hospitaliers ruraux de Sioux Lookout, de Mount Forest et de la South Huron Hospital Association à Exeter. Nous avons colligé les données démographiques et les renseignements spécifiques aux infections, y compris l'utilisation récente de l'antibiothérapie et les hospitalisations ou séjours en foyers de soins infirmiers récents ou en cours.
Résultats : Au cours de la période de l'étude, 34 infections à *C. difficile* ont été dénombrées chez 29 patients, pour un taux annuel brut estimé de 24,3/100 000 habitants. Parmi ces cas, 47,1 % n'étaient pas hospitalisés au moment du diagnostic. La plupart des patients (76,5 %) avaient pris des antibiotiques au cours des 90 jours précédents et l'antibiothérapie et l'hospitalisation caractérisaient 47,1 % des cas. La clindamycine a le plus souvent été associée aux infections à *C. difficile* dans le site le plus au Nord et la ciprofloxacine, dans les deux sites plus au Sud. On a déploré 2 décès par suite de comorbidités.
Conclusion : L'incidence annuelle estimée de l'infection à *C. difficile* au cours de notre étude a été similaire aux estimations obtenues en milieu urbain. Près de la moitié des cas s'observaient chez des patients non hospitalisés, rappelant la nécessité de considérer cette infection comme un grave problème de santé chez les patients externes. La bonne gestion de l'utilisation des antibiotiques demeure un enjeu constant puisque la plupart des patients avaient été exposés à des antibiotiques avant leur infection.

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INTRODUCTION

Clostridium difficile infections as a cause of symptomatic diarrhea and colitis are reported in the literature to be on the rise.[1] Until relatively recently,[2] most published data consisted of reportable infections in hospital inpatients, whereas infections that were acquired in the community and treated on an outpatient basis went uncounted. In 2014, studies in Manitoba and Australia documented that about 40% of *C. difficile* infections were community-associated.[1,2] Data are lacking on estimates of *C. difficile* infections among inpatient and outpatient populations in rural Canada.

In northwestern Ontario, high rates of antibiotic-resistant bacterial illness, including invasive disease, that are sensitive to clindamycin have been identified.[3–5] Antibiotic use (and overuse) is a known risk factor for *C. difficile* infections. We conducted a retrospective, population-based study to assess the prevalence of *C. difficile* infections and the associated risk factors among inpatients and outpatients in our region. To add to the total number of cases and to compare our rates with those of other rural regions in the province, we enlisted researchers in 2 rural centres in southern Ontario.

METHODS

We collected laboratory data for positive *C. difficile* test results for inpatients and outpatients over a 2-year period, from Apr. 1, 2012, to Apr. 1, 2014, from 3 sites in rural Ontario: Sioux Lookout, Mount Forest and the South Huron Hospital Association in Exeter. In-house *C. difficile* toxin tests and Public Health Ontario laboratory test results were collated. The catchment area populations for the 3 rural hospital laboratories were estimated from regional strategic plans.

We gathered demographic data and infection-specific information, including recent antibiotic use, and recent or present hospital admission or nursing home stay. Hospital-associated cases were defined by onset of symptoms and positive testing more than 48 hours after admission. Community-associated cases were defined by no hospital admission or by onset of symptoms and positive testing within 48 hours of a hospital admission. We defined recurrence by a positive specimen result 2–8 weeks after previous positive testing. Positive results beyond 8 weeks were considered a new case.

The Sioux Lookout Research Review and Ethics Committee granted ethics approval for this study.

RESULTS

The 3 rural laboratory sites had a total estimated population of 70 000 in the catchment areas (Table 1). A total of 34 cases (in 29 patients) of *C. difficile* infection were encountered during the study period (Table 2). This is an estimated crude annual rate of 24.3/100 000 population. These cases included both inpatients and outpatients. The northern site (Sioux Lookout) had the same number of cases as the 2 southern sites (Mount Forest and South Huron Hospital Association) combined; taking into account the populations (29 000 for the northern site v. 41 000 for the southern sites combined) the difference in rates of *C. difficile* infection was not significant ($p = 0.6$).

Most *C. difficile* infections were new cases (78.8%) and 7 were recurrences. The mean age was 61.7 (range 2–93) years, with one outlier at 2 years of age (Table 2). Of the patients, 76% were older than 50 years, and 50% were older than 65 years. Outpatient diagnosis occurred 47.1% of the time (Table 2) and outpatient treatment occurred 41.2% of the time (Table 3).

Most patients (76.5%) had taken an antibiotic within 90 days of their diagnosis. Antibiotic use and

Table 1: Estimated population service areas for laboratory services*

Service area	Population catchment area for laboratory services
Sioux Lookout	29 000
South Huron Hospital Association, Exeter	19 000
Mount Forest	22 000
Total	70 000

*The estimates came from Statistics Canada and internal hospital audits, according to which communities the laboratory served and/or from internal strategic planning documents developed by each laboratory service.

Table 2: Patient characteristics at presentation, *n* = 34 infections

Characteristic	No. (%)*
Age, mean (range), yr	61.7 (2–93)
New cases	26 (76.5)
Recurrent cases	7 (20.6)
Diagnosed in outpatient	16 (47.1)
Diagnosed in inpatient	17 (50.0)
Days of diarrhea before diagnosis	
Mean (range)	11.7 (1–40)
1–3	6 (17.6)
1–7	13 (38.2)

*Unless stated otherwise.

hospital admission accounted for 47.1% of cases. Only a small portion of our identified cases had no hospital admission or antibiotic use (14.7%). Of the patients, 38.2% were concurrently taking proton pump inhibitors (PPIs) (Table 4).

The associated antibiotics used within 90 days of case detection was almost evenly distributed: ciprofloxacin (26.5%), clindamycin (23.5%) and cephalosporins (20.6%). Clindamycin was more commonly associated with *C. difficile* infections at the northern site and ciprofloxacin at the southern sites (Table 5). Treatment was commonly metronidazole (64.7%) (Table 3).

There were 2 deaths, both in older, immunocompromised patients with other infections and end-stage renal disease or cancer.

DISCUSSION

Our population-based incidence is similar to those quoted in urban-based North American studies, which commonly quote a rate of 20–30/100 000 population.[6] Outpatients amounted to almost half of the total cases in our study, which is also in keeping with recent estimates for urban populations. A 2006 Manitoba study of 1006 cases of *C. difficile* infection found a similar rate in their provincial population data of 23.4/100 000 and a 40% outpatient incidence.[2,6]

Advanced age is a known risk factor for *C. difficile* infection.[7,8] Our study supports this, with a mean age of 61.7 years and half of the patients being older than 65 years.

Antibiotic use has long been considered a risk factor for *C. difficile* infection, and our study does nothing to challenge that assumption. In more than three-quarters of cases, an antibiotic had been used within the previous 90 days. We did find that clindamycin use in the northern site was more commonly associated with *C. difficile* infection than at the other sites. This may represent a prescribing difference, with clindamycin being prescribed more commonly at the northern location. Recently, higher rates of community-associated methicillin-resistant *Staphylococcus aureus* have occurred in that region, including serious invasive bacteremias. Clindamycin is 1 of 3 possible early treatments (along with sulfamethoxazole–trimethoprim and doxycycline), and this finding may reflect an increased use of this antibiotic relative to other rural sites in the province.[3–5]

In the 1970s, clindamycin was commonly associated with *C. difficile* infection and its usage declined as a result. In the 1980 and 1990s, cephalosporins were the commonly identified culprit. More recently,[9] fluoroquinolones have been associated with *C. difficile* infection (including the 2002/03 Quebec outbreak of a highly virulent strain).[10] We see all 3 offending antimicrobials in equal numbers in our study.

Proton pump inhibitors are statistically associated with increased rates of *C. difficile* infection in large US and UK population studies.[11–15] Although this is still controversial, the US Food and Drug Administration has issued a warning to patients taking long-term PPI therapy about an increased risk of *C. difficile* infection. A 2013 Scottish study calculated a 1.7-fold increase in risk of *C. difficile* infection with chronic PPI use.[16] The proposed mechanism is the protective effect of normal stomach acidity and the change in stomach and large

Table 3: Treatment of *Clostridium difficile* infection, *n* = 34 infections

Variable	No. (%)
Medication	
Metronidazole	22 (64.7)
Vancomycin	4 (11.8)
Vancomycin and metronidazole	4 (11.8)
Data unavailable	4 (11.8)
Patient status at time of treatment	
Outpatient	14 (41.2)
Inpatient	17 (50.0)
Data unavailable	3 (8.8)

Table 4: Exposures before *Clostridium difficile* infection, *n* = 34 infections

Preinfection exposure	No. (%)
Antibiotic use within 90 d	26 (76.5)
Recent hospital admission plus antibiotic use	16 (47.1)
Outpatient antibiotic use	10 (29.4)
Outpatient status, with or without antibiotic use	15 (44.1)
Antibiotic use within 90 d in 26 new cases	18/26 (69.2)
Hospital admission, without antibiotic use	2 (5.9)
No hospital admission or antibiotic use	5 (14.7)
Recent PPI use	13 (38.2)

PPI = proton pump inhibitor.

Table 5: Antibiotic use within 90 days of diagnosis of *Clostridium difficile* infection, *n* = 34 infections

Antibiotic	No. (%)
Ciprofloxacin*	9 (26.5)
Clindamycin*	8 (23.5)
Cephalosporin*	7 (20.6)
Penicillin, amoxicillin	3 (8.8)
Other	8 (23.5)
Data unavailable	9 (26.5)

*Ciprofloxacin: 6/9 cases were at southern sites; clindamycin: all cases were at the northern site; cephalosporin: cases at northern and southern sites.

intestine flora by PPIs.[17–19] Our study sheds no light on this developing discussion, as PPIs were used in 38.2% of cases, but most of these patients had also received antibiotics (11/13).

Given that outpatient diagnosis and treatment often occur in office practice settings, it is sobering to know that recent studies indicate that spore shedding can occur up to 4 weeks after treatment initiation and can inhabit any skin location and high contact environmental areas, such as door handles and examination tables.[20,21] Attention to hand washing and hand protection, and use of sporicidal-containing cleansers may be warranted in attending to affected patients in our office settings.

Limitations

Our catchment-area populations were estimates from regional service planning sources. These are not directly comparable to province-wide census population figures. Our methods were similar to those of other population-based studies that also used laboratory-based catchment areas as a starting point. Cases were identified if their tests were processed in the identified laboratory. We did not cross-check those cases with home addresses, so we may have included some visitors to the community in our case detection. Because we were able to access most inpatient records from the hospital associated with the laboratory, this effect may be minimal. Alternatively, patients from 1 of our 3 catchment areas may have been tested elsewhere, and we would have missed those cases. Our rates of *C. difficile* infection are therefore considered estimated crude rates.

CONCLUSION

The estimated annual incidence of *C. difficile* infection is similar to other existing urban population-based figures. The northern rural site in the study had a higher incidence than the 2 southern sites, which was not significant. Most cases were associated with antibiotic use. Antibiotic stewardship is an important consideration in our communities.

Almost half of the identified cases of *C. difficile* infection involved outpatients. Although we have traditionally viewed *C. difficile* infection as a hospital-acquired infection, this is no longer accurate. Care will have to be taken with hygiene in our office examination rooms and other outpatient clinic settings.

Competing interests: None declared.

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Acute rheumatic fever in First Nations communities in northwestern Ontario

Social determinants of health "bite the heart"

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Abstract

Objective To document a case series of 8 young First Nations patients diagnosed with acute rheumatic fever (ARF), a preventable disease that resulted in the death of 2 patients, in northwestern Ontario in the context of late diagnosis, overcrowded housing, and inadequate public health response.

Design Retrospective case series over an 18-month period.

Setting Remote First Nations communities in northwestern Ontario.

Participants Eight patients with ARF.

Main outcome measures Incidence, mortality, residual rheumatic heart disease, time to diagnosis, barriers to diagnosis and treatment, housing situation of patients, patient demographic characteristics (age, sex), and investigation results.

Results The incidence of ARF in this population was 21.3 per 100 000, which is 75 times greater than the overall Canadian estimated incidence. The average patient age was 9.4 years. Most cases developed joint findings, and 5 of the surviving patients had rheumatic heart disease when they received echocardiography. The average time to diagnosis was 88 days. Two 4-year-old children died from ARF. Most patients lived in inadequate and crowded housing.

Conclusion This rare disease still exists in remote First Nations communities. These communities demonstrate an incidence equal to that in aboriginal communities in Australia and New Zealand, which have among the highest international incidence of ARF. Primordial prevention, including improved on-reserve housing, is urgently needed. Case detection and ongoing surveillance for primary and secondary prophylaxis requires a well resourced regional strategy.

EDITOR'S KEY POINTS

- Acute rheumatic fever (ARF) is generally thought to be a disease of the past in high-income countries like Canada, yet it continues to present at an alarming rate in northwestern Ontario. The incidence is approximately 75 times that in the general Canadian population.
- This retrospective case series detected 8 cases of ARF in an 18-month period in the Sioux Lookout region of Ontario. Two of the patients died, and 5 of the surviving patients developed rheumatic heart disease, with documentation of moderate to severe valvular dysfunction. Diagnosis was generally delayed, as was secondary prophylaxis in several of the cases.
- The authors identify an urgent need for a robust regional ARF strategy incorporating primordial prevention, addressing the social determinants of health, particularly inadequate and crowded housing; primary prevention, improving early diagnosis and treatment of group A streptococcal infection; and secondary prevention, removing barriers to accessing secondary prophylaxis.

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Acute rheumatic fever (ARF) is the immunologic sequela to untreated group A streptococcal (GAS) infection; it primarily affects children and has lifelong consequences[1,2] (**Figure 1**). As the leading cause of acquired heart disease globally, incidence of rheumatic fever is often an indicator of the health status of a population.[3] It is clearly linked to socioeconomic determinants, such as poverty and overcrowded housing, and it highlights the health inequities facing indigenous communities in high-income countries such as Canada, Australia, and New Zealand.[4-8]

While thought to be a disease of the past in Canada, ARF continues to present at an alarming rate in northwestern Ontario.[9] In 2009, local physicians published a case series of 5 cases over 36 months at the Sioux Lookout Meno Ya Win Health Centre in Ontario.[9] This review further documents a series of 8 cases of ARF over an 18-month period among First Nations youth and young adults from the Sioux Lookout region.

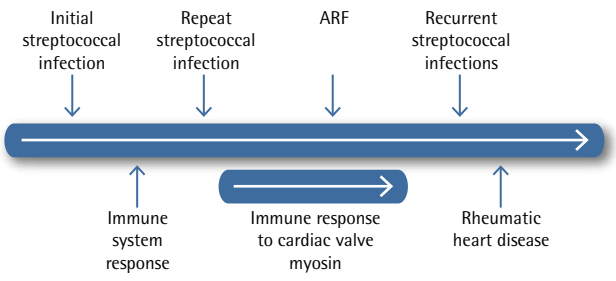
METHODS

Cases were identified by the authors and communicated to them by colleagues. Chart reviews were completed for cases diagnosed between September 1, 2013, and March 1, 2015, including information from hospital electronic records, physician primary care electronic medical records, and nursing notes from the community nursing stations. When examined, 5 years of hospital admission and discharge diagnostic code records provided no new cases and rarely referenced the 8 known cases, as the recorded diagnosis for most cases was typically one of the presenting Jones criteria and not the eventual diagnosis of ARF. The diagnosis was typically arrived at in an outpatient setting after test results were completed.

Community and specialist consultant physicians for the cases were contacted as needed to clarify case presentation and management details. General housing information was obtained from publicly available Statistics Canada data sets. Case-specific housing details were collected by community representatives. Consistency with the First Nations OCAP (ownership, control, access, possession) principles was assessed and ethics approval was granted by the Sioux Lookout Meno Ya Win Health Centre Research Review and Ethics Committee.

In January 2015, an ad hoc Acute Rheumatic Heart Disease Working Group was established to examine these new cases. Representatives from Health Canada, Sioux Lookout First Nations Health Authority, Sioux Lookout Meno Ya Win Health Centre, the University of Ottawa Department of Infectious Diseases, and the Anishinaabe Bimaadiziwin Research Program were included. This working group ensured case detection was accurate and that treatment, investigation, secondary prophylaxis, and documentation were undertaken in these known cases.

Figure 1. Autoimmune infection sequence in ARF



ARF—acute rheumatic fever.

RESULTS

In a catchment area of 25 000 primarily First Nations patients in 31 remote communities, 8 cases of ARF were identified in the 18-month period from September 1, 2013, to March 1, 2015 (**Table 1**).[10] One case was diagnosed and another was confirmed postmortem, with ARF listed as the cause of death. The remaining cases were confirmed using the Jones criteria. Patients ranged in age from 3 to 20 years (mean 9.4) and originated from 5 different communities. One patient had a previous history of rheumatic fever.

Patients initially presented with cardiac signs and symptoms (n=3), arthritis (n=2), and chorea (n=1), and 5 of the 8 patients developed transient arthritis during the course of their illness. The average time to diagnosis for the 6 surviving patients was 88 days (range 4 to 240). Four patients had preceding pharyngitis and received treatment for positive findings of GAS infection. Three patients were originally misdiagnosed with conditions including juvenile rheumatoid arthritis and septic arthritis.

Identified risk factors included inadequate or crowded housing in many of the cases involved. One patient had a wound swab positive for GAS before ARF, and 1 patient had spent time in the local women's crisis shelter with family around the time of infection. All patients had access to nursing station health care 24 hours a day, 7 days a week. Several of the communities involved had in-community physicians, while others had monthly, week-long doctor visits.

Death attributable to rheumatic fever occurred in 2 cases. Rheumatic heart disease (RHD) was diagnosed in 5 of the surviving patients, with documentation of moderate to severe valvular dysfunction. Initiating secondary prophylaxis with penicillin was delayed in several cases. The reasons for delay included the patient not being

registered under the Indian Act and as such not having coverage with the Non-Insured Health Benefits program, as well as limited community follow-up following discharge from tertiary hospitals.

All patients had up-to-date immunizations. The annual incidence rate for ARF was calculated to be 21.3 per 100 000.

DISCUSSION

Minimal data on ARF in Canada exist, and it is largely considered to be a disease of the past. A prospective review by the Canadian Paediatric Surveillance Program between 2004 and 2007 found an incidence of 2.9 cases per million population per year for those aged 0 to 19.[11] In comparison, the incidence for the Sioux Lookout region in this case series was nearly 75 times higher, with 21.3 cases per 100 000 population. This incidence is likely an underestimate. Rheumatic fever is not a reportable illness in Ontario, and no other formal surveillance systems exist. In addition, physicians are unfamiliar with the diagnosis and are likely to miss cases.

Globally, ARF remains prevalent in low-income countries and marginalized indigenous communities in high-income countries.[12] The incidence of ARF among First Nations children and youth in the Sioux Lookout region is consistent with indigenous populations in Northern Australia and New Zealand—both of which demonstrate among the highest reported rates in the world.[13,14] In 2010, the incidence of ARF was reported to be 26 per 100 000 in the Northern Territories of Australia.[13] Similar rates of 24 per 100 000 are found among Maori children aged 5 to 14 in New Zealand.[14,15]

Unlike Canada, both Australia and New Zealand have committed to addressing the health inequity of ARF in indigenous children. Both countries have national and state-level rheumatic fever strategies that incorporate surveillance, prevention, and ongoing facilitation of secondary prophylaxis. In addition, there is explicit recognition of the contribution of crowded housing conditions and socioeconomic deprivation.[16] In contrast, a coordinated response to the ARF crisis in northwestern Ontario is impeded by the lack of accountability toward First Nations child health, rooted in jurisdictional complexities across all levels of government for public health service delivery on reserves.

Surveillance and prevention

There is an immediate need for the establishment of a surveillance system for timely detection and diagnosis of cases of ARF and for monitoring trends in the Sioux Lookout region. While rheumatic fever is not a notifiable disease in Canada or Ontario, it is reportable in many US states, as well as in Australia and New Zealand. Given the potentially increasing and undocumented incidence of this preventable disease in northwestern Ontario, as well as the profound consequences in terms of age of onset and the severity and complexity of the lifelong consequences, we advocate for Ontario to add ARF to the list of reportable diseases. Additionally, other regional surveillance mechanisms such as active case finding or the establishment of a regional registry should be pursued. This requires dedicated resources and commitment from both federal and provincial public health authorities to establish an effective regional program.

Effective ARF control programs integrate features of primordial, primary, and secondary prevention. Rheumatic fever is inextricably linked to the social determinants of health, and primordial prevention addresses the underlying behavioural, social, and environmental conditions that contribute to the acquisition and spread of GAS infections. The overall decrease in ARF in high-income countries has long been attributed to improved determinants such as housing, nutrition, and access to primary care.[17] A 2010 New Zealand–sponsored systematic review of 34 international studies concluded that there is an association between crowded and poor-quality housing and rates of ARF.[4,18]

Remote First Nations populations in Ontario continue to face a housing crisis that undoubtedly puts them at risk of poor health outcomes including rheumatic fever (**Table 2**).[19-23] The Ontario results of the First Nations Regional Health Survey in 2008 to 2010 described living

Table 1. Patient characteristics

CHARACTERISTIC	PATIENT 1	PATIENT 2	PATIENT 3	PATIENT 4	PATIENT 5	PATIENT 6	PATIENT 7	PATIENT 8
Age, y	4	4	20	3	12	8	15	9
Sex	Male	Female	Female	Female	Female	Female	Female	Male
Sore throat	No	Yes	Yes	NA	Yes	Yes	No	No
Time from presentation to diagnosis, d	NA*	240	4	43	43	70	140	77
Outcome	Deceased	Deceased	CHF, RHD	CHF, RHD	Chorea	CHF, RHD	RHD	RHD

CHF—congestive heart failure, NA—not available, RHD—rheumatic heart disease.
*Diagnosis was made post mortem.

Table 2. Canadian on-reserve housing

ON-RESERVE HOMES IN CANADA	VALUE
Estimated total[19]	108 000
Housing in need of major repairs, %[20,21]	44–93
Estimated new housing units needed[19,22]	35 000–85 000
Annual federally funded new housing units[23]	1750

conditions for some First Nations people on reserve.[20] Overall, 93.5% of adult respondents indicated that they lived in households in need of general or major repair.[20] Relative to the general Canadian population, Statistics Canada census data from 2006 reported that First Nations people on reserve had the highest rate of overcrowding and were 4 times more likely to live in homes in need of major repairs.[21] Housing improvement strategies are key components of primordial prevention programs in New Zealand.[4] A similar approach is needed to address ARF in the Sioux Lookout region.

Primary prevention attempts to prevent the development of ARF by ensuring appropriate antibiotic treatment of GAS infections.[24] Approaches involve early identification and treatment of GAS pharyngitis through school- and community-based programs, improved access to primary care, and education of health care providers.[14] This incorporates both community-level and targeted education campaigns. Following the recognition of an increased number of ARF cases in Sioux Lookout, educational sessions have been coordinated by local care providers targeting physicians and community health nurses. However, primary care on reserve suffers from a lack of continuity in front-line providers, which has led to inconsistent approaches to GAS pharyngitis. Ongoing educational and treatment protocols that recognize this as a high-risk region for ARF are needed. Investigation pathways in Australia and New Zealand propose treatment with penicillin while lengthy investigations are undertaken, and investigations with negative results in suspected cases are routinely repeated in 2 to 4 weeks' time to ensure thorough case detection. As both pharyngitis and carditis might be silent, a high index of suspicion and common treatment and follow-up pathway are needed.[25-27]

Secondary prevention targets progression or worsening of known ARF disease. Chemoprophylaxis with monthly administration of benzathine penicillin G has been shown to be both clinically effective and cost-effective.[14,28] An ARF recurrence rate of 10% exists in the 5-year period following the initial episode.[27] In areas with high disease frequency, such as New Zealand, secondary prophylaxis is recommended for 10 years, compared with the 5-year Canadian recommendation. Without recurrences the carditis might improve in subsequent years but it will worsen with repeat incidences of ARF.[25] In our study, the ARF working group discovered that registration under the federal Indian Act was not up to date for several participants. This meant they could not get prescriptions filled under their treaty rights by the First Nations and Inuit Health Branch benefits program. We learned that there was an 18-month backlog in processing such applications already filed. We further learned that registration for health insurance benefits both provincially and federally presented substantial administrative and cultural hurdles for First Nations children and their families. This creates more potential barriers to appropriately funded transportation, treatment, and follow-up for this life-threatening disease. While the ARF working group has been able to expedite this process for current ARF patients, urgent transition to a system where registration can easily be initiated at the hospital at birth is needed. Leaving a vulnerable population of First Nations children uninsured is unacceptable. The recent Auditor General of Canada's 2015 report recognized how critical such registration is, as it enables funded medical transportation: "First Nations individuals who are denied access to medical transportation benefits may not be able to receive health services that are only available outside of their community."[29]

Diagnosis of ARF is difficult if it is not routinely included in the differential diagnosis of children presenting with inflamed joints in a region with a high incidence of ARF. In our series, 1 case was diagnosed and another case was confirmed post mortem. Overall, there was an average delay in diagnosis from first presentation of 88 days. Physicians should be mindful of this diagnosis when assessing migratory polyarthritis or new, undocumented cardiac murmurs in aboriginal children or other groups at risk.

With this case series and the establishment of a temporary working group, the provision of secondary prophylaxis has been more vigilant, and all 6 surviving cases are receiving prophylaxis. While effective advocacy by local physicians reestablished penicillin on the list of drug benefits covered by the Non-Insured Health Benefits program without a special access request, a coordinated patient care follow-up mechanism has yet to be established.

Registries for ARF and RHD in Australia and New Zealand have been shown to improve appropriate case follow-up and facilitation of secondary prophylaxis.[14,25] The Sioux Lookout First Nations Health Authority currently administers a successful tuberculosis program, which performs case detection and ongoing management of tuberculosis. A similar regional service for ARF would be beneficial, as ARF and its sequela, RHD, are lifelong issues, often requiring anticoagulation, cardiology follow-up, and timely surgical intervention as required. It is important to rethink our approach to pharyngitis in our region in order to ensure timely management of streptococcal pharyngitis.

Limitations

As this disease is not reportable, case detection was by word of mouth. Other cases might have gone unrecognized and our estimate might underreport actual disease incidence.

Conclusion

The documentation of 8 cases of rheumatic fever within an 18-month time frame in remote First Nations communities in northwestern Ontario is very concerning. It represents a clear indication of the ongoing contribution of social determinants of health and persistent health inequities that exist in this region. Deficient and overcrowded housing is not a benign social condition. While the ad hoc Acute Rheumatic Heart Disease Working Group has been effective, the high rate of ARF requires an organized ongoing strategy and permanent oversight by both the public health and primary care systems. An accountability to First Nations children's health is clearly needed. We advocate for immediate action on the establishment of a surveillance system and a coordinated approach to primordial, primary, and secondary prevention.

Our case series serves to demonstrate, as detailed by the Auditor General of Canada, that "Health Canada has not adequately managed its support of access to health services for remote First Nations."[29] This community-based research also highlights areas identified by the recent Truth and Reconciliation Commission in which we must "close the gaps in health outcomes between Aboriginal and non-Aboriginal communities."[30] Action is urgently needed.

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Contributors

All authors contributed to the concept and design of the study; data gathering, analysis, and interpretation; and preparing the manuscript for submission.

Competing interests

None declared

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Acute rheumatic fever in First Nations communities

Janet Gordon, Mike Kirlew, Raphael Saginur, Natalie Bocking, Christine Kennedy, Terri Farrell, Yoko Schreiber, L Kelly. http://www.cmaj.ca/letters/#cmaj_el_728846

> Re: "A 39-year-old man with recurrent rheumatic fever" Bagnall, et al., *187:50-54doi:10.1503/cmaj.140155*

The January 6 2015 issue of the CMAJ described acute rheumatic fever in a member of Canada's immigrant population.1 In the same article, Canada's First Nations were correctly identified as another population at risk for this disease. There is no known First Nations immunologic susceptibility for this. Rather, social determinants of health are contributory: poverty, inadequate housing and systemic neglect. The Sioux Lookout Acute Rheumatic Working Group has recently identified 8 cases of acute rheumatic fever in First Nations youth, including two 4-year-olds for whom the disease was fatal.

We are at a crossroads in how we perceive and respond to the inequities present for First Nations communities in Canada. Deaths from acute rheumatic fever are preventable deaths. They result in part from the living conditions present in on-reserve communities. This is present day Canada. Overcrowding and inadequate housing plays a direct role in the incidence of acute rheumatic fever, a disease unheard of in the rest of the country. The recent report of the Truth and Reconciliation Commission recommendations that: "the federal government, in consultation with Aboriginal Peoples ...close the gaps in health outcomes between Aboriginal and non-Aboriginal communities".2 The UN Special Rapporteur on Indigenous Peoples in 2014 reported that we face a "continuing crisis" with regard to our Aboriginal Peoples in Canada and that government efforts have been "insufficient".3 Canada's Auditor General recently concluded that: "Health Canada did not have reasonable assurance that eligible First Nations individuals living in remote communities in Manitoba and Ontario had access to clinical and client care services and medical transportation benefits".4 The Senate of Canada is presently studying on-reserve housing in Canada and its Feb 2015 interim report identifies a growing crisis, with "existing housing often of poor quality and in need of major repair".5

The social and healthcare needs of First Nations are apparent to the UN, the Auditor General and Senate of Canada and the Truth and Reconciliation Commission. We suggest it is also of keen interest to Canadian physicians and their patients who may be experiencing the vast health and social inequities firsthand.

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Out of sight, out of mind

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Some might consider 8 cases of acute rheumatic fever (ARF) with 2 deaths in remote First Nations communities in northwestern Ontario hardly newsworthy. Given the challenges that face humanity and the carnage caused by the many threats to our health globally, it might hardly merit a second glance. But for Canadians, it is a canary in the coal mine—bellwether for problems and serious deficiencies in our health care system.

Rise of an old scourge

We know that, in general, our fellow citizens of aboriginal heritage suffer from rates of disease and burdens of ill health that are considerably greater than those of their neighbours. The case series published in this issue of *Canadian Family Physician* (**page 881**) describes the recrudescence of an old scourge, ARF.[1] Relegated largely to the history books in affluent countries, we currently have an alarmingly high rate in communities far flung across the Canadian shield.

The particulars of the cases are instructive. The nonsuppurative manifestations of streptococcal infection remind us of the great burden of infections and the consequences of late or missed diagnoses. Diagnosis and treatment of these infections requires excellent clinical, laboratory, and imaging services. Integration of public health and primary care ensures that the suffering of unfortunate victims is minimized. This did not happen in this case series. Two children died from complications of streptococcal infections.

It is not simply a question of ensuring adequate public health services for aboriginal communities. First Nations communities across this country are subject to a variety of challenges in housing; education; employment; domestic abuse; violence, particularly against women; drug use; and so on. Despite notable successes, the overall picture shows a widening gap between the health status of this marginalized population and the rest of Canadians.

No clear way forward

Federal policies to develop capacity and autonomy have been sparse, inadequate, and ineffective. The relationship between First Nations and our federal government has yet to result in strategies that improve the basic determinants of health for this vulnerable population.

When the layers of the onion are peeled back, ARF is a disease of poverty. Not just financial poverty, with its inadequate housing, overcrowding, poor sanitation, and suboptimal nutrition, but poverty in the thinking, concern, and commitment that permeates the relationship between the dominant society and its most vulnerable component. The quiddity of this relationship is fiduciary—putatively beneficial to both parties. The reality falls very short.

Most Canadians are unaware of the circumstances in which a great number of their aboriginal brothers and sisters live. Cloistered in ghettos in some of our larger cities or buried in the vast hinterland, they are not front of mind for the average Canadian. It is not that Canadians do not care but that they simply do not know enough to create the concern that will lead to much-needed action.

If the increased rate of ARF occurred in the affluent suburbs of Toronto, Ont, there would be a considerable mobilization of concern and resources. If the rates of suicide that have plagued reserve communities were mirrored in Ottawa, Ont, we would have declared a state of emergency and demanded that mental health services and strategies be commensurate with the size of the problem.

Troublesome reading

The recent report of the Auditor General of Canada makes for troublesome reading. In describing access to health services for remote First Nations communities, it lists a litany of serious deficiencies in Health Canada's capacity to deliver on its responsibilities.[2] Particularly remarkable in Health Canada's response is the absence of a concrete plan with timelines, actions, assignations, and the requisite additional budgets. Instead we see a weak-kneed acknowledgment of the problems with a series of blandishments and a commitment to, largely, continue with business as usual. The actual gap between what exists and what is needed is not acknowledged, measured, or addressed.

This is a signal failure of a federal department that has a mandate to improve and protect the health of all Canadians, with a particular responsibility to the original inhabitants of this wonderful part of the world. It has eerie echoes of the report of Canada's first Chief Medical Officer, Dr Peter H. Bryce, who, as early as 1907, pointed out the adverse effects on the health of children who attended residential schools.[3] The response at the time was to deny a budget to publish and circulate the findings and to, perversely, discontinue the collection of the data that supported such unwelcome criticism. We should not have had to wait for an independent body to

Cet article se trouve aussi en français à la **page 841**.

inform us of this glaring gap in the performance of what is, arguably, the most important federal ministry. Health Canada should generate and articulate the standards of the programs for which it is accountable and it should ensure robust and transparent mechanisms to monitor their performance.

New approach needed

A just and civilized society is measured by how the weakest and most vulnerable are encouraged and assisted to reach their highest potential. We all benefit from this. This is not a patronizing, patriarchal, post-colonial, top-down process, but a partnership in which we realize that currently marginalized populations have gifts, a worldview, a culture, a heritage, and a spiritual capacity that enrich us all.

The recent conclusion of the Truth and Reconciliation Commission and its findings can help us enormously on this journey.[4] Viewed in combination with the report of the Royal Commission on Aboriginal Peoples, it gives a very clear picture of the history, the context, and the extent of the challenges that face all Canadians as we confront the legacy and reality of racism in this wonderful land.[5]

A practical departure in the delivery of health care to vulnerable aboriginal communities would be the development of a federal department of aboriginal health. It would report to Parliament through the Chief Public Health Officer for Canada, who would be charged with the responsibility for ensuring public health services and primary care services. It could facilitate a coordinated approach, allowing for the diversity of challenges and needs of this population, to improve the health of the First Nations and aboriginal peoples here. It would work in conjunction with the existing regional First Nations health authorities to undo the institutional racism that continues to permeate the various departments of the federal government.[6] The recent work and insightful publications of the National Collaborating Centre for Aboriginal Health[6] will assist in this process, as will its involvement in the wide, forthright, and inclusive approach that must replace current inadequate efforts.

This is a challenge. The failure to manage ARF properly underscores the inadequacy of the strategies and services aimed at improving health on reserves. The very publication of this case series[1] shows that there is local capacity to solve problems and a community of professionals who are keen to be involved. This is not enough. Current services are inadequate. This failure might not be as egregious as that of the residential school system, but it is a failure nonetheless. If it is not addressed, the health gap will widen. This is not the hope or the wish of those who labour at the coalface to deliver services. Neither is it the hope or wish of the policy makers who labour on behalf of our government, nor any Canadian who values the diversity that makes us the country that we have become. Yet this will be the outcome if we do not address this issue in a different, more comprehensive, and more unified fashion than we have to date.

Let us hope that we have the courage, humility, and wisdom to do so and that we support our current Chief Public Health Officer for Canada to have more effect than the sterling but, ultimately, futile efforts of his predecessor just over a century ago.

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Competing interests
None declared

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Feasibility and Outcomes of a Community-Based Taper-to-Low-Dose-Maintenance Suboxone Treatment Program for Prescription Opioid Dependence in a Remote First Nations Community in Northern Ontario

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ABSTRACT

Objective: Non-medical prescription opioid use (NMPOU) is a major health problem in North America and increasingly prevalent among First Nations people. More than 50% of many Nishnawbe Aski Nation communities in northern Ontario report NMPOU, resulting in extensive health and social problems. Opioid substitution therapy (OST) is the most effective treatment for opioid dependence yet is unavailable in remote First Nations communities. Suboxone (buprenorphine and naloxone) specifically has reasonably good treatment outcomes for prescription opioid (PO) dependence. A pilot study examining the feasibility and outcomes of a community-based Suboxone taper-to-low-dose-maintenance program for PO-dependent adults was conducted in a small NAN community as a treatment option for this particular setting.

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Design: Participants (N = 22, ages 16–48 years) were gradually stabilized on and tapered off Suboxone (provided on an outpatient and directly-observed basis) over a 30-day period. Low dose maintenance was offered post-taper to patients with continued craving and relapse risk; community-based aftercare was provided to all participants.
Results: Of 22 participants, 21 (95%) completed the taper phase of the program. Fifteen (88%) of 17 participants tested by urine toxicology screening had no evidence of PO use on day 30. No adverse side effects were observed. All but one of the taper completers were continued on low-dose maintenance.
Conclusion: Community-based Suboxone taper-to-low-dose-maintenance is feasible and effective as an initial treatment for PO-dependence in remote First Nations populations, although abstinence is difficult to achieve and longer term maintenance may be required. More research on OST for First Nations people is needed; existing OST options, however, should be made available to First Nations communities given the acute need for treatment.

KEYWORDS

Aboriginal health, addiction, community-based treatment, prescription opioids, opioid substitution treatment

INTRODUCTION

In North America, non-medical prescription opioid use (NMPOU)—involving drugs such as OxyContin (oxycodone), hydromorphone, and morphine — and related harms have become a major public health crisis in recent years, causing extensive morbidity and mortality (Dhalla et al., 2009; Fischer & Argento, in press; Manchikanti, Fellows, Ailinani, & Pampati, 2010). In Canada, up to 6.5% of the general adult population report NMPOU in the past year with even higher rates reported for young people, including secondary students (Shield, Ialomiteanu, Fischer, & Rehm, 2012). Both prescription opioid (PO)-related accidental deaths and admissions to substance use treatment facilities have risen substantially in Canadian jurisdictions (Dhalla et al., 2009; Fischer, Nakamura, Rush, Rehm, & Urbanoski, 2010).

First Nations people are among the most socio-economically disadvantaged groups in Canada, experiencing substantially poorer health outcomes for chronic diseases (e.g., cardiovascular problems and diabetes) as well as a higher incidence of premature mortality compared to non-First Nations populations (Dyck, Osgood, Lin, Gao, & Stang, 2010; Health Canada, 2009). First Nations people also have much higher rates of substance use (alcohol, tobacco, and injection drug use, among others) and are consistently found to be at much greater risk for morbidity and mortality outcomes such as HIV or hepatitis C transmission and drug overdose (Duncan et al., 2011; Health Canada, 2009; Wu et al., 2007). First Nations people are considered particularly vulnerable to substance abuse due to the systemic impact of social determinants of health—e.g., lack of adequate housing or employment—and trauma, such as the legacy of residential schools. The loss of distinct cultural knowledge and capital related to traditions, land, and people is also widely accepted as a pathway to substance abuse, especially at an early age (Dell et al., 2012; Gracey & King, 2009).

Recently, NMPOU has become acutely problematic in First Nations communities, including the Nishnawbe Aski Nation (NAN). The NAN, encompassing most of Ontario's northern land mass, is comprised of 49 smaller communities and has a total population of around 45,000. In some NAN communities, more than 50% of the adult population are reported to be PO (mainly OxyContin) abusers and in need of treatment; similar data have been reported for high school populations (Nishnawbe Aski Nation Think Tank, 2011). A recent study from a NAN health centre found that 17.2% of pregnant women sampled abused POs (oxycodone) during pregnancy, with a significant percentage of exposed neonates experiencing opioid withdrawal symptoms or neonatal abstinence syndrome (Kelly et al., 2011). In addition, multiple NAN communities have reported major increases in family and child neglect, crime and violence, and overall community decay due to NMPOU. On this basis, the NAN Chiefs-in-Assembly formally declared a "state of emergency" related to PO misuse, urgently requesting assistance and intervention support (Nishnawbe Aski Nation Think Tank, 2011).

Opioid pharmacotherapy, specifically opioid substitution therapy (OST) with either methadone or buprenorphine, is considered the gold standard of treatment for opioid dependence, with both drugs included on the World Health Organization's list of essential medicines. Methadone and buprenorphine have demonstrated similarly beneficial outcomes in OST, such as reductions in illicit opioid use, health risk behaviors, and overdose (Mattick, Kimber, Breen, & Davoli, 2008; White & Lopatko, 2007). OST is widely available and easily accessible to most Canadians. The number of people in methadone maintenance treatment in Ontario has doubled to more than 28,000 in recent years, primarily due to patients with PO dependence (College of Physicians and Surgeons of Ontario, 2009). However, OST is not ordinarily available to First Nations people in remote communities, as no treatment infrastructure exists. Patients who need OST are required to travel or move to distant urban centres to receive treatment.

While methadone has been used for maintenance treatment purposes in Canada for decades, Suboxone (a combined buprenorphine/naloxone formulation, administered via sublingual tablets) is a relatively new OST drug that has shown reasonably good outcomes in treating opioid dependence (Fudala et al., 2003; Kahan, Srivastava, Ordean, & Cirone, 2011; Ling et al., 2005). Health Canada approved Suboxone to treat opioid dependence in 2007, but the drug was not included for coverage under the Federal Non-Insured Health Benefits Program (FNIHBP) for First Nations people at the time of study. Based on its pharmacodynamics and pharmacokinetics, buprenorphine has a longer duration of action than methadone as well as a ceiling effect, and therefore has superior withdrawal resolution as well as a lower risk of abuse and overdose (Alho, Sinclair, Vuori, & Holopainen, 2007; Dunn, Sigmon, Strain, Heil, & Higgins, 2011; Gowing, Ali, & White,

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2009). Suboxone has also been used for opioid detoxification treatment approaches; most studies to date, however, involve only heroin users. A recent study found that a 30-day Suboxone detoxification regimen was more effective than a five-day regimen in terms of treatment completion (16% vs. 4% of participants) and producing opioid-free urines (4.3 vs. 4.8 positive specimens) (Katz et al., 2009). Two recent studies focusing on short-term Suboxone detoxification treatment for PO dependence have found that only a minority (i.e., less than one-third) of treatment completers have opioid-free urine at the end of treatment (Sigmon, Dunn, Badger, Heil, & Higgins, 2009; Weiss et al., 2011).

Given the absence of OST options, as well as the urgent need for effective NMPOU treatment in remote areas, a pilot study to explore the feasibility and potential benefits of a Suboxone taper-to-low-dose-maintenance treatment program was conducted in a small NAN community with high rates of PO dependence. Specifically, the study sought to examine a workable and effective treatment option that would ideally accomplish a taper-to-abstinence outcome. Post-taper low-dose maintenance would be an option for those with continued craving and relapse risk in this particularly challenging setting. The NAN community in which the study took place (the name of the community was kept anonymous to protect the identities of study participants) has a total population of around 300 people, with 75% of adults estimated to be PO-dependent. The community is located 400 km from the nearest city and is accessible only by air. It has an elementary school, a small variety store, and a fuel supply station. Basic health (i.e., nursing) services are provided Monday to Friday, but all serious health problems require air transportation to the nearest hospital 160 km away.

METHODS

For purposes of this study, investigators established a customized basic infrastructure and protocol for the Suboxone taper-to-low-dose-maintenance program in the target population. The treatment program was delivered in the community's local health station by a team comprised of an off-site physician, a nurse practitioner and case manager with extensive addiction care experience, and an on-site registered nurse and addiction worker. The off-site team members were present at the health station during the first (induction) and fourth (tapering) weeks of the initial 30-day phase of the program. Further consultations occurred with opioid dependence treatment specialists in the Addictions Program at the Centre for Addiction and Mental Health (CAMH) in Toronto, Ontario.

The study involved a convenience sample, in that community members with known PO abuse were approached and invited to participate in the pilot treatment program. A total of 22 participants with PO dependence were enrolled in the study. The principal treatment objective was to stabilize participants on, and completely taper them off, Suboxone by day 30 of the program. Patients for whom it was clinically necessary due to continued craving and/or relapse risk would remain on low-dose Suboxone maintenance post-taper. Opioid dependence and treatment eligibility were confirmed by a comprehensive medical examination, including an assessment of opioid use history, urine toxicology screening (UTS), and the Clinical Opiate Withdrawal Scale (COWS) (Tompkins et al., 2009). Exclusion criteria were confirmed pregnancy and currently acute, serious mental health episodes. Participants were required to not consume any psychoactive substances in the 24 hours before starting treatment. Initial induction was 2–4 mg of Suboxone, followed by another 4 mg dose on the same day as determined by withdrawal symptoms. Suboxone doses were increased to optimum levels of 8–16 mg over the following three days. Suboxone was dispensed daily and administered under direct observation at the treatment site on an outpatient basis. In cases of continued withdrawal problems, participants received ancillary medications (e.g., ibuprofen or clonidine). After successful stabilization, Suboxone tapering began on days 8–9, with successive dose decrements of 2 mg every three days. Both UTS and COWS were performed at the end of the 30 day taper period and each patient was assessed individually for a personalized treatment aftercare plan, including the potential need for continued low-dose Suboxone maintenance. Aftercare programming consisted of several weeks of individual and group counselling focusing on relapse prevention, incorporating motivational enhancement, health education, and spiritual support.

Suboxone medications were kept in the care of on-site health staff, stored at the health station in a lockbox with two padlocks. The local police constable provided safe storage at the police office when the nurse was not in the community. Following the practice guidelines for community-based Suboxone treatment programs, the treatment staff completed a medication register. There were no incidents of lost or stolen medication during the study period.

TABLE 1. SOCIO-DEMOGRAPHIC AND OPIOID USE CHARACTERISTICS OF THE SAMPLE (N = 22)

Gender (male)	45.0% (*n* = 10)
Age (years)	Mean: 26.7 (*SD*: 8.2); Median: 23.5 Range: 16.0–48.0
Employed	32.0% (*n* = 7)
Duration of opioid use (years)	Mean: 3.7 (*SD*: 1.89); Median: 4.0 Range: 1.0–7.0
Opioid use (morphine equivalent, mg/day)	Mean: 203.1 (*SD*: 119.8); Median: 180.0 Range: 45.7–481.2
OxyContin use (mg/day)	Mean: 87.6 (*SD*: 65.5); Median: 80.0 Range: 0.0–240.0
Proportion of OxyContin in total opioid use	Mean: 83.7% (*SD*: 26.4%); Median: 95.2% Range: 0.0–100.0%

The initial taper phase of the study took place October 3–November 2, 2011. Participants signed a consent and treatment agreement. The specific objectives of the study were to assess treatment feasibility and progress, as well as basic outcomes at the end of the initial 30-day phase of the program.

RESULTS

The treatment sample consisted of 10 males and 12 females, with an age range of 16–48 years (see Table 1). Participants had abused POs for a mean duration of 3.7 years; most abuse was in the form of OxyContin and, to a lesser extent, Percocet (oxycodone and acetaminophen). Of the total 22 patients enrolled, 21 (95%) completed the initial 30-day taper phase of the Suboxone taper-to-low-dose-maintenance program (see Table 2). Fifteen of 17 (88%) tested participants had PO-free urine (measured by UTS) on day 30 of the initial taper phase. No adverse side effects were observed in the cohort. While the primary objective of the treatment program was opioid abstinence at the end (day 30) of the initial taper phase of the program, following the individualized assessments the treatment team decided to have 19 of the 21 taper phase completers continue on low-dose Suboxone maintenance (most at 4 mg/day) for a short-term (i.e., 6–8 week) period. These decisions were made primarily because of continued substantive opioid cravings, to try to prevent the acute possibility of relapse to PO abuse in these patients. One participant was comfortable being completely tapered off of Suboxone, while a female participant with pregnancy detected and confirmed after the start of treatment was switched to low-dose Suboxone maintenance when the application for the clinical standard of buprenorphine monoformulation maintenance was not approved by Health Canada.

DISCUSSION

This study assessed a community-based Suboxone taper-to-low-dose-maintenance program for PO-dependent individuals in a small and remote First Nations community with an extremely high rate of PO abuse, yet no ready access to adequate regular treatment resources or programming (e.g., OST). This small, exploratory study confirmed the overall feasibility of the Suboxone taper-to-low-dose-maintenance program as implemented in this distinctly challenging setting. The findings contribute to the evidence on evolving models for the delivery of community-based health care—in this case, acute addiction treatment—in remote and disadvantaged First Nations communities (Hay, Varga-Toth, & Hines, 2006; Rygh & Hjortdahl, 2007). Investigators easily recruited participants into the treatment program, and the collaboration between off-site addiction treatment specialists (either on a fly-in basis for key phases of the treatment program or by consulting over distance) and on-site care providers was effective and worked well. On this basis, this study represents a possible and workable model for opioid dependence treatment in remote, and specifically First

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TABLE 2. SUBOXONE TREATMENT (TAPER PHASE) PARAMETERS AND OUTCOMES (*N* = 22)

Initial COWS* score	Mean: 8.1 (*SD*: 3.7); Median: 8.0 Range: 1.0–15.0
Suboxone dose on day 1 (mg)	Mean: 7.1 (*SD*: 1.6); Median: 8.0 Range: 4.0–8.0
Maximum daily Suboxone dose (mg)	Mean: 14.7 (*SD*: 2.3); Median: 16.0 Range: 8.0–16.0
COWS score on day 30	Mean: 4.2 (*SD*: 2.0); Median: 4.0 Range: 1.0–9.0
30-day taper phase completers	95.0% (*n* = 21)
UTS specimens negative for opioids on day 30 (n = 17 validly administered tests)	88.0% (*n* = 15)
Taper completers continued on low-dose maintenance of Suboxone or Subutex (buprenorphine)	95.0% (*n* = 20)

*Clinical Opiate Withdrawal Scale

Nations, communities with extensive and urgent care needs (Gray & Saggers, 2009; Wakerman, 2009).

The study was effective in that the vast majority of participants completed the initial taper phase of the Suboxone taper-to-low-dose-maintenance treatment program, i.e. they were successfully retained in treatment for the 30-day taper period, and were successfully transitioned onto low-dose Suboxone maintenance, even though the idealized objective of zero-dose tapering (i.e., opioid abstinence) was not possible for the majority of participants. Ongoing craving symptoms and the risk of immediate relapse to PO misuse were too great for many participants, and therefore these individuals received the low-dose Suboxone maintenance option. In this respect, our study confirms findings from other research suggesting that it is difficult for most opioid-dependent individuals to achieve abstinence from opioids following short-term Suboxone detoxification or taper regimens (Sigmon et al., 2009; Weiss et al., 2011; Woody et al., 2008). It is unknown whether longer taper regimens (e.g., 45 or 60 days) would help improve the rate of successful treatment outcomes towards opioid abstinence or detoxification (Dunn et al., 2011; Ling et al., 2009; Weiss et al., 2011). It has also not been effectively established what patient characteristics may predict more successful short-term detoxification or taper-to-abstinence outcomes. Based on non-systematic impressions from the present study, it appears that those participants with long and intensive PO use histories were less likely to be able to successfully taper off of Suboxone at the 30-day mark. Short-term low-dose Suboxone maintenance may help some patients to achieve a successful zero-dose taper (i.e., abstinence). For others, opioid dependence may be a chronic condition requiring long-term or infinite maintenance treatment (Sigmon et al., 2009; Weiss et al., 2011). Our ongoing research will document and assess the low-dose maintenance phase, as well as future treatment courses and outcomes, of the study population in future publications.

CONCLUSIONS

Our study has important implications for research and practice. First, longer term follow-up is needed to assess long-term OST options and outcomes in opioid-dependent First Nations populations. Second, a larger scale study should examine treatment outcomes for different opioid treatment regimens (e.g., shorter and/or longer term Suboxone taper or maintenance regimens or use of other OST agents) in PO-dependent First Nations populations. Given the extensive and acute PO misuse crisis in the NAN and other First Nations communities, OST infrastructure and services for opioid dependence in remote First Nations communities must be quickly improved (Kelly et al., 2011; Nishnawbe Aski Nation Think Tank, 2011). In the absence of these measures, existing OST options such as the Suboxone taper-

to-low-dose-maintenance model used in this study should be made readily available to those in need.

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PROJECT REPORT

Facilitating medical withdrawal from opiates in rural Ontario

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ABSTRACT

Context: The abuse of oxycodone in Northwestern Ontario, Canada, has escalated at alarming rates raising concerns that opiate use has reached epidemic proportions, particularly among the First Nations communities. The authors were involved in establishing Ontario's first rural inpatient medical withdrawal unit to serve patients seeking abstinence.

Issues: The development of the medical withdrawal support services (MWSS) required creative and adaptive strategies to respond to the geographical, cultural and institutional circumstances.

Lessons learned: Key factors to support program efficacy and successful outcomes for clients during the inaugural eight months of operation are interprofessional and collaborative approaches with a cultural awareness.

Key words: addiction, Canada, First Nation, medical withdrawal.

Context

The changing face of narcotic abuse

Canadian patterns of opioid abuse are changing: the abuse of pharmaceutical opioids has seen an extraordinary rise while heroin abuse has decreased[1]. Urban centres saw a 25% fall in heroin use between 2001 and 2005[1,2]. Between 2000 and 2004, the Centre for Addiction and Mental Health reported admission to the detoxification program for controlled-release oxycodone increased from 3.8% to 55.4%[3]. OxyContin™, the newer long-acting narcotic, was

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fraudulently marketed as opioid medication that was effective in managing pain with the benefit of a low dependence liability (addictive properties)[3]. The long-acting mechanism of this medication could easily be circumvented by crushing the pill and subsequently chewing, snorting, smoking or injecting the drug, which further increased the dependence liability[4]. The euphoric effects of OxyContin™ that exist even when used at therapeutic doses are enhanced with these alternative routes of administration and are comparable to heroin[5]. Between 1991 and 2004, the prescribing of OxyContin™ increased by 850% in Ontario, with a doubling of opioid-related mortality[6]. The use of OxyContin™ created new markets for illicit drug consumption by patients who developed an iatrogenic dependence and by individuals seeking its euphoric effects.

Rural communities and remote First Nations communities have been hit particularly hard by the increase in this narcotic abuse. Regional chiefs in Northwestern Ontario have declared prescription drug abuse to be an epidemic, a crisis and even a state of emergency, with some remote communities incurring an addiction rate of 70% of their adult population[5]. A regional maternity program noted that in 2009, 17% of newborns were exposed to narcotics in utero[7].

In two surveys investigating the severity of problems as reported by Aboriginal Canadians, 73% reported alcohol as a problem, 44% reported family violence, 59% reported drug abuse, 35% reported suicide, 72% reported anxiety, 70% reported violence and 51% reported child abuse[8]. Substance abuse is proposed to be a 'coping strategy for poverty, unemployment, poor health, low educational levels, low or absent community economic development, and negative residential school experiences' and is associated with complex historical situations and socio-economic factors[8]. Aboriginal Canadians face higher rates of mortality than non-Aboriginal Canadians. The number of deaths due to overdose is estimated to be two-to-five times higher for First Nations people[9]. First Nations people experience high rates of unemployment, poverty, histories of physical and sexual abuse, and overcrowded homes, which contribute to the complexities of supporting healthy changes at an individual level[10,11].

Often an individual's continued use of narcotics, beyond the desire for a euphoric effect, is avoidance of the severe discomfort, or anticipated discomfort, of withdrawal effects. Withdrawal management is vitally important. While Oxcontin may initially be abused for the euphoric effects of the drug, the associated costs quickly add up. In Northwestern Ontario, at the time of writing, a single 80 mg OxyContin™ cost $80 to $800 depending on the geographical location of the community. People seeking help to quit using opioid drugs frequently disclose that they have sold all their furniture; the cupboards are bare of food; they have dealt drugs themselves; and they may have stolen, lost their job or not been able to provide adequate child care. Patients who are seeking assistance to quit using opioid drugs have often already tapered their opioid consumption to the point of avoiding withdrawals, rather than seeking the positive effects.

Communities and health professionals across Northwestern Ontario are increasingly attempting to find solutions to help patients meet their goals of overcoming their dependence on opioids and lead healthier, more satisfying lives. The Sioux Lookout Meno Ya Win Health Centre (SLMHC) provides health care to the residents in 32 communities in Northwestern Ontario, including 28,000 First Nations patients in a geographical area of 385,000 km². The SLMHC initiated the first rural inpatient medical withdrawal support service (MWSS) program in the province. The MWSS attempts to incorporate interpersonal, physical, emotional, experiential and contextual factors attending to cross-cultural safety models.

Issues

Health Canada observed that 'the reality of substance abuse may illustrate the most convincingly, the need for a convergence of the four components of well-being – physical, emotional, spiritual and mental – in ensuring the health of a

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community and a person. In Aboriginal tradition, the health and well-being of an individual flows, in large part, from the health and social make-up of the community'[8]. Accordingly, to effectively support the First Nations clients who attend MWSS, the structure has been adapted to address the pharmacological effects of drugs and withdrawal as well as the psychological, cultural and social dimensions of health and well-being. To achieve this, service provision requires an interprofessional, culturally appropriate approach.

The MWSS was developed with the medical management of symptoms being one component of the service, which will be discussed in more depth. At the same time, drawing on genuine cross-cultural models, the values enacted by the organization must be responsive to the espoused values of the patients and communities[12]. Intercultural health practices are enhanced through the development of trusting relationships and multi-directional knowledge exchange[12]. A significant indicator of the success of MWSS to establish trusting and responsive relationships is the number of people who call after discharge to share their successes and struggles or to request advice, and who refer their friends and family to the program.

Community-based Aboriginal treatment programs are enhanced by attending to community development and applying sociocultural theories of addiction[13]. Relapse prevention strategies are designed in consideration of the needs of the patients and an understanding of the social, cultural and geographical living environment. They include establishing a healthy daily routine, improving healthy eating habits and daily exercise, effectively communicating and dealing with emotions, building self-esteem and respectful relationships, managing finances, practising relaxation skills, and identifying ways to be leaders in their community. Individual counselling, group work and activities integrate a First Nations focus, including education about the medicine wheel, beadwork, legends, animal guides and cedar bark art.

The options for medical management of withdrawal symptoms are varied. The Institute of Medicine identified three stages of substance abuse treatment:

1. Detoxification (withdrawal management)
2. Active treatment and rehabilitation (counselling, residential treatment)
3. Relapse prevention (maintenance with naltrexone, buprenorphine or methadone, ongoing counselling and care)[14].

Inpatient versus outpatient detoxification

A 2010 (n=68) randomized controlled trial of urban outpatient versus inpatient opioid detoxification found that a greater percentage of people successfully completed inpatient detoxification, although the difference was not significant[15,16]. An advantage of inpatient detoxification is that it can be achieved more quickly, co-morbid conditions can be monitored and the patient is isolated from risky environments. However, outpatient treatment is typically more readily available[17,18].

Pharmacological treatment

Long acting morphine (MS Contin™, Kadian™): One of the concerns facing physicians when prescribing opiates is the need to balance effective pain management while minimizing the potential for abuse. Two long-acting morphine preparations that do not lend themselves to being diverted (for snorting or injecting) due to their chemical properties are MS Contin (twice a day) and Kadian™ (once a day). These preparations are commonly used as opioid replacement by primary care physicians in our region; while the provincial recommendation is that methadone maintenance should be the standard of care, it is rarely available in rural and remote areas[19].

In Northwestern Ontario, many physicians initially use these preparations in the short term for harm reduction and substitution, then for gradual dose reduction and tapering for outpatient management of oxycodone dependence, with marginal results. Patients are generally offered one or two attempts of outpatient substitution and tapering management. If unsuccessful, they are offered outpatient withdrawal

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symptom management, referral to a non-medical withdrawal unit or inpatient medical withdrawal.

Symptom management: The mainstays of outpatient management are clonidine, ibuprofen and loperamide. Symptom management protocols involve regular, sometimes daily, follow-ups at a physician's office or nursing station.

Methadone: Methadone maintenance is available in many urban centres as a substitution treatment for opiate dependence. There is an extensive body of research available in regards to methadone maintenance and medical literature generally refers to it as standard care, particularly for heroin addiction[20]. Our regional centre has documented that 48% of pregnant illicit narcotic users followed a binge pattern of use, quite distinct from the daily intravenous heroin user portrayed in the literature[7]. Methadone is often not available in rural communities due to its licensing requirements for physician prescription. Some communities have tele-medicine methadone clinics, which may fill a need for maintenance treatment but may not be integrated into other health services and counselling. For remote community members, the additional disadvantages include daily dosing schedule, risk of overdose and the need for physicians to meet certain prescribing requirements.

Accommodation in Sioux Lookout for patients from northern First Nations communities who attend methadone treatment are presently funded by the federal Non-Insured Health Benefits for up to three months. Following that, the patients are either discharged home without continued access to methadone or need to relocate to a community that provides methadone maintenance, thereby leaving their home community. Methadone has a lengthy withdrawal period with symptoms lasting for several months and the tapering process can take months or years.

Suboxone™: Suboxone™ is a 4:1 combination of buprenorphine (a weak partial opioid agonist) and naloxone (an opioid antagonist) supplied as a sublingual wafer[21]. At first glance this combination may seem contradictory, but the naloxone component is poorly absorbed when the medication is taken sublingually. Alternate routes of administration of naloxone combination will engender significant absorption and narcotic withdrawal, thereby lowering its abuse and diversion potential. The opioid component, buprenorphine, is a weak opioid agonist with a high affinity for the mu opioid receptor. If buprenorphine is used alone, it will displace other opioids for the mu receptor, potentially precipitating withdrawal[21,22]. Since it has weak opioid properties, there is not a euphoric effect. Suboxone™ can be used to taper from opiates in 5–10 days and the withdrawal effects typically resolve within 2–3 days[15,23]. It may also be used for medical maintenance. Suboxone™ can be administered in alternate day dosing for relapse prevention and has a lower overdose potential due to a lower opioid activity level (partial agonist) than methadone (full agonist) and has fewer prescribing limitations placed on physicians[22,24].

The sublingual use of Suboxone™ allows for narcotic substitution, weaning or maintenance with a low potential for abuse and diversion. Studies in healthy individual have shown that intranasal administration of naloxone has low (4%) bioavailability[25]. Studies of opioid dependent individuals demonstrate that intranasal naloxone precipitates withdrawal[26] and intravenous naloxone precipitates opioid withdrawal[27]. Because the parenteral (injection or intranasal) use of Suboxone™ will precipitate withdrawal and will not produce an opioid high (high mu receptor affinity with low opioid effect of buprenorphine accompanied by the receptor antagonism of nalaxone), the potential for abuse is minimal[28].

Sioux Lookout Meno Ya Win inpatient medical withdrawal support services

The MWSS consists of a five-bed inpatient unit, which has been fully subscribed since inception in December of 2011. The length of stay is typically 14-21 days for opioid (primarily oxycodone and morphine) withdrawal (>21 days for methadone), and seven days for alcohol withdrawal. Although Suboxone™ is conducive to a shorter withdrawal duration, it was decided to offer a slower Suboxone™ tapering process. However, given the complex circumstances that contribute to drug use among First Nations populations

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combined with the barriers of access to services in Northwestern Ontario, it was decided that a longer admission would support post-discharge abstinence. Barriers to abstinence include a scarcity of addiction-related treatment services available for residents of remote communities, long waitlists for addiction treatment centres, infrequent availability of mental health services, easy availability of drugs, high prevalence of drug use, complex interpersonal circumstance, few opportunities for a variety of leisure activities in the community and a large geographic region.

The MWSS is a secure, non-smoking, caffeine-free space where patients can safely withdrawal from drugs and/or alcohol with the support of a multidisciplinary team. The focus extends beyond addictions to address concurrent mental health issues. The central team includes physicians, nurses, counsellors, an activation worker and occupational therapists. The program benefits from the support of many other hospital services including the dietician, traditional healers, a laboratory service, physiotherapists and a smoking cessation counsellor. All patients are referred to physical therapy, which is an essential complement for patients who require management of chronic pain. Nicotine replacement therapy is offered to patients who smoke. Patients may also access the Traditional Healing, Medicine, Foods and Support Program. This program offers unique services, including traditional menus, elders-in-residence, traditional healers, ceremonial practices, medical interpreters and 'mashkiki' (traditional medicines)[12].

Opioid protocols for withdrawal from drugs and/or alcohol and symptom management protocols were developed locally. Patients are encouraged to refrain from drug use for at least 12 hours before admission, although it is not a prerequisite. The Clinical Opiate Withdrawal Scale (COWS) developed by the Centre for Addiction and Mental Health (CAMH) in Toronto is used to determine daily Suboxone dosing[29]. Patients are encouraged to stay 3 days after they have tapered to a zero dose of suboxone to allow time for the medications to be completely out of their system before going home. This constitutes 'successful completion' for the program. Between December 2011 and June 2012, all patients except two successfully completed the program; for those who left, it was in relation to interpersonal stressors that existed prior to admission. Suboxone™ is increasingly continued in outpatient maintenance therapy as community-based maintenance programs are established.

Patients sign a code of conduct prior to admission agreeing to participate in unit activities, to be respectful of other patients' privacy and to not be disruptive to other patients. The MWSS created its own code of conduct requiring staff to support one another in their professional roles. Daily activities include educational groups to address issues such as relapse prevention, yoga, harm minimization, and active leisure activities that are designed to provide patients with the opportunity to set goals and plan for discharge. The program is designed to promote 'bimaa dizi win', which is defined as 'living in a good way' and gives patients an opportunity to envision themselves living a drug free life[12]. At discharge, patients' goals are reviewed and information on loss of tolerance to previous narcotic doses is provided.

Patients are offered support by phone once they are discharged. They are also contacted post-discharge for follow-up program evaluation interviews that occur at 2 weeks, 3 months and 6 months post-discharge. The interviews are designed to obtain client feedback regarding the program design and implementation, to evaluate progression on goals that were set prior to discharge, and to provide ongoing encouragement and support. The goals that are set are typically to abstain from the primary drug of concern, but may involve harm minimization for other drugs or alcohol, and extend to other aspects of the person's life such as spending more time with children, exercising, engaging in community events and maintaining employment. Some examples of goals and reasons for making a change are:

> *To have a better life for kids.*
>
> *I want to live a clean life. I want to live a happy life.*
>
> *To get back in touch with the land, hunting, and traditional lifestyle.*

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Spend money on food.

Go to family treatment with my daughter.

Begin an N.A. group.

Get back to exercising.

Ideally an admission is coordinated so the discharge date will coincide with admission dates to longer term treatment centres. If patients are not attending residential treatment they are encouraged to access supports within their communities post-discharge. If two opiod-dependent patients are partners (ie spouses), they are admitted successively, with one entering the program immediately following the discharge of the other. Patients living in Sioux Lookout can be referred to SLMHC Community Counselling and Addiction Services for outpatient counseling.

Recognizing that recovery leads beyond withdrawal management, a life skills initiative for outpatients is under development and local vocational and life skills agencies have been invited to work in partnership. Hospital facilities will be placed at the disposal of these organizations in the hope of encouraging personal development alongside addiction treatment.

The pregnant patient: Approximately 48% of pregnant women in the SLMHC area who use OxyContin™ were found to 'binge': they used narcotics several times a month at times when narcotics were available in their community. Only 30% of pregnant women who used illicit narcotics were self-described as daily users[10].

Pregnancy can be a motivating factor to encourage parents to quit using opiate drugs. Ontario provincial guidelines indicate methadone as the standard of care due largely to the availability of research with methadone and pregnancy[30]. While the national obstetrician and gynaecology association guidelines concur, they also allow for other long-acting narcotics when required[31]. The treatment approach developed in our pre-natal clinic is presently to switch the patient to MS Contin and initiate a slow taper in the second and third trimester to achieve the lowest maternal drug use level at delivery.

Neonates exposed to non-tapering methadone maintenance have predictably high rates of Neonatal Abstinence Syndrome with much longer lengths of stay postpartum[32]. Suboxone™ is presently contraindicated during pregnancy due to the theoretical risk of uterine withdrawal from the Naloxone component.

Babies exposed to opiate drugs in utero appear to develop normally and narcotics are not teratogenic, while alcohol is[33,34]. A 1996 study estimated 10% of the children born regionally were diagnosed with Fetal Alcohol Syndrome (FAS)[35], with additional cases of fetal alcohol effects anticipated. For this reason, the MWSS ensures that education groups include a focus on the importance of not switching from opiates to alcohol.

Lessons learned

Substance abuse on the scale being seen in Northwestern Ontario tears at the fabric of communities. Families and communities suffer. There is a need for more treatment programs similar to MWSS on a regional and more distributed level. The MWSS at SLMHC is a beginning step to improving access to addiction-related services and may provide an example for other rural communities who are interested in undertaking this type of venture. Undoubtedly, for people who request treatment programs, including residential programs and maintenance treatment (stages two and three of the Institute of Medicine [IOM] framework), increased availability, timely access and a more efficient application process is needed. Adapting national standards to the regional and local cultural, geographic and practical context can be accomplished in a rural area with a committed interdisciplinary team approach.

Another initial development of our service is the beginning of partnerships between hospital personnel and provincial

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addiction treatment programs. Perhaps even more critical are the developing multidisciplinary relationships between hospital-based services and community partners. There are emerging opportunities to provide life-skills training within the hospital setting to add another necessary dimension to inpatient addiction management.

Conclusion

Beyond withdrawal management, patients should be able to access all three stages of addictions treatment in a culturally safe environment close to home. Treatment programs with a community focus should be developed in remote First Nations communities for effective healing of the individual and community. It is important that treatment options continue to develop and that evaluation and research help us determine best practices for rural and remote populations. Our patients tell us that they want to be better parents, get jobs or go back to school. We need to look more broadly at addictions treatment and healing to make these visions a possibility.

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Incidence of narcotic abuse during pregnancy in northwestern Ontario

Three-year prospective cohort study

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Abstract

Objective To document the incidence and outcomes of narcotic use during pregnancy in northwestern Ontario.

Design Three-year prospective cohort study.

Setting Sioux Lookout and surrounding communities in northwestern Ontario.

Participants A total of 1206 consecutive births in a catchment area of 28 000 First Nations patients.

Main outcome measures Incidence of narcotic use, and maternal and neonatal outcomes.

Results Incidence of narcotic use in pregnancy has risen to 28.6% ($P<.001$) and incidence of neonatal abstinence syndrome has fallen to 18.0% of narcotic-exposed births ($P=.003$). Daily intravenous drug use is now a common pattern of abuse.

Conclusion Narcotic abuse in pregnancy has dramatically increased in northwestern Ontario. Neonatal outcomes have improved as a result of a family medicine–based prenatal and obstetric program that includes a narcotic replacement and tapering program.

EDITOR'S KEY POINTS

- Narcotic abuse is an ongoing, widespread issue among northwestern Ontario First Nations communities. Maternal narcotic use has risen to 28.6% of all pregnancies, including increases in both intravenous and daily use. Among infants born to narcotic users, the rate of neonatal abstinence syndrome fell significantly from 29.5% in 2010 to 18.0% in 2013 after the January 2012 institution of a narcotic weaning program ($P=.003$).
- Narcotic-exposed and nonexposed pregnancies had similar neonatal outcomes as measured by general birth parameters.
- The Sioux Lookout Meno Ya Win Health Centre, with its prenatal and obstetric program, is one of several institutions affording an effective generalist response to this social and medical dilemma in pregnancy. With sustained effort, developing community-based programs will hopefully decrease the incidence of opioid dependence with both prevention and early treatment.

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The epidemic of narcotic use in northwestern Ontario continues to be a substantial social and health problem.[1] Some communities have documented addiction rates as high as 70%, and health services and First Nations communities struggle to respond to this widespread issue in effective ways.[2] The Sioux Lookout Meno Ya Win Health Centre (SLMHC) provides obstetric services to a primarily First Nations population of 28 000 patients in a large geographic region encompassing 28 remote communities. Most on-reserve patients receive late pregnancy care and delivery in Sioux Lookout, unless they are referred earlier for prenatal complications, including opioid dependence. In 2010, the centre documented that up to 17% of pregnancies that year involved exposure to illicit narcotics.[3] The purpose of this study is to document recent trends in narcotic use in pregnancy in northwestern Ontario over 3 years.

METHODS

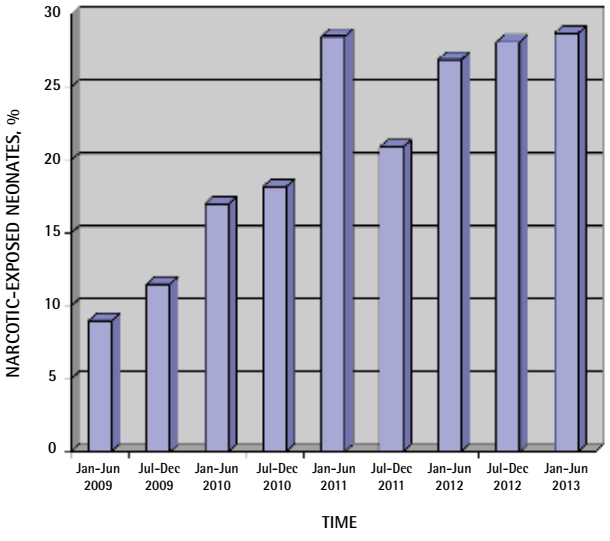
All 1206 births were prospectively studied from June 30, 2010, to June 30, 2013. Maternal attendance at routine daily prenatal clinics and twice-weekly specialized clinics in tapering narcotics in pregnancy was recorded. Specific prenatal information was documented, including amount and route of drug use, specific drug of abuse, and comorbidities. Birth outcomes including Apgar score, birth weight, length of term, gravidity, and length of stay were gathered, as were addiction-related outcome measures including Finnegan scores, presence of neonatal abstinence syndrome (NAS), and neonatal treatment. Ethics approval was granted by the SLMHC Research Review Committee.

Data were entered into an Excel spreadsheet and imported into SPSS, version 21.0 for Windows, for statistical analysis. Data were initially analyzed descriptively, using means and SDs for continuous data and frequencies and percentages for categorical data. Independent-sample *t* tests were used to compare the exposed and nonexposed mothers and infants for continuous data, and Pearson χ^2 tests were used to compare the 2 groups for categorical data. Univariate ANOVA (analysis of variance) was used to assess the incidence rates over time.

RESULTS

Incidence of narcotic use in the 1206 pregnancies studied reached 28.6% in 2013. Rates for every 6 months during the 3 years studied are recorded in **Figure 1**. Rates from our earlier retrospective study in 2010[3] are included for comparison ($P<.001$). Overall, 300 pregnancies were exposed to narcotics.

Figure 1. Proportion of narcotic-exposed neonates during consecutive 6-month periods from January 1, 2009, to June 30, 2013: P *<.001 when comparing the period from January 2009 to June 2010 and the period from July 2010 to June 2013.*



Data for January 2009 to June 2010 from Kelly et al.[3]

Controlled-release oxycodone was the reported drug of abuse in 87.2% of narcotic exposures.

Neonatal abstinence syndrome occurred in 4.5% of all deliveries by 2013, concomitant with the development of a prenatal narcotic maintenance and tapering program. In the 300 narcotic-exposed pregnancies, the NAS rate was 18.0%. Higher Finnegan scores indicating a need for pharmacologic treatment of the neonate fell from 2.5% of all deliveries 18 months before instituting the narcotic tapering program in January 2012 to 1.5% 18 months after instituting the program; the difference was not significant ($P=.403$).

In all narcotic-using patients who attended the SLMHC integrated prenatal program, 66.0% either quit or decreased (22.3% and 43.7%, respectively) their narcotic use by the time of delivery.

Narcotic-exposed and nonexposed pregnancies shared similar maternal characteristics (**Table 1**) and neonatal outcomes, except for withdrawal measures (**Table 2**). Specifically, there were no significant neonatal differences in Apgar scores, birth weights, or gestational ages. There were 12 stillbirths, 3 in the exposed group of 300 pregnancies and 9 in the nonexposed group ($P=1.0$).

Patient history correlated well with urine drug screening. Of the 849 self-reported non-users, all of their 131 random urine screening results were negative for oxycodone; 1 patient had positive results for tetrahydrocannabinol,

Table 1. Maternal characteristics: *Significance tests for age, parity, and gestational age are based on* t *tests; the rest are based on* χ^2 *tests.*

CHARACTERISTIC	TOTAL PREGNANCIES N = 1206	EXPOSED PREGNANCIES N = 300	*P* VALUE
Mean (SD) age, y	24.6 (5.9)	24.2 (4.7)	.088
Mean (SD) parity	2.8 (1.8)	2.9 (1.7)	.152
Mean (SD) gestational age, wk	38.9 (1.5)	38.9 (1.3)	.825
Smoking, n (%)	672 (55.7)	250 (83.3)	< .001*
Alcohol consumption, n (%)	225 (18.7)	39 (13.0)	.003*
Hypertension, n (%)	70 (5.8)	19 (6.3)	.657
Type 2 diabetes mellitus, n (%)	38 (3.2)	13 (4.3)	.184
Gestational diabetes, n (%)	90 (7.5)	20 (6.7)	.533
Cesarean section, n (%)	305 (25.3)	74 (24.7)	.774
Nonelective cesarean section, n (%)	193 (16.0)	51 (17.0)	.497
Out-of-hospital delivery, n (%)	36 (3.0)	4 (1.3)	.052
Postpartum hemorrhage, n (%)	112 (9.3)	28 (9.3)	.978

*Statistically significant difference between exposed and nonexposed pregnancies.

Table 2. Neonatal characteristics: *Significance tests for birth weight, Apgar score, head circumference, length, and blood pH are based on* t *tests; the rest are based on* χ^2 *tests.*

CHARACTERISTIC	TOTAL PREGNANCIES N = 1206	EXPOSED PREGNANCIES N = 300	*P* VALUE
Mean (SD) birth weight, g	3526.3 (556.1)	3420.8 (538.6)	< .001*
Mean (SD) Apgar score at 1 min	8.5 (1.1)	8.5 (1.3)	.794
Mean (SD) Apgar score at 5 min	9.0 (0.5)	8.9 (0.7)	.148
Mean (SD) head circumference, cm	35.0 (1.7)	34.8 (1.5)	.103
Mean (SD) length, cm	50.9 (3.2)	50.5 (3.2)	.011*
Mean (SD) arterial pH	7.24 (0.09)	7.25 (0.08)	.211
Mean (SD) venous pH	7.30 (0.24)	7.31 (0.08)	.254
Preterm birth (< 37 wk), n (%)	54 (4.5)	16 (5.3)	.408
NAS, n (%)	54 (4.5)	54 (18.0)	< .001*
Finnegan score ≥ 8,† n (%)	32 (2.7)	32 (10.7)	< .001*
Male sex, n (%)	596 (49.4)	136 (45.3)	.099
Transfers out, n (%)	18 (1.5)	8 (2.7)	.093
Stillbirths, n (%)	12 (1.0)	3 (1.0)	1.0

NAS—neonatal abstinence syndrome.
*Statistically significant difference between exposed and nonexposed pregnancies.
†Finnegan scores ≥ 8 indicate a need for pharmacologic treatment of the neonate for NAS.

1 had positive results for benzodiazepines, and 1 had positive results for opiates.

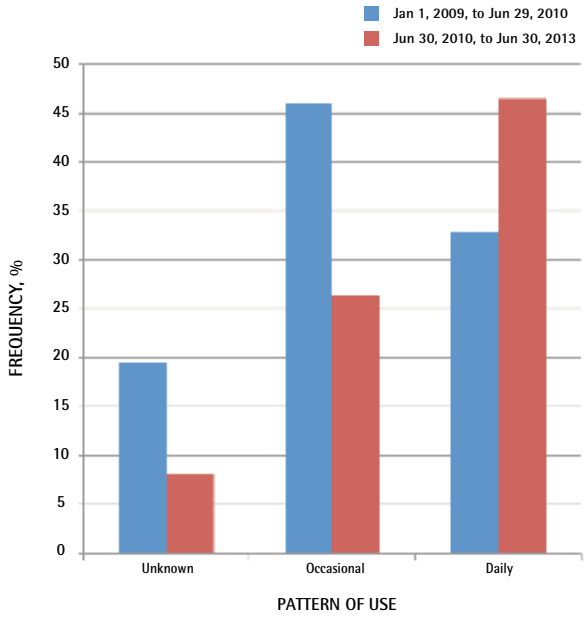
In narcotic-exposed pregnancies, most patients used narcotics daily (46.5%) by 2010 to 2013, whereas in 2009 to 2010 occasional use predominated (45.9%, $P < .001$) (**Figure 2**). Route of administration has also seen a dramatic shift toward intravenous use, which was quite rare in 2009 to 2010, but which is now the route of administration in 30.0% of cases ($P < .001$). Snorting still remains the most common route of abuse at 32.0%. Only 3 cases of hepatitis C infection were recorded and no cases of HIV infection were encountered.

Thirty male partners were also treated for narcotic use and attended the prenatal clinics. They were offered long-acting morphine weaning or maintenance on an individual basis.

DISCUSSION

The high rates of NAS experienced by neonates in our catchment area in 2010 was concerning, and our first clinical responsibility was to develop expertise in identifying and treating NAS.[4] Subsequently, a prenatal

Figure 2. Patterns of use of narcotics in pregnancy: *P < .001 when comparing the 2 time periods.*



Data for January 2009 to June 2010 from Kelly et al.[3]

narcotic maintenance and tapering program was initiated in 2012 to stabilize the large number of women using narcotics in pregnancy and lessen the neonatal burden of opioid withdrawal.

Maternal narcotic use has risen to 28.6% of all pregnancies ($P < .001$), including increases in both intravenous and daily use. Among infants born to narcotic users, the rate of NAS fell significantly from 29.5% in 2010 to 18.0% in 2013 after the January 2012 institution of our narcotic weaning program ($P = .003$).[3] Traditional methadone and more recent buprenorphine maintenance therapies do not typically include dose weaning; infants born to participants have NAS rates of more than 50%, and rates are often quoted as being close to 90%.[5] Our program has achieved stable, low rates of NAS in the face of increased overall daily intravenous narcotic use by our pregnant patients. More important, the number of neonates whose Finnegan scores mandated pharmacologic treatment (2 consecutive values ≥8) has fallen from 2.5% of all births to 1.5% ($P = .403$). In view of the dramatic increase in daily and intravenous use, we see these outcomes as promising.

In our study, narcotic-exposed and nonexposed pregnancies had similar neonatal outcomes as measured by general birth parameters. Birth weight was lower in the narcotic-exposed group but the difference was not clinically meaningful, with a mean (SD) birth weight of 3420.8 (538.6) g. Although the SLMHC provides intrapartum services for 63.0% of the region's deliveries, all stillbirths in the region came to our centre in the 3-year study period as a function of air ambulance service routes. The 12 stillbirths are therefore measured against the regional live birth totals of 1899, for a rate of 6.3 per 1000 live births. The Ontario stillbirth rate in the study period was 8.4 per 1000. Of the 12 stillbirths, 3 were in the exposed group of 300 pregnancies and 9 were in the nonexposed group ($P = 1.0$).

The dramatic increase in intravenous use of illicit opioids is concerning for the risk of communicable diseases. Despite this development, hepatitis C infection was only seen in 3 cases and HIV infection was not seen. This finding might be secondary to the many well developed needle exchange programs in northern communities.

OxyContin (controlled-release oxycodone) manufacture ceased March 1, 2012, and its substitutes were no longer supported by federal or provincial drug subsidy programs (Non-Insured Health Benefits and the Ontario Drug Benefit Program).[6-8] Surprisingly, it continues to be a common drug of abuse in our region, lessening the likelihood that *prescription drug abuse* is an accurate description of this narcotic abuse problem.[9]

The 2012 Ontario NAS clinical practice guidelines recognized that while methadone maintenance therapy is generally recommended, our region, with limited resources over a vast geographic area, might need to explore alternative options, including other opioids or opioid tapering.[10,11] Our narcotic maintenance and tapering program uses more easily prescribed long-acting morphine preparations such as twice-daily MS Contin or daily Kadian. This approach seems to be effective in our population, with good birth outcomes and low rates of NAS. A recent Cochrane review also found that "oral slow-release morphine seemed superior to methadone for abstinence from heroin use during pregnancy ([relative risk] 2.40, 95% CI 1.00 to 5.77)."[12] A 1999 Finnish open randomized study of 48 opiate-addicted pregnant women found slow-release morphine to be equivalent to methadone in treatment and birth outcomes.[13]

Self-reporting seems reliable in our setting. Of 131 random drug screening tests done on self-reported nonusers, all had negative results for oxycodone, while 1 patient had positive results for tetrahydrocannabinol, 1 had positive results for benzodiazepines, and 1 had positive results for opiates. It might be that the widespread nature of narcotic abuse in our region has lessened the stigma associated with self-reporting.[1] Advances in cross-cultural care at the SLMHC and a welcoming interdisciplinary prenatal program that commonly deals with narcotic use might also be factors.[14]

Also, rural populations might differ from urban ones. In a subanalysis[15] of the MOTHER (Maternal Opioid Treatment: Human Experimental Research) study,[16] Baewert et al noted regional disparities, with rural American newborns having shorter NAS treatment duration than European or urban American participants.

They concluded the results "revealed significant intergroup differences with regard to sociodemographic and clinical/substance abuse characteristics,"[15] suggesting that women in urban areas were more severely affected.

The SLMHC prenatal narcotic tapering clinics are managed by generalist rural family physicians working in a multidisciplinary team. These family physicians are capable of treating male partners, managing narcotic use, and delivering obstetric services and postnatal maternal and neonatal care. This is done in conjunction with nurses who have a broad scope of practice, a social worker, and a lactation consultant. Having a concentrated core of health care professionals who can move between critical functions is vital in a rural setting. Four family physicians are currently involved, 3 of whom provide cesarean sections when needed.

The psychological and cultural dimensions of drugs, withdrawal, and recovery are supported by outpatient and inpatient social and addictions workers in Sioux Lookout and the surrounding communities.[17] In addition, community visits by addiction specialists have been useful in establishing remote community-based programs.[18]

Limitations

A 3-year study in a busy clinical setting will have incomplete data. We did not order universal urine drug screening. We have looked at the rates of both maternal narcotic use and NAS in comparison to an earlier retrospective study and, despite similar methods, some inaccuracies might be inherent in this comparison. Finnegan scoring by obstetric physicians and nurses is subjective, but we now have 5 years of experience and believe our practice has become clinically standardized.

Conclusion

Narcotic abuse is an ongoing widespread issue among northwestern Ontario First Nations communities. Almost 30% of pregnancies are now affected. Effective community-based programs, many using narcotic maintenance and tapering therapy, are being developed by creative partnerships between health care providers, Health Canada, the Ontario Ministry of Health and Long-Term Care, and First Nations community leadership.

The SLMHC, with its prenatal and obstetric program, is one of several institutions affording an effective generalist response to this social and medical dilemma in pregnancy. With sustained effort, developing community-based programs will hopefully decrease the incidence of opioid dependence with both prevention and early treatment.

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Contributors

Dr Kelly was the research lead, with responsibility for study design and writing all of the drafts. **Drs Guilfoyle**, **Dooley**, **Antone**, and **Gerber-Finn** were involved in the prenatal and obstetric program, attended regular clinical and research meetings, and gave overall direction to the project. **Ms Dooley**, **Ms Brunton**, **Ms Kakegamuck**, and **Ms Muileboom** gathered the data and contributed to data analysis. **Ms Hopman** provided advice on data gathering and did the extensive data analysis. **Ms Cromarty**, **Ms Linkewich**, and **Ms Maki** oversaw the research process from the hospital perspective and contributed to the drafts of the manuscript. **Ms Cromarty** was also the Special Advisor in First Nations Health for this project. All of the co-authors have approved the final draft.

Competing interests

None declared

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The evolving nature of narcotic use in northwestern Ontario

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In our careers, we witness changes in medical practice and disease profiles, but not often in our own backyard. One of the most interesting aspects of doing research in a rural area is the capacity to follow and study a locally developing clinical trend. Such is the case in northwestern Ontario, which has experienced high rates of opioid abuse in the past 10 years.[1,2]

NARCOTIC USE IN PREGNANCY

Narcotic use in pregnancy has been a noticeable clinical development confronting the nursing and medical staff at the Sioux Lookout Meno Ya Win Health Centre.[3] This regional maternity centre provides prenatal services and obstetric services to a catchment area of 28 000 primarily First Nations people.[4] The services include 400 deliveries annually.

Narcotic use during pregnancy became a clinical issue in early 2009 as clinicians noted an increasing trend.[3] Rates of narcotic use in pregnancy, measured over 3 consecutive 6-month periods, went from 8.4% to 17.2% and averaged out to 13.0% (Table 1).[3] Neonatal abstinence syndrome (NAS) affected 29.5% of these narcotic-exposed pregnancies. The clinical response included development of the nursing and medical expertise for recognition and management of narcotic use in pregnancy and subsequent neonatal withdrawal, when it occurred.[7] The clinicians also developed an integrated prenatal program, in which routine prenatal care, narcotic management and narcotic ordering took place in a single setting. Male partners were also encouraged to attend to receive addiction services, if needed (30 received treatment in 2012–2013).[5]

Because NAS was a clinical concern, and stressful for affected neonates and families, one of the aims of the integrated prenatal program was to encourage safe narcotic tapering, or weaning, whenever possible, to decrease the incidence of NAS.[6] The tapering program, using a long-acting morphine, began in January 2012 and contributed to a significant drop in the rates of NAS, without adverse neonatal outcomes.[6] Rates of NAS in narcotic-exposed pregnancies fell from 29.5% in 2010 to 18% in 2013 ($p < 0.001$). Over a 5.5-year period (2009–2014) data showed a decreasing trend ($p = 0.123$).[6] The rate of NAS appears to have stabilized

Table 1. Narcotic use in pregnancy over 5.5 years[3,5,6]

Variable	No. (%) 18 mo (Jan 2009–June 2010)	36 mo (June 2010–June 2013)	12 mo (June 2013–June 2014)	*p* value (Jan 2009–June 2014)
Total births	482	1206	431	
Narcotic exposure	61/482 (13.0)	300/1206 (25.0)	113/431 (26.2)	$p < 0.001$
NAS/all births	21/482 (4.4)	54/1206 (4.5)	23/431 (5.3)	$p = 0.729$
NAS/exposed	18/61 (29.5)	54/300 (18.0)*	23/113 (20.4)	$p = 0.123$

NAS = neonatal abstinence syndrome.
*$p = 0.040$.

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at about 20% of narcotic-exposed pregnancies in 2014. Cases of more severe withdrawal (Finnegan scores > 7) requiring consideration of pharmacologic treatment also stabilized at 7% of narcotic-exposed pregnancies. During this time, the clinical burden of disease has increased: daily and intravenous use of narcotics have become the most common user profile, whereas snorting and occasional use once predominated.[3,5]

COMMUNITY-BASED SUBSTITUTION THERAPY PROGRAMS

In 2013–2014, we began to encounter pregnant patients who had conceived while receiving opioid substitution therapy, and we have begun to follow the outcomes of these pregnancies. These patients, who live in remote northern communities, have benefitted from the recent development of community-based programs for treatment of opioid dependence. Along with culturally appropriate addictions counselling, narcotic substitution therapy with sublingual buprenorphine–naloxone is undertaken.[8] The buprenorphine is for suppression of opioid cravings, and the naloxone is meant to deter diversion to intravenous use. These holistic addiction treatment programs have developed in 16 of the 30 remote First Nations communities in our region. Substitution therapy with buprenorphine–naloxone has become commonplace, which highlights the extent of the problem with opioid dependence in our region. Community organizations are beginning to partner with local researchers to evaluate such community-based programs, which grow out of a clinical and social imperative with limited funding support. Local researchers have recently partnered with northern communities that have age-adjusted adult addiction rates exceeding 50% to document the effects of such widespread addiction and the success of community-based treatment programs.[8]

Although buprenorphine–naloxone is officially contraindicated during pregnancy because of the theoretical risk of the naloxone component precipitating acute narcotic withdrawal, its use in pregnancy is gradually becoming accepted.[9] If a patient wishes to conceive, it is optimal to transfer her from buprenorphine–naloxone to the single narcotic component, buprenorphine, but this involves a complex application process to Health Canada and the manufacturer. Patients have often completed most of their pregnancy by the time the single-component drug is available to them.

The increasing number of women receiving opioid substitution therapy throughout pregnancy is preferable to the vacillation of dosing and withdrawal encountered through access to illicit narcotics. In 2013–2014, we have managed the treatment of 28 women who conceived while receiving opioid substitution therapy, and we will continue to monitor this evolving trend.

CONCLUSION

The opioid abuse epidemic in northwestern Ontario has challenged the communities and the health care system. The response has included many positive developments. First, generalist nurses, physicians and counsellors in our region have developed expertise in the management of narcotic use in pregnancy and subsequent neonatal withdrawal. Second, a team of community members, nurses and physicians has developed unique community programs for culturally appropriate addictions treatment and substitution therapy, resulting in a local capacity to treat narcotic use in pregnancy. Third, rural researchers are conducting ongoing surveillance of the scope of the problem and evaluation of program outcomes, and contributing to an evolving treatment approach. Finally, Ontario's first rural unit for inpatient withdrawal management was established (although it was recently closed because of program cuts).[10]

Additional needs remain. It is important that Health Canada recognize the need for robust program support for the unprecedented rates of opioid dependence being encountered. Also, we must address social and psychological needs in remote First Nations communities, which are suffering the effects of decades of intergenerational trauma and are dealing with high rates of addiction.

Competing interests: None declared.

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Narcotic tapering in pregnancy using long-acting morphine

An 18-month prospective cohort study in northwestern Ontario

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Abstract

Objective To document the management of and outcomes for patients receiving narcotic replacement and tapering with long-acting morphine preparations during pregnancy.

Design A prospective cohort study over 18 months.

Setting Northwestern Ontario.

Participants All 600 births at Meno Ya Win Health Centre in Sioux Lookout, Ont, from January 1, 2012, to June 30, 2013, including 166 narcotic-exposed pregnancies.

Intervention Narcotic replacement and tapering of narcotic use with long-acting morphine preparations.

Main outcome measures Prenatal management of maternal narcotic use, incidence of neonatal abstinence syndrome, and other neonatal outcomes.

Results The incidence of neonatal abstinence syndrome fell significantly to 18.1% of pregnancies exposed to narcotics (from 29.5% in a previous 2010 study, $P = .003$) among patients using narcotic replacement and tapering with long-acting morphine preparations. Neonatal outcomes were otherwise equivalent to those of the nonexposed pregnancies.

Conclusion In many patients, long-acting morphine preparations can be safely used and tapered in pregnancy, with a subsequent decrease in observed neonatal withdrawal symptoms.

EDITOR'S KEY POINTS

- Illicit narcotic use during pregnancy is a pervasive problem in northwestern Ontario, affecting 28% of pregnancies in 2013. In response to this high incidence of narcotic abuse in pregnancy, the Meno Ya Win Health Centre in Sioux Lookout, Ont, instituted a narcotic replacement and tapering program using long-acting morphine preparations.

- Approximately half of women using narcotics during their pregnancies agreed to participate in the program, and many patients decreased or quit narcotic use without documented measurable neonatal adverse effect. By delivery, 91.9% of participants had quit (9.3%) or decreased (82.6%) their long-acting morphine dose, although almost half of those who decreased their dose were still occasionally using oxycodone. The incidence of neonatal abstinence syndrome among participants decreased significantly ($P = .003$) from that found in a previous study in this setting. Other neonatal outcomes were similar to those of nonexposed pregnancies.

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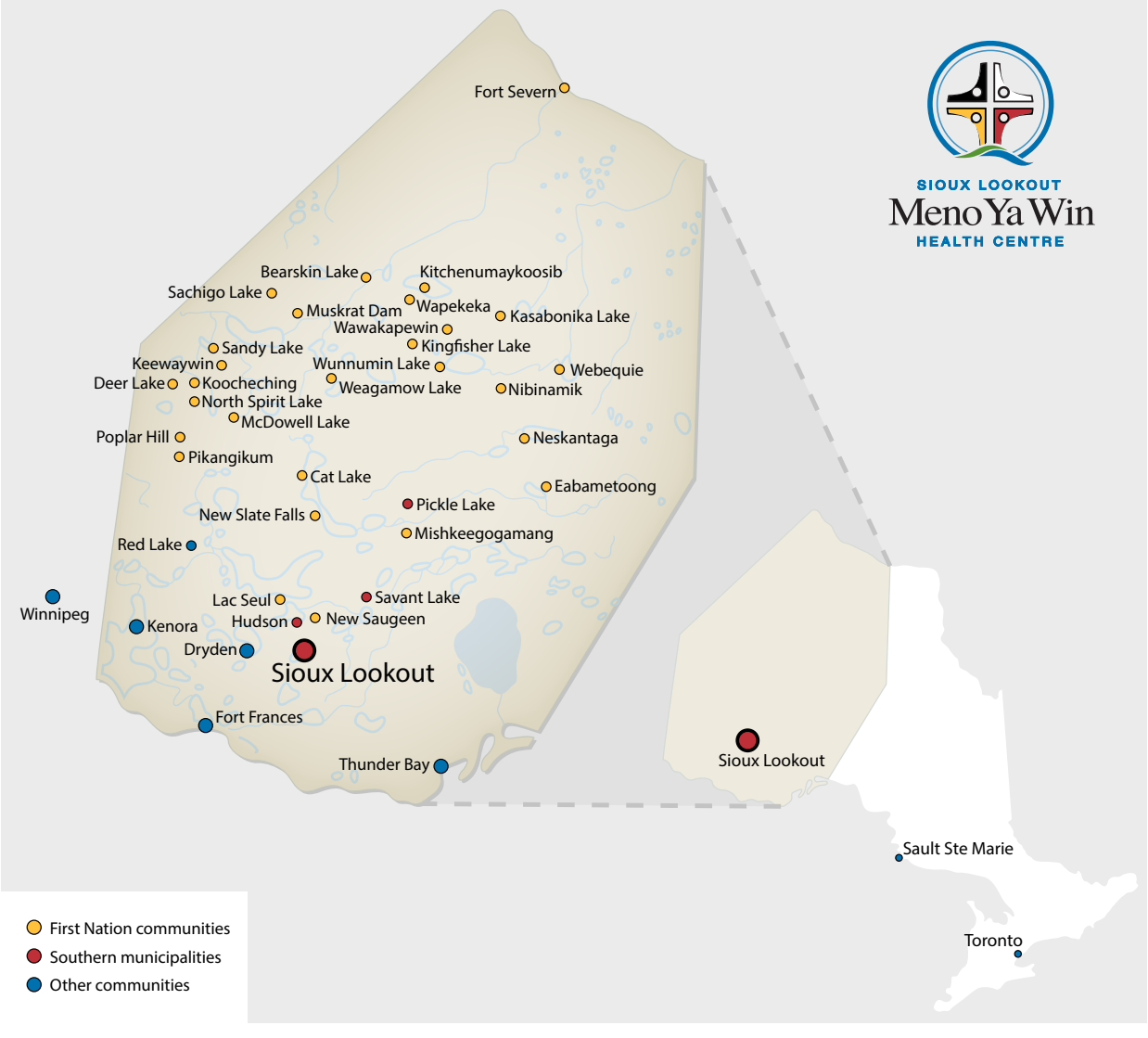
Illicit narcotic use during pregnancy is a pervasive problem in northwestern Ontario. In 2010, 17% of pregnancies were affected by narcotic abuse and 29.5% of neonates from exposed pregnancies experienced some degree of neonatal abstinence syndrome (NAS).[1] In 2013, the rate of narcotic abuse in pregnancy rose to 28% ($P<.001$).[2]

The Meno Ya Win Health Centre in Sioux Lookout, Ont, provides obstetric services to a catchment area of 28 000 primarily First Nations patients (**Figure 1**).[3-5] None of these remote communities hosts a methadone maintenance program. In response to the high incidence of narcotic abuse in pregnancy, a narcotic replacement and tapering program using long-acting morphine preparations was instituted. The purpose of this study is to document the role narcotic tapering with long-acting morphine preparations can play in the management of narcotic abuse in pregnancy.

METHODS

All 600 births occurring at Meno Ya Win Health Centre from January 1, 2012, to June 30, 2013, were prospectively studied. Data related to maternal attendance at the integrated prenatal clinics and specialized narcotic-in-pregnancy clinics were analyzed. In addition to typical prenatal data, information regarding type, amount, and route of drug abuse was documented. Birth outcome information including Apgar scores, birth weights,

Figure 1. The service area of the Meno Ya Win Health Centre in Sioux Lookout, Ont



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gestational age, and stillbirths was gathered, as were addiction-related outcome measures: Finnegan scores, incidence of NAS, and neonatal treatment. The Sioux Lookout Meno Ya Win Health Centre Research Review Committee granted ethics approval.

Statistical analysis was performed using SPSS, version 21.0 for Windows. Data were initially analyzed descriptively, including means and standard deviations for continuous data and frequencies and percentages for categorical data. Independent-samples *t* tests were used for continuous data to compare the tapered and nontapered exposed pregnancies, and the nonexposed pregnancies. Pearson χ^2 tests were used to compare the groups for categorical data.

Modified Finnegan scoring was used by the treating physician or obstetric nurse as the practical measure of neonatal symptoms of withdrawal from opioids.[6]

Prenatal care in the 31 remote First Nations communities in our catchment area is initiated at the nursing station by local nurses and visiting family physicians who fly in 1 week each month. The integrated prenatal program based at the Meno Ya Win Health Centre holds daily clinics for patients near term or those referred earlier for potential complications. The number of narcotic-use referrals required the institution of twice-weekly narcotic-in-pregnancy clinics as well. These are staffed by a family physician, a nurse, a social worker, and a lactation consultant. Four family physicians are currently involved, 3 of whom also provide cesarean section coverage. The same family physicians also provide intrapartum and postpartum care of mothers and neonates. All narcotic-exposed patients receive their prenatal and narcotic management at the Meno Ya Win Health Centre, with direct observed therapy for prescribed narcotics. A standardized questionnaire about addictions is completed and written informed consent is obtained. Other nonexposed pregnancies also receive their prenatal care at the centre.

When the program began, 2 types of controlled-release morphine (MS Contin or M-Eslon) were commonly used twice daily for replacement and tapering; currently Kadian is typically used owing to its simpler once-daily dosing. Patients are seen daily as needed. Narcotic carries are seldom prescribed. If return to a northern community is undertaken, community nurses or reliable family or community members are contacted for in-community dispensing. Urine drug screening is performed for every patient. Counseling by family physicians, social workers, and First Nations mental health workers is offered on a case-by-case basis. All services—obstetric services, ultrasound scans, narcotic substitution or tapering, delivery, and daily 7- to 10-day postpartum follow-up—are provided at the Meno Ya Win Health Centre. Prenatal and narcotic management, including care of partners and, at times, other children, are integrated into the one setting.

RESULTS

In the 18 months of the study (January 1, 2012, to July 1, 2013), 600 births were attended, including 166 (27.7%) narcotic-exposed pregnancies (**Table 1**). Eighty-six of these narcotic-using pregnant women (51.8%) participated in the narcotic-in-pregnancy tapering program. Despite being off the market since early 2012, 85% of the narcotic abuse we encounter involves OxyContin.[2,7] Polysubstance abuse included cocaine (9 patients), morphine (5 patients), methadone (3 patients), benzodiazepines (2 patients), and methamphetamines (2 patients). No changes were made in our prenatal clinic during the time frame of the study other than instituting the formalized narcotic replacement and tapering program. Urine drug screening was universal in the narcotic tapering program.

Each patient and couple was assessed individually. With the exception of some occasional users, all narcotic users were offered participation in our narcotic replacement and tapering program.

The 86 patients tapered with long-acting morphine included 24 who received MS Contin (or M-Eslon) and 48 who received Kadian. Eight patients who were already started on buprenorphine in their northern

Table 1. Maternal characteristics

MATERNAL CHARACTERISTIC	TAPERED N = 86	EXPOSED, NONTAPERED N = 80	NONEXPOSED N = 434	*P* VALUE
Mean (SD) age, y	24.8 (4.5)	23.9 (4.9)	25.1 (6.3)	.29
Cesarean section, n (%)	25 (29.1)	24 (30.0)	116 (26.7)	.78
Postpartum hemorrhage, n (%)	5 (5.8)	9 (11.2)	36 (8.3)	.45
Smoking, n (%)	75 (87.2)	69 (86.2)	206 (47.5)	<.001
Alcohol use, n (%)	14 (16.3)	15 (18.8)	94 (21.7)	.48
Hypertension, n (%)	5 (5.8)	6 (7.5)	30 (6.9)	.90
Type 2 diabetes mellitus	4 (4.7)	4 (5.0)	15 (3.5)	.73
Gestational diabetes	3 (3.5)	6 (7.5)	37 (8.5)	.27

communities also participated and were tapered on that medication (**Table 2**). Morphine-equivalent doses of narcotics were calculated by standard methods, and each patient was changed to an oral starting dose and seen daily until clinically stabilized. A daily dose of 90 mg of Kadian orally was a common starting dose (the average morphine dose was 54 mg), and the dose was slowly titrated or maintained as the patient tolerated. The eventual end dose for most (58.5%) of the tapered patients was between 0 and 10 mg of long-acting morphine per day; the average morphine end dose for the total tapering cohort was 16 mg (**Table 3**). The length of the weaning varied based on patient comfort and degree of dependence, and ranged from 7 to 238 days (mean [SD] of 101 [67], median 98).

By delivery, 91.9% of the tapered patients had quit (9.3%) or decreased their substitute narcotic doses (82.6%) (**Table 4**). Of the tapered patients who decreased their doses, 53.3% used only the taper drug at delivery; others still occasionally used some oxycodone. Quit rates were based on self-reporting, supported by urine drug screening. Of the 30 urine screening test results that were positive for oxycodone close to delivery, only 3 were in patients who professed having "quit" narcotics, and they were all in the taper program. Most of the urine test results positive for oxycodone were in tapered patients who admitted to ongoing but decreased use of illicit narcotics who were therefore expected to have ongoing positive urine test results (18 of 30). Urine drug screening was not performed for the neonates.

Table 2. Comparison of tapering agents

OUTCOME	KADIAN, ONCE DAILY, N (%) N = 48*	MS CONTIN OR M-ESLON, TWICE DAILY, N (%) N = 24*	SUBUTEX, N (%) N = 8*	*P* VALUE
Quit narcotics	5 (10.4)	2 (8.3)	0 (0.0)	.85
Decreased dose	42 (87.5)	21 (87.5)	7 (87.5)	
No change	1 (2.1)	1 (4.2)	1 (12.5)	

*Six patients were taking other agents or were missing outcome data.

Table 3. Tapering profile: *N* = 86.

TAPERING VARIABLE	VALUE
Timing of taper, n (%)	
• First trimester	14 (16.3)
• Second trimester	32 (37.2)
• Third trimester	32 (37.2)
• No data	8 (9.3)
Mean (SD) length of taper, d	101 (67)
Average morphine starting dose, mg	54
Average morphine end dose, mg	16

Table 4. Rates of narcotic quitting and dose decrease

OUTCOME	TAPERED, N (%) N = 86	NONTAPERED, EXPOSED, N (%) N = 80	TOTAL, N (%) N = 166	*P* VALUE
Quit	8 (9.3)	32 (40.0)	40 (24.1)	<.001
Decreased	71 (82.6)	18 (22.5)	89 (53.6)	
No change	5 (5.8)	20 (25.0)	25 (15.1)	
Unknown	2 (2.3)	10 (12.5)	12 (7.2)	

The narcotic-exposed mothers who did not participate in tapering or who were not offered replacement and tapering were generally only occasional users. Offering them long-acting morphine, even with tapering, would have, in effect, increased their narcotic intake. This group of 80 patients who also attended the integrated prenatal clinic also had high quit (40.0%) or decrease (22.5%) rates.

The incidence of any NAS experienced by narcotic-exposed infants was 18.1% in 2013. The proportion of infants with high Finnegan scores who required pharmacologic therapy (morphine or phenobarbital) for their symptoms (2 consecutive Finnegan scores ≥8) was low, at 1.5% of total births. All infants roomed in with their mothers. Other neonatal outcomes were largely similar to those of the nonexposed pregnancies (**Table 5**).

Thirty men were also treated with taper protocols similar to their pregnant female partners. After hospital discharge, families are housed for 7 to 10 days at the attached 100-bed First Nations hostel. They are followed daily for maternal and neonatal health, weight gain, and any signs of narcotic withdrawal or need for further treatment as inpatients or outpatients. The length of hospital stay was statistically longer for narcotic-exposed, tapered pregnancies ($P < .001$).

In this 18-month study, 15 deliveries occurred out of hospital (typically, precipitously back home in the nursing station), and only 2 of these were in narcotic-exposed pregnancies, neither of which were being tapered.

Postpartum women from communities that had developed buprenorphine maintenance programs were transitioned into those programs.

DISCUSSION

The narcotic replacement and tapering program using long-acting morphine facilitated a significant decrease in neonatal withdrawal. The incidence of NAS in narcotic-exposed pregnancies fell from 29.5% in 2010 to 18.1% in 2013 ($P = .003$).[1,2] Despite the overall proportion of narcotic-exposed pregnancies rising from 17% to 28%, neonates requiring pharmacologic management, as a percentage of total births, fell from 2.5% to 1.5% ($P = .403$).[1,2]

Table 5. Neonatal characteristics

NEONATAL CHARACTERISTICS	TAPERED N = 86	NONTAPERED, EXPOSED N = 80	NONEXPOSED N = 434	*P* VALUE
Mean (SD) birth weight, g	3301 (507)	3512 (530)	3537 (558)	.001
Mean (SD) gestational age, wk	38.7 (1.3)	39.0 (1.4)	38.8 (1.4)	.37
Prematurity (<37 wk), n (%)	5 (5.8)	3 (3.8)	24 (5.5)	.79
Mean (SD) Apgar score at 1 min	8.5 (1.4)	8.5 (1.4)	8.5 (1.1)	.84
Mean (SD) Apgar score at 5 min	9.0 (0.4)	8.8 (1.1)	9.0 (0.4)	.037
Mean (SD) head circumference, cm	34.7 (1.4)	35.0 (1.6)	35.0 (1.7)	.33
Mean (SD) length, cm	49.7 (3.4)	51.1 (2.7)	50.8 (3.0)	.006
Mean (SD) arterial pH	7.25 (0.08)	7.24 (0.08)	7.24 (0.09)	.61
Mean (SD) venous pH	7.32 (0.07)	7.30 (0.08)	7.30 (0.08)	.27
NAS, Finnegan score >0, n (%)	22 (25.6)	8 (10.0)	0 (0.0)	<.001
NAS, Finnegan score >7, n (%)	11 (12.8)	5 (6.2)	0 (0.0)	<.001
Transferred out, n (%)	1 (1.2)	5 (6.2)	5 (1.2)	.006
Mean (SD) length of stay, d*	2.41 (1.53)	1.70 (1.05)	1.65 (0.94)	<.001
Stillbirths, n (%)†	2 (2.3)	1 (1.2)	4 (0.9)	.540
Males, n (%)	39 (45.3)	33 (41.2)	204 (47.0)	.62

NAS—neonatal abstinence syndrome.

*Length of stay does not include 7-10 d stay in neighbouring hostel facility or outpatient attendance at the maternity ward or prenatal clinic for follow-up and NAS surveillance.

†Two regional stillbirths were attended at our centre from outside our obstetric program owing to air ambulance service routes (1 was narcotic exposed and the other was not). The stillbirths rate for this 18-month period is therefore 6.4/1000 live births based on the regional birthrate.

Neonates from tapered pregnancies did have significantly lower birth weights ($P = .001$), but the difference was not thought to be clinically relevant, with an average birth weight of 3301 g in the tapered cohort.

This prenatal narcotic-tapering program is unique in 3 ways: the use of long-acting morphine preparations, the tapering of narcotics in pregnancy, and care delivered by generalist family physicians.

Long-acting morphine is the most accessible narcotic in rural Canada. Methadone clinics and facilities are largely urban. Accessing federal funding and stock for methadone and buprenorphine in remote First Nations communities can be problematic, especially with the clinical immediacy of narcotic use and withdrawal in a pregnant patient. Fischer et al demonstrated the equivalency of long-acting morphine versus methadone in a small randomized study in 1999 (N = 48).[8] A 2013 Cochrane review also found equivalency to methadone.[9] The Society of Obstetricians and Gynaecologists of Canada clinical practice guidelines allow for the use of long-acting morphine, as do the 2012 Ontario provincial guidelines, particularly where methadone programs are not available.[10,11] These latter guidelines noted the epidemic of narcotic use in our region, and although methadone maintenance was generally recommended, the guideline authors recognized that our region might need to consider narcotic replacement and tapering with long-acting morphine preparations.[12]

Tapering narcotics in pregnancy raises the twin concerns of precipitating maternal and fetal withdrawal.[13] Geographic factors in our region, with dozens of isolated remote communities, interrupt the supply chain of many commodities, including illicit narcotics. We have many patients who use intermittently owing to availability as well as poverty, making narcotic withdrawal a common challenge. Once we have initiated a long-acting morphine replacement, our tapering schedule is very gradual. The recommended 10% weekly reduction is typically spread out over a longer period of time according to patient preference, withdrawal apprehension, and physical symptoms.[14] McCarthy has discussed the possibility of intrauterine fetal withdrawal in an urban context, which might be more likely to involve multidrug and daily heroin users.[13] In this context methadone maintenance makes good sense. The absence of any common test for intrauterine withdrawal renders it a real concern, but without clear implications in our setting. Our finding that many of our patients decreased or quit narcotic use without documented measurable neonatal adverse effect is an important one. A US study in 2013 of inpatient detoxification of 95 pregnant women being treated with decreasing doses of methadone resulted in a 56% success rate and no neonatal adverse outcomes.[15] In 2012, Ontario guidelines and the Centre for Addiction and Mental Health both identified our catchment area as one where traditional methadone maintenance programs would not

be able to address the scope of the problem.[10,12,14] The Ontario guidelines specifically acknowledge that, in our setting, opioid tapering might be a useful approach.[12] The Centre for Addiction and Mental Health's 2012 health alert attests: "based on recent evidence, there is minimal risk associated with tapering opioids during pregnancy."[14] All patients regularly using opioids in our study were offered tapering. Those who declined continued to be offered routine prenatal care, including fetal surveillance with regular biophysical profiles and supportive counseling. It is recommended that tapering occur in the second and third trimesters, and that is when most of our tapering occurred. However, patients were tapered so gradually with our approach that it was initiated in the first trimester (and completed in the second trimester) if the patient expressed a wish to begin reducing her narcotic use. Because decreasing the incidence of NAS was one of our program goals, we offered tapering to all regular narcotic users, and the patient ultimately decided by her comfort level whether she was maintained or slowly tapered. Patients who were occasional users constituted a large component of the exposed, nontapered cohort. This group had high quit rates and lower rates of NAS, presumably owing to self-directed narcotic management or response to the program's supportive addiction treatment environment. All quit determinations were self-reported, supported by urine drug screening.

Another of the unique aspects of our program is the involvement of generalists with a broad scope of practice.[4] These family physicians are involved in prenatal, intrapartum, postpartum, and neonatal care of the mother, child, and partner. They have become experienced in addiction management and can treat mother, father, and neonate. This multirole perspective, common in rural and urban family medicine, allows for an integrated approach early in pregnancy to safely reducing the incidence of NAS.[16] It also reduces the need for long-distance travel to urban centres for care, which further disrupts families already dealing with addiction issues.

The rural First Nations population we serve differs from opioid-dependent patient populations encountered in the literature. Baewert and colleagues, in their subanalysis of the multicentre MOTHER [Maternal Opioid Treatment: Human Experimental Research] study, noted a difference between rural and urban settings that suggested women in urban areas were more severely affected.[17] Additionally, the epidemic of oxycodone abuse encountered in our region is currently a pervasive social as well as medical issue. Clearly this is a whole-community problem, and it is being addressed directly by community-based initiatives across northwestern Ontario.[18-20] It does not just involve an isolated sector of society. This might both allow more openness in discussing the topic as well as facilitate creative, workable solutions that are a good fit for dealing with opioid dependence in pregnancy.

It can be argued that NAS has a known treatment with no known serious sequelae for the neonate and that avoiding it has limited value. The traditional approach to narcotic use of any type during pregnancy is to treat mothers with relatively high-dose methadone in the prenatal period and to provide prolonged neonatal care unit stays for the neonate postpartum. It is not generally acknowledged that this approach might unnecessarily cause a considerable disruption to family life and maternal-child bonding when a simpler approach might be effective.

Limitations

Owing to the busy nature of the obstetric program, some patient information was missing. Finnegan scoring is a user-dependent process but it is the commonly used standard in Canadian hospitals. In-house training sessions with physicians and obstetric nurses were undertaken to address our initial inexperience. During the time frame of the study, many First Nations communities were developing various buprenorphine-naloxone maintenance programs, and willing postpartum patients were transitioned into these programs upon their request. Community-based follow-up with addictions workers is also available to returning couples. Not all communities have equivalent local program support, and this remains one of the limitations of the spectrum of care in our region. Urine drug screening was universally done in the prenatal clinic but not routinely at time of delivery, so findings for the last prenatal urine collection were used in our results.

Conclusion

In the right setting, with appropriate patient screening and support, long-acting morphine can be safely initiated and tapered in pregnancy for patients abusing narcotics. Our program has safely lessened the incidence of NAS and plays an important role in the treatment of families with addiction during pregnancy in our region.

Ms Dooley is a medical student at the University of British Columbia in Prince George. **Dr Dooley** is Chief of Obstetrics at the Sioux Lookout Meno Ya Win Health Centre (SLMHC) in Sioux Lookout, Ont. **Drs Antone, Guilfoyle,** and **Gerber-Finn** are assistant professors at the Northern Ontario School of Medicine and rural family physicians in Sioux Lookout. **Ms Kakekagumick** is a research intern at the SLMHC. **Ms Cromarty** was Special Advisor on First Nations Health at the SLMHC at the time of the study. **Ms Hopman** is a statistician in the Department of Medicine at Queen's University in Kingston, Ont. **Ms Muileboom** and **Ms Brunton** are research interns at the SLMHC. **Dr Kelly** is Professor at the Northern Ontario School of Medicine in Sioux Lookout.

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Contributors

Ms Kakekagumick, Ms Muileboom, Ms Dooley, and **Ms Brunton** performed the data collection and literature search and review. **Ms Dooley** also designed

data collection software. **Drs Dooley, Antone, Guilfoyle,** and **Gerber-Finn** contributed clinical program development and management, data collection, and draft approvals. **Ms Cromarty** was Special Advisor on First Nations Health at the time of the study and ensured the project met community expectations of the First Nations for hospital-based research. **Ms Hopman** performed statistical analysis and data organization. **Dr Kelly** contributed to the overall research design and writing. All authors approved the final draft.

Competing interests
None declared

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Community-wide measures of wellness in a remote First Nations community experiencing opioid dependence

Evaluating outpatient buprenorphine-naloxone substitution therapy in the context of a First Nations healing program

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Abstract

Objective To document the development of unique opioid-dependence treatment in remote communities that combines First Nations healing strategies and substitution therapy with buprenorphine-naloxone.

Design Quantitative measurements of community wellness and response to community-based opioid-dependence treatment.

Setting Remote First Nations community in northwestern Ontario.

Participants A total of 140 self-referred opioid-dependent community members.

Intervention Community-developed program of First Nations healing, addiction treatment, and substitution therapy.

Main outcome measures Community-wide measures of wellness: number of criminal charges, addiction-related medical evacuations, child protection agency cases, school attendance, and attendance at community events.

Results The age-adjusted adult rate of opioid-dependence treatment was 41%. One year after the development of the in-community healing and substitution therapy program for opioid dependence, police criminal charges had fallen by 61.1%, child protection cases had fallen by 58.3%, school attendance had increased by 33.3%, and seasonal influenza immunizations had dramatically gone up by 350.0%. Attendance at community events is now robust, and sales at the local general store have gone up almost 20%.

Conclusion Community-wide wellness measures have undergone dramatic public health changes since the development of a First Nations healing program involving opioid substitution therapy with buprenorphine-naloxone. Funding for such programs is ad hoc and temporary, and this threatens the survival of the described program and other such programs developing in this region, which has been strongly affected by an opioid-dependence epidemic.

EDITOR'S KEY POINTS

- Opioid dependence has become a widespread issue in northwestern Ontario, particularly in remote First Nations communities, with some communities reporting prevalences of prescription opioid abuse between 35% and 50%.
- North Caribou Lake First Nation had an age-adjusted adult rate of treated opioid dependence of 41%. Opioid addiction affects the whole fabric of a community, so North Caribou Lake First Nation developed a community-based treatment program that combined substitution therapy and intensive, culturally appropriate counseling.
- The program has received strong community support, and considerable improvements in community-wide measures of wellness have been documented, including decreases in child protection cases, criminal charges, and drug-related medical evacuations, and increases in school attendance, participation in community events and vaccination programs, and spending at the local store.

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Opioid dependence has become a widespread issue in northwestern Ontario, particularly in remote First Nations communities. In 2009, the northwestern Ontario First Nations chiefs declared a state of emergency regarding "prescription drug abuse" related to the epidemic of abuse of long-acting oxycodone preparations.[1] This was in response to mounting concerns about the social, health, and economic consequences of opioid abuse among many remote First Nations communities: increasing crime, family dysfunction, unemployment, and increasing rates of hepatitis C and neonatal abstinence syndrome.[1]

In Ontario between 1991 and 2007, the number of prescriptions for oxycodone increased by 850%.[2] While the proportion of First Nations people in Ontario receiving opioids through Non-Insured Health Benefits, the responsible federal medical insurance agency, remained steady between 1999 and 2009, the quantity and proportion of oxycodone dispensed increased substantially.[3]

Concurrent with opioid prescribing among First Nations patients,[3] diversion of prescription opioids and trafficking of oxycodone products from larger centres appears to have played an important role in their availability in First Nations communities.[4] The 2008 to 2010 First Nations Regional Health Survey reported that 6.8% of Ontario on-reserve respondents used opioids without a prescription.[5] However, community-led surveys in several Nishnawbe Aski Nation communities reported prevalences of prescription opioid abuse between 35% and 50%.[6,7] In addition, a 3-fold increase in the number of aboriginal people (mostly First Nations) seeking treatment for addiction to prescription opioids in Ontario occurred from 2004 to 2009.[8]

Remote communities need and have developed unique solutions to address the crisis of opioid drug abuse. In northwestern Ontario, the relatively inaccessible geography of remote First Nations communities limits travel for most of the population. Thirty-one remote First Nations communities, which vary in size from a few hundred to several thousand in population, are situated across a vast area accessible primarily only by small planes. Primary care clinics are staffed by nurses and supported by regular fly-in or in-community family physicians. North Caribou Lake First Nation (estimated population 1100) is one such community, as its regional health care centre and the closest hospital are located in Sioux Lookout, Ont, which is a 1-hour flight away. In 2012, in response to the urgent need for a workable opioid-dependence program, the community leadership in conjunction with health care providers developed a unique buprenorphine-naloxone opioid substitution and maintenance program, including in-community aftercare counseling by First Nations healers. A pilot project in a neighbouring community in 2012 had demonstrated the effectiveness and safety of buprenorphine-naloxone for substitution therapy in this setting.[9] This medication combines an opioid agonist (buprenorphine) with an opioid antagonist (naloxone) and resists diversion from its intended sublingual route. The naloxone component, which is inactivated by first-pass effect when taken mucosally, precipitates withdrawal if used intravenously.

Primary care settings

The safety and efficacy of buprenorphine-naloxone induction in primary care settings (including "home" or unobserved inductions) is well established.[10-14] In fact, primary care delivery of buprenorphine-naloxone programs have success rates similar (50%) to those of more resource-intensive clinical settings.[10-14] Treating addicted patients in a primary care setting allows for more cost-effective delivery of medical services for concurrent illnesses, development of therapeutic relationships, and surveillance for addiction-related complications and infections.

The program in North Caribou Lake First Nation is unique in the scope of community participation in treatment and its remote setting, far from hospital services.

METHODS

Setting and participants

A written request for program evaluation was provided by the Chief and Band Council of North Caribou Lake First Nation. Ethics approval was granted by the Sioux Lookout Meno Ya Win Health Centre Research and Review and Ethics Committee. All program participants signed a narcotic treatment contract, and no individual patient information was used in this study.

Program description

As of May 2014, 140 self-referred community members of North Caribou Lake First Nation in northwestern Ontario had participated in the outpatient healing and buprenorphine-naloxone substitution program since the first intake in July 2012; 8 groups of up to 20 participants went through the induction and maintenance program. All patients met the *Diagnostic and Statistical Manual of Mental Disorders,* 4th edition, criteria for substance dependence. Medication inductions (and sublingual administration) are undertaken in the community clinic by the visiting family physicians or addiction specialists. Initially the program runs daily for each patient for 28 days and is managed by the community nurses and mental health workers. Following that initial month, buprenorphine-naloxone dispensing and daily follow-up is managed by community-trained health aides. First Nations counselors and healers deliver group and individual daily sessions several weeks per month during and after the month-long initiation of the program. They

focus on addiction recovery, relapse prevention, understanding early-life trauma, grief counseling, and traditional healing teachings. Land-based activities were used, along with individual and group education and counseling sessions.

Study design

Statistics from community programs and health-related data were collected and compared for time periods 1 year before and 1 year after the initiation of the buprenorphine-naloxone program. Community-wide measures that are routinely monitored by their respective agencies were collected, as they could be easily followed for changes in incidence.

Main outcomes

Data on community-wellness measures were collected to assess the effectiveness of the program on the community as a whole. The community-wellness measures included the number of emergency air ambulance medical evacuations out of the community, seasonal influenza immunization rate, number of child protection apprehensions, local community policing calls, number of needles given out by the needle distribution program, school attendance rates, and sales at local stores. Personal observations of manifestations of community spirit were contributed by community and visiting health care professionals and local community mental health workers.

RESULTS

The 140 patients enrolled in the opioid-dependence treatment program were all between 20 and 50 years of age. Using local medical record population statistics, this accounts for a 41% age-adjusted rate of adult community members in that age group receiving opioid-substitution therapy, including a rate of 48% for patients in their 20s.

Medical evacuations are emergency evacuations to hospital by paramedics in a fixed-wing aircraft (supplied by the provincial air ambulance service). *Drug-related medical evacuations* were grouped as the total of drug-related assaults, suicide attempts, overdoses, and sexual assaults believed to be directly related to drugs or addiction. This subset of medical evacuations fell by 30.0%, while the total number of medical evacuations rose by 15.7% (**Table 1**).[4]

In the year following program initiation, police criminal charges fell by 61.1%, including a 94.1% drop in robbery and arson charges (from 17 in 2011 to 1 related charge in 2013). Young offender criminal or drug charges fell by 66.3%. The needle distribution program dispensed less than half its previous volume, and in 2013, 700 used needles were returned, a rare occurrence in earlier years. The nursing station noted that children and elderly patients were being brought in for medical care at earlier stages of illness. They also noticed that the community clinic became more of a primary care centre than a trauma centre, as they were now caring for less drug-related violence and its medical sequelae. School attendance had increased and most children now arrived having had breakfast at home.

Public support of the program is integrated into the community. The community leadership is strongly supportive and donated a building to house the program called New Horizons. Clients proudly wear T-shirts attesting to their participation both in the substitution program and in the ongoing aftercare counseling. The chief and band councilors take a keen interest in the success of the program and maintain supportive relationships with clients and the medical, nursing, clerical, and counseling program staff. Accepted community health indicators, such as increased planning of and participation in community events and activities for youth and elders, were also evident but not systematically measured. Both the pervasiveness of the issue and the positive, holistic community response have served to lessen the stigma typically associated with substance abuse, perhaps rendering it more amenable to treatment.

Community members strongly endorsed the program: "It has brought life back to our community, [which] is being restored to the way it used to be before everyone got stuck in addiction." Practical benefits include more disposable income:

> When I am on Facebook, I see a lot of people writing that they are so happy they joined the program because now that they are not using, their cupboards always have food in [them] and they have money in their pockets and they can buy what they need for them or their children.

DISCUSSION

We have documented, for the first time, an accurate measure of the scope of the problem in one of our regional communities. The age-adjusted rate of 41% of the adult population participating in the treatment program gives credence to the regional chief's 2009 description of an "epidemic" of opioid dependence.[1] This figure informs the community-wide scope of the problem occurring in northwestern Ontario.

Given the depth of the issue, the successful community-based development of this opioid-dependence program is even more remarkable. North Caribou Lake First Nation is effectively dealing with the community-wide opioid abuse it has experienced. The novel

Table 1. Annual community-wide wellness measures 1 year before and 1 year after initiation of the program combining buprenorphine-naloxone substitution therapy and First Nations healing strategies

WELLNESS MEASURE	2011	2013	CHANGE
Total medical evacuations	183	217	15.7%
Drug-related medical evacuations	86	66	-30.0%
Child protection cases	120	50	-58.3%
School attendance	60 of 130	90 of 130	33.3%
School breakfast program attendees	48 of 60	Rare of 90	>90% decrease
Police criminal charges	226*	88	-61.1%
Prenatal program	12 of 18 using illicit narcotics (66%)	10 of 22 taking buprenorphine substitution	Reduction of illicit narcotic use in pregnancy
Needle distribution, no. of needles	10 093	4830	-52.2%
Seasonal flu immunizations	200	700	350.0%
Local store purchases†	NA	NA	18%

NA—not available.
*Statistics for 2012 are presented, as 2011 statistics were not available.[4]
†Sales increase given by store; sales figures were not released.

combination of intensive addictions counseling, First Nations healing strategies, and substitution therapy with buprenorphine-naloxone are all key components. That effective integration has occurred speaks to the effort and creativity brought to bear on a desperate situation by community members, leaders, and health care providers.

In North Caribou Lake First Nation, not only are more community events being planned and well attended, but there is also a sense of community purpose being expressed to health care providers. Total medical evacuations out of the community rose by 15.7% in the study period. Clinicians believed this increase was due to community members bringing serious medical conditions to the attention of the nursing staff that might have previously remained unreported. The dramatic fall in crime and increase in wellness behaviour such as flu vaccinations speak to the dramatic public health effects the healing and substitution therapy program has achieved. Few public health interventions can effect a 350% increase in seasonal flu immunizations or a dramatic drop in child protection cases of almost 60%. The spinoff from the whole community addressing the opioid dependence from a community-based perspective was dramatic public health benefits.

Integrating regular visiting cultural healers into the follow-up care within the remote community allows for powerful role modeling and story sharing. Personal transformation stories are becoming commonplace in the intense cultural healing and counseling sessions that accompany the medical substitution therapy in this community.

Of the 31 regional fly-in First Nations communities, 16 others have similar treatment program experiences. Despite their success, existing programs continually deal with issues of losing their present level of funding and some have recently had to stop accepting new patients pending available resources. Another dozen communities struggle with attracting the necessary funding to initiate their own treatment and healing programs, which are federally funded annually on an ad hoc basis.

The larger question is, how does a First Nations community come to have a 41% age-adjusted adult rate of treated opioid dependence? The 2014 United Nations' special rapporteur report on indigenous peoples in Canada concluded that we face a "continuing crisis" regarding the situation of our indigenous peoples and that government initiatives have to this point been "insufficient."[15] Its recommendations include "strengthening and expanding services that have already demonstrated success," and this would certainly seem to apply to the community-based buprenorphine-naloxone programs in First Nations communities in northwestern Ontario.

Once communities have been able to stabilize their current addiction treatment management, what is next? Given limited economic resources, how do they move forward with community development initiatives including housing, employment, education, self-administration, and community planning to alter the social conditions that are such a fertile field for addiction? Long-term federal and provincial commitments, accompanied by sustained financial support, are required to assist First Nations communities in addressing the roots of opioid addiction.

Limitations

Population estimates of remote communities such as North Caribou Lake First Nation can vary widely. Our overall population estimate is based on

community-generated numbers used in recent fire evacuation planning in 2011, as well as age ranges derived from community medical records.

Data were gathered as available and markers were chosen by community members and health care providers that highlighted the most important changes experienced by community members and health care providers, as the community moved from crisis to stability of addiction treatment. Future measures of community wellness will need to proceed systematically and involve community-based indicators of wellness using more subtle indicators of health.[16] Our study was not intentionally limited to 20- to 50-year-olds, that was the actual age range of present participants. Program retention rates and urine drug screening values are also being collected and will be available in the future.

Before-and-after studies are limited in their ability to infer causality; however, in the small isolated community of North Caribou Lake First Nation, there were no other such programs or economic or social changes in the community during the observed time frame.

Conclusion

Opioid addiction affects the whole fabric of a community. The combination of substitution therapy and intensive, culturally appropriate counseling appears to be immensely effective.

Long-term funding is required to sustain these community-based health and social initiatives around addiction management. They are hallmarks of success in treating opioid dependence within communities.

Ms Kanate is Chief of North Caribou Lake First Nation and oversees the New Horizon Program in Round Lake, Ont. **Dr Folk** is a regional physician in Sioux Lookout, Ont, and regularly visits the community in North Caribou Lake as a family physician. **Dr Cirone** is an addiction specialist at St Joseph's Health Centre in Toronto, Ont, and visits the North Caribou Lake community regularly for addictions work. **Ms Gordon** is Director of Health Services at the Sioux Lookout First Nations Health Authority. **Dr Kirlew** is Assistant Professor at the Northern Ontario School of Medicine in Sioux Lookout. **Ms Veale** is a community nurse in Round Lake. **Dr Bocking** was a resident in community medicine at the University of Toronto at the time of the study. **Ms Rea** was a research intern at the Anishinaabe Bimaadiziwin Research Unit in Sioux Lookout at the time of the study. **Dr Kelly** is Professor at the Northern Ontario School of Medicine in Sioux Lookout.

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Contributors

All authors contributed to concept and design of the study; data gathering, analysis, and interpretation; and preparing the manuscript for submission.

Competing interests

None declared

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Evaluation of an inpatient medical withdrawal program in rural Ontario: a 1-year prospective study

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Introduction: We present a 1-year program evaluation of the Medical Withdrawal Support Service (MWSS) provided at the Sioux Lookout Meno Ya Win Health Centre. The centre's service area includes 4 rural municipalities and 28 First Nations communities. The program involves inpatient detoxification for opioid dependence with the use of buprenorphine–naloxone.
Methods: Data were collected from preadmission interviews (i.e., medical history, substance use history, previous counselling, social history, previous addiction treatment and screening tools used during the interview); discharge forms (i.e., length of stay, maximum dose of prescribed buprenorphine–naloxone and client goals); and postdischarge interviews.
Results: Overall, 81% of the clients successfully completed the program. Two weeks after discharge, 48% of clients reported continued abstinence. At 3-month follow-up, 32% were abstinent, and at 6 months, 30% were abstinent.
Conclusion: The MWSS shows positive outcomes for many clients, their families and communities. Clients returned to work and school, became more engaged in healthy meal preparation and exercise, spent more time with family and were more involved as leaders in their communities.

Introduction : Nous présentons l'évaluation d'un programme d'un an offert par les Medical Withdrawal Support Services (MWSS) au Centre de santé Sioux Lookout Meno Ya Win. La zone desservie par le Centre englobe 4 municipalités rurales et 28 communautés des Premières Nations. Il s'agit d'un programme de désintoxication au moyen de buprénorphine–naloxone offert en établissement à des patients qui souffrent d'une dépendance aux opiacés.
Méthodes : Des données ont été recueillies à partir d'entrevues précédant l'admission (incluant antécédents médicaux, antécédents de toxicomanie, thérapies antérieures, histoire sociale, traitements antérieurs contre les dépendances et outils de dépistage appliqués en cours d'entrevue), des sommaires d'hospitalisation (c.-à-d., durée du séjour, dose maximum de buprénorphine–naloxone prescrite et objectifs du client) et d'entrevues consécutives au congé.
Résultats : Dans l'ensemble, 81 % des clients ont terminé le programme avec succès. Deux semaines après leur congé, 48 % des clients disaient être demeurés abstinents. Au suivi de 3 mois, 32 % étaient encore abstinents et après 6 mois, 30 % l'étaient toujours.
Conclusion : Les MWSS donnent des résultats positifs pour de nombreux clients, leurs familles et les communautés. Les clients sont retournés au travail ou à l'école, ont adopté de meilleures habitudes en ce qui concerne la préparation de repas santé et la pratique d'exercice, ont passé plus de temps en famille et ont davantage agi comme leaders dans leur communauté.

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INTRODUCTION

This article presents the findings of a 1-year inpatient program evaluation of the Medical Withdrawal Support Service (MWSS) provided at the Sioux Lookout Meno Ya Win Health Centre in Ontario. The centre's service area includes 4 municipalities and 28 First Nations communities, most of which are accessible only by air, with the farthest more than 700 km away.[1] In 2014, opiate use was epidemic, with some remote First Nations communities documenting an age-adjusted adult rate of over 40%.[2]

The MWSS is an inpatient adult program held in a 5-bed secure unit. The service offers medical management for withdrawal from substance use, primarily opiates and alcohol. Admission is voluntary, and clients are referred by health service providers or by self-referral. An exclusion criteria is pregnancy, with addiction services for pregnant clients provided through the prenatal program of the Sioux Lookout Meno Ya Win Health Centre.[3]

Program design and evaluation are responsive to current practices for addiction treatment that recognize addiction as more than the severity of symptoms, but also as an experience that has repercussions on quality of daily life.[4] There is a combination of psychoeducational groups and skills groups held throughout the day, including meal preparation, budgeting, stress management, sexual health, relapse-prevention strategies, daily exercise and beadwork. The unit is smoke-free, and clients are offered nicotine replacement therapy and counselling for smoking cessation.

Focus of research

We focused on withdrawal from opiates, including symptom management (e.g., clonidine) and/or use of sublingual buprenorphine–naloxone, a substitution medication that combines buprenorphine, a partial opioid agonist, and naltrexone, an opioid antagonist.[5] Because of the limited availability of outpatient maintenance programs using buprenorphine–naloxone in the remote First Nations communities and restrictions on the number of people who can be admitted to the 5-bed inpatient service, most inpatients were tapered off buprenorphine–naloxone before discharge.

Methadone versus buprenorphine–naloxone

The challenges associated with the medical monitoring of substitution pharmaceuticals preclude the use of methadone in our setting. Methadone is not considered feasible because it has a long half-life, a lengthy tapering period and a long duration of withdrawal effects, and it is not available for posttreatment maintenance in remote communities. Buprenorphine–naloxone as a substitution therapy is found to have higher retention rates than methadone for substitution programs.[6] This may be related to buprenorphine (its opioid agonist component) having a more immediate effect (20–30 min) on relief of withdrawal symptoms.[6] Buprenorphine–naloxone is also gaining acceptance in outpatient settings, including unsupervised "home starts" in several primary care settings in the United States, with narcotic abstinence rates up to 50%.[7–11]

OxyContin use

In 2012, OxyContin was delisted in Ontario and replaced by OxyNEO for pharmaceutical purposes.[12] Within the Sioux Lookout region, OxyContin 80 mg pills were frequently purchased with costs shared among a collective of people, and generally the pills were quartered. At the time of delisting, the cost of a quarter tablet (20 mg) skyrocketed from $80 to $250. Individuals who were using OxyContin, therefore, tended to use relatively small doses but at a high financial cost that resulted in selling all personal items and exchanging sex for drugs. Throughout 2012, OxyContin remained the primary substance being abused in our region, despite being delisted, followed by morphine. This study evaluates the outcomes of the first year of operation of the MWSS to treat this epidemic of opioid dependence.

METHODS

This program evaluation includes clients whose admission dates were between Jan. 1, 2012, and Dec. 1, 2012, the program's first year of operation. The program evaluation was designed prospectively. Qualitative data collection was integrated into therapeutic activities, and was performed by program staff, primarily nurses, occupational therapists and counsellors.

There were 3 primary sources of data. Before admission, an extensive initial intake interview was conducted, predominantly by telephone. Data collected included a medical history, substance use history, current substance use, previous counselling, social history, previous addiction treatment and screening tools used during the interview. Medical examinations and histories were performed on admission.

The second stage of data collection occurred at discharge. Staff completed a discharge form, recording information such as length of stay and maximum dose of prescribed buprenorphine–naloxone. Clients were also requested to write their personal goals for discharge. Clients were encouraged to consider goals beyond substance use and include other changes they wanted to achieve or maintain.

The third stage of data collection involved follow-up telephone interviews after discharge, at 2 weeks, 3 months and 6 months. These follow-up interviews, in the 91 available clients, included data about substance use after discharge, subsequent counselling or addictions services, subjective evaluation of the MWSS program and client evaluation of progress on the goals they identified for themselves at discharge.

All clients were included in the data analysis (intention-to-treat analysis).

RESULTS

In 2012, there were 112 admissions, which included 109 clients in total (72 women and 37 men). The age of the clients ranged from 18 to 70 years.

There was a fairly high amount of polydrug use (i.e., marijuana and cocaine in addition to oxycodone); however, in most cases there was one substance of importance for management of withdrawal. Of the 109 clients, 5 were admitted for substitution from methadone to buprenorphine–naloxone (3 women and 2 men aged 24–42 yr), 1 of whom was still injecting oxycodone daily at the time of admission; 16 for alcohol withdrawal (11 women and 5 men aged 18–70 yr); and 88 for withdrawal from unprescribed opiate use (i.e., oxycodone, morphine, hydromorphone, oxycodone–acetaminophen and/or codeine) (57 women and 31 men aged 18–44 yr). Of the 88 clients who used illicit opiates (including 1 client taking illicit methadone), 69 (78%) administered by injection. Twenty-eight (32%) clients reported snorting, and 6 (7%) reported smoking the crushed pills.

The length of stay ranged from 1 to 29 days, with a mean of 12 days. Length of stay was determined according to client tolerance for tapering and experience of severity of withdrawal symptoms.

Successful completion of the program for alcohol was defined as 7 days' admission or completion of medically facilitated withdrawal plus 3 days free of medications for withdrawal management. Successful completion of opiate withdrawal included tapering off buprenorphine–naloxone completely or to an established maintenance dose, plus 3 days without a medication for withdrawal management. Using these definitions, 91 of the 112 admissions (81%) were successfully completed. Successful completion was achieved in 13 of 16 admissions (81%) for alcohol withdrawal, 3 of 5 admissions (60%) for methadone and 75 of 92 admissions (82%) for opiates.

Eighty clients were prescribed buprenorphine–naloxone as inpatients. Doses ranged from 4 mg to 22 mg, and the dose did not correlate with the amount of illicit opiates used by the clients before admission. The maximum doses of buprenorphine–naloxone are shown in Figure 1. Twenty-seven people were discharged on a maintenance dose of buprenorphine–naloxone, with doses ranging from 4 mg to 22 mg. The mode and median maintenance dose at the time of discharge was 8 mg.

Substance use after discharge

Because 3 clients were readmitted to the MWSS, there were 91 admissions for opiate use; these are reported as discrete events ("individuals") in the remainder of this section. A total of 72 individuals (79%) were contacted for follow-up interviews; participants were not available for interviews at all time points. At 2 weeks after discharge, 66 (73%) individuals were interviewed; at 3 months, 49 (54%) were interviewed; and at 6 months, 33 (36%) were interviewed.

A summary of substance use after discharge is provided in Table 1. Opiate use was classified as no opiate use, lapse, reduced use or relapse. Reduced use was considered important from a harm-reduction

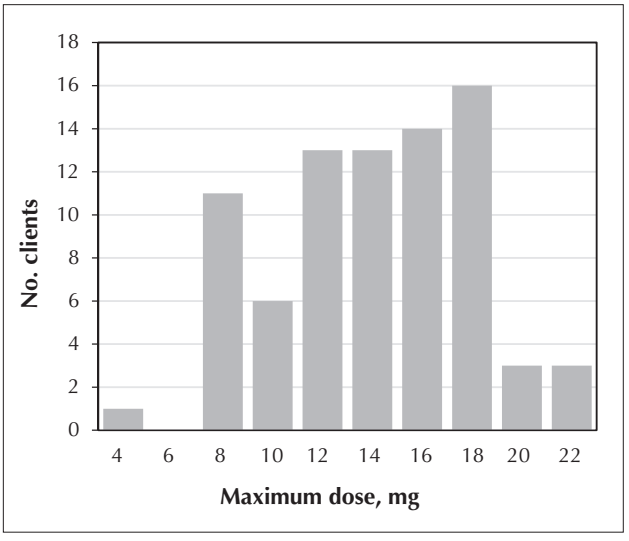

Fig. 1. Maximum prescribed doses of buprenorphine–naloxone.

perspective, because clients' risks for physical harm, financial instability and impact on performance in daily activities would be decreased. There was insufficient data for a comparative analysis; however, it was observed that a lapse or reduced use did not necessarily predict a relapse.

Overall, 97% of clients contacted at the 2-week interview said that they would recommend the program to others, or already had. The other 3% (2 clients) were not sure, with one of them clarifying that it was hard to be away from home.

When asked about what was helpful to achieve goals after discharge, clients described the importance of "keeping busy" and spending time with people who are supportive of their goals (Box 1). The following are examples of client responses:

- "Keep busy. Keep self away from friends. Right now, trying to keep myself healthy and clean and keep my life together. I'm with people who support me. I don't lie or hide the truth. Focus on future goals."
- "Positive attitude; more to life than drugs; seeing a whole new world."

Clients reported becoming more involved in community events, going fishing, doing yoga, walking, journalling, beadwork, attending pow wows, and caring for children or grandchildren as examples of healthy activities. Some clients spoke about needing to move from their home community to support goals of abstinence. Where available, community-based maintenance programs using buprenorphine–naloxone were also beneficial to many.

Asked about the challenges of achieving goals, clients explained that some friends and family members were not supportive, it was difficult to find work and there was a lack of opportunities to receive counselling.

DISCUSSION

In this program evaluation, we found that the MWSS has high success rates. Success is measured in several ways, including successful completion of the program, abstinence, a reduction in substance use, a change in the administration route (e.g., from intravenous to snorting) and achievement of individual goals. One of the factors that might be associated with outcomes is the quality of therapeutic engagement during the program, facilitated by a safe, respectful alliance between the health providers and clients.[13]

Comparatively, retention rates vary broadly in other programs described in the literature. One short-term residential medical withdrawal program in Ohio reported that 26% of their clients were discharged against medical advice over a 15-month period.[14] Another US study involving 644 people who attended short-term inpatient withdrawal services to establish buprenorphine or methadone maintenance doses reported retention rates of 83% and an average length of stay of 4 days.[6] We found that the MWSS had relatively high retention rates with a longer mean length of stay (12 d) and with most clients being tapered off buprenorphine–naloxone. One of the reasons that rates of successful completion were high may be Health Canada's Non-Insured Health Benefits Program for First Nations and Inuit people, which will fund travel for medical appointments. If a client is discharged "against medical advice," he or she must pay for the return flight out of pocket.

Many clients who continued to abstain from opiates at 3 months and 6 months after discharge were administered buprenorphine–naloxone at community-based treatment programs. However, a considerable number of clients who were discharged without

Table 1: Reported opiate use after discharge, *n* = 91

	No. (%) of clients				
Length of time after discharge	Reported opiate use	Lapse*	Reduced use†	Relapse‡	No follow-up
2 wk	42 (46)	9 (10)	7 (8)	8 (9)	21 (23)
3 mo	29 (32)	5 (5)	6 (7)	9 (10)	42 (46)
6 mo	27 (30)	NA	3 (3)	3 (3)	58 (64)

NA = not applicable.
*Opiate use once or twice after discharge.
†A return to opiate use at a quantity ≤ 25% of opiate use at intake, which in some cases involved less frequent weekly use.
‡A return to substance use at a quantity and frequency similar to intake or ≥ 25% of the intake dose and frequency.

maintenance medication successfully abstained from opiate use. In fact, even clients who did not successfully complete the program according to the defined criteria were able to maintain abstinence and achieve the goals that they had set on discharge.

Many program evaluations for addiction treatment programs included only the clients who successfully completed the program and were available for follow-up, thereby inflating abstinence rates for comparison with intentention-to-treat methods. The MWSS had success rates comparable to other program evaluations that included numerous exclusion criteria for data analysis. When comparing program outcomes, the MWSS rates of abstinence, lapse, and relapse include all clients (including those who left against medical advice and those lost to follow-up) and are similar to the finding of other programs after exclusion criteria for research have been applied.[14] Few rural comparators exist. A 2007 evaluation involving 604 clients enrolled in treatment programs in rural Kentucky found beneficial effects from short-term detoxification with buprenorphine–naloxone, measured as a substantial drop in criminal activity and increased employment at 6-month follow-up.[15]

According to Waldorf and colleagues,[16] "what keeps many heavy users from falling into the abyss of abuse, and what helps pull back those who do fall, is precisely this *stake in conventional life*. Jobs, family, friends — the ingredients of a normal identity." The clients interviewed for our study echo this in their descriptions of goal attainment that highlight the need to restructure daily routine. Clients returned to work and school, became more engaged in healthy meal preparation and exercise, spent more time with family and were more involved as leaders in their communities. Certainly, medications that manage withdrawal symptoms and cravings can play an important role in supporting abstinence. However, the goals that clients achieved extended beyond abstinence toward the creation of a better life for themselves and their families.

An important success of the MWSS is the positive feedback from clients about the program and the staff. Many clients experience stigma and negative judgment from health professionals, which results in avoiding requesting help when it is needed. Although not all clients achieved their goals or remained abstinent from substance use, they continue to call the unit for ongoing support when needed and have developed trusting relationships with health professionals. A positive experience with the MWSS may act to increase the likelihood that clients will access support in the future when they decide to make changes.

The need for clients to leave their community and family for a lengthy period with restricted contact is a deterrent for many people to attend distant, longer term residential programs. The MWWS, therefore, provides an essential and effective service because of its short duration. There is a parallel, ongoing need to support more community-based services, continuity of counselling before and after addiction intervention, outpatient buprenorphine–naloxone programs and family-based treatment programs in home communities.[5,17] These approaches would offer health care to far more people, reduce the financial burden of relying on inpatient services and potentially serve a preventative role. Community-based case management can support goals, such as securing employment, coordinating mental health counselling and access to other health services, and prevent relapse.[18] Inpatient withdrawal programs are recognized as particularly effective for individuals who have a short history of substance use before progression to injection, which reflects the recent experience in our region.[2,19]

Box 1: Sources of support after discharge

Physical

Internal

- Exercise
- Good sleep

External

- Staying away from people who use
- Moved communities
- Methadone/buprenorphine–naloxone
- Counselling
- Elders

Emotional

- "My kids"
- "Seeing my wife and kids happy"
- "Talking to someone I trust"
- Being positive
- "My kids are coming to me and hugging me more. I used to say 'don't hug me.' Now I hug back and don't feel tense or annoyed."

Mental

- Keeping busy
- Working
- Writing music
- Self-awareness
- Following a schedule
- Knowing that help is available

Spiritual

- Taking things a day at a time
- Praying
- Traditional practices (e.g., sweat lodges)

Limitations

Data collection was performed as a component of the health providers' role of assessment and information gathering. This shared duty had the advantage of making data collection feasible and sustainable; however, it posed a limitation to the rigour of data collection because therapeutic rapport was prioritized over collection of research data. A second limitation to the interpretation of the program outcomes may be the therapeutic nature of the follow-up interview, which had value that altered clients' perspective. Third, contacting clients after discharge was a challenge. Many clients reported that having a cellphone was a risk for relapse, so they disconnected their service; some clients moved; and others were attending a residential treatment program at the time of follow-up. Clients who relapsed may have chosen not to respond to follow-up telephone calls. Although simple telephone follow-up is not ideal, it was used because it was cost-effective and was used in many other primary care addiction programs described in the literature.

CONCLUSION

Hospital-based withdrawal and stabilization on buprenorphine–naloxone are relatively costly. However, given the context — a paucity of alternative services available that have comparable effectiveness — this approach is warranted. The MWSS provides an opportunity to address substance use that is not otherwise available to the residents in northwestern Ontario, and the program had positive outcomes for many clients, as well as for their families and communities.

Competing interests: None declared.

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Viewpoint

Community-based participatory research with Indigenous communities: The proximity paradox

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ABSTRACT

Community-based participatory research (CBPR) is a promising approach used with increasing prevalence in health research with underserviced Indigenous communities in rural and remote locations. This case comparison used CBPR principles to examine the characteristics of two collaborative research projects in Canada. Both projects reflected CBPR principles in unique ways with particular differences related to community access and proximity of collaborating partners. CBPR principles are often used and recommended for partnerships involving remote underserviced communities, however many of these principles were easier to follow for the collaboration with a relatively well serviced community in close proximity to researchers, and more challenging to follow for a remote underserviced community. The proximity paradox is an apparent contradiction in the increasing application of CBPR principles for use in distal partnerships with remote Indigenous communities when many of these same principles are nearly impossible to follow. CBPR principles are much easier to apply in proximal partnerships because they afford an environment where collaborative relationships can be developed and sustained.

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1. Introduction

New research paradigms are evolving to meet the health needs of Indigenous communities, and it is important to understand the implications of these approaches. According to the World Health Organization (2007), the global Indigenous population comprises over 370 million people in 70 different countries. The term Indigenous usually characterizes people who self-identify with a shared territory and heritage that predates colonial and settler societies (World Health Organization, 2007).

Over 1.4 million First Nations, Inuit and Métis people from Canada's Indigenous population (Statistics Canada, 2013)[1], many of whom live in rural and remote communities or reserves dispersed across Canada's expansive geography. There are 617 First Nation communities in Canada representing a wide variety of cultural groups with 50 distinct languages (Aboriginal Affairs and Northern Development Canada, 2013). Most of these communities are located in their traditional geographic territories which predates colonization and mass immigration from Europe and other regions of the world. In the province of Ontario, nearly 25% of the 133 First Nation communities are located in the isolated Far North region of Ontario (Chiefs of Ontario Office, 2013; Ministry of Natural Resources, 2013). The Far North region is a relatively new designation used by the Ministry of Natural Resources in Ontario to describe the vast northern region of the province. Most of the communities in this region are only accessible by air or ice road in winter. Thus, access to mainstream health services, programs, and resources is a significant challenge for many remote Indigenous communities.

In order to reflect a broader international perspective, we use the terms Indigenous in place of the terms Aboriginal, First Nations, Native American Indian, and Tribe. Similar to other colonial countries such as Australia, New Zealand, and the United States, there is a long history of imperialism and discriminatory policies in Canada that have marginalized many Indigenous people and communities. The 1996 Report of the Royal Commission on Aboriginal Peoples

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[1] Indigenous people in Canada are collectively referred to as Aboriginal peoples, and the Canadian constitution recognizes three distinct groups of people: Indian (commonly referred to as First Nations), Métis and Inuit (Aboriginal Affairs and Northern Development Canada, 2013).

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represented a turning point in Canada, since it identified many of the historical policies and practices of "domination and assimilation", such as treaty making, establishment of reserve lands for communities, and developing a network of residential schools Royal Commission on Aboriginal Peoples in Canada (1996). Research practices related to Indigenous people worldwide have followed a similar legacy of imperialism (Smith, 2012). In recent years in Canada, there has been a positive shift and evolution in ethical guidelines involving research with Indigenous people to redress earlier deficiencies (Brant-Castellano, 2004; Canadian Institutes of Health Research, 2010, Chapter 9; Martin-Hill and Soucy, 2005; Schnarch, 2004). Castleden et al. (2012, p. 166) summarized this evolution and concluded that "partnership approaches informed by community collaboration is [are] clearly necessary".

Community-based participatory research (CBPR) has emerged as a collaborative approach to health research well suited for diverse populations in many underserviced areas, such as those in rural and remote locations (Israel et al., 2005b; Minkler and Wallerstein, 2008a). Often remote populations have a "disproportionate burden of morbidity and mortality… with few economic and social resources" (Israel et al., 2008, p. 48). The literature recommends collaborative research in geographically isolated communities, as it is essential to address local research questions and needs (Israel et al., 2008; Lightfoot et al., 2008). CBPR approaches vary from project to project to adapt to the unique contextual challenges and rewards that are often encountered with Indigenous populations (Lardon et al., 2007; LaVeaux and Christopher, 2009; Maar et al., 2011; Mohammed et al., 2012; Peterson, 2010). Understanding the nature of these adaptations is essential to guide research with Indigenous populations in Canada and beyond.

The purpose of this paper is to compare two CBPR projects with two different Indigenous communities in northern Ontario, Canada, both of which are geographically isolated, but to a different degree. This comparison has global significance, since it profiles CBPR approaches with respect to the proximity of collaborating partners.

The first project was the integrated development and evaluation of an Outdoor Adventure Leadership Experience (OALE) using a mixed methods design. The collaboration involved community leaders from Wikwemikong Unceded Indian Reserve and researchers from Laurentian University. The OALE is an intervention designed to promote resilience and well-being for adolescents from the Wikwemikong community (Ritchie et al., 2010, 2012). Wikwemikong (population 2592) is a rural Indigenous community with road access. The second project was the integrated program development and evaluation of the Sachigo Lake Wilderness Emergency Response Education Initiative (SLWEREI), using qualitative methods. The SLWEREI is a community-based first aid training program with adapted curriculum for lay members in remote locations (Born et al., 2012; Orkin et al., 2012). The collaboration included community leaders from Sachigo Lake First Nation along with researchers from Laurentian University and the Northern Ontario School of Medicine. Sachigo Lake (population 450) is a remote Indigenous community with no permanent road access.

The first author (SR) was directly involved in both research projects, and was therefore in a position to coordinate the comparative analysis in collaboration with colleagues from both teams (OALE and SLWEREI). We use this comparison to advance what we dub the proximity paradox – the observation that the geographically isolated communities that might benefit most from involvement in CBPR initiatives are the very communities where a CBPR approach also becomes most challenging.

2. Community-based participatory research (CBPR)

CBPR is a collaborative approach to research that is usually characterized by community leaders partnering with university-based researchers to address a mutual health concern. There is a need for CBPR approaches when "researchers, practitioners, and community members are to address the growing disparities in health status between marginalized communities and those with greater social and economic resources" (Israel et al., 2008, 61). Maiter et al. (2008) used the term reciprocity to describe the foundational trust and respectful relationships that are essential to effective CBPR. Israel et al. (2005a) emphasized the process of sharing expertise, decision-making, and ownership through equitable involvement of partners in all phases of the research from inception through to implementation and dissemination. Minkler and Wallerstein (2008b) differentiated research that is community-based from that which is simply community placed, suggesting that the CBPR process is a cooperative alliance characterized by research, action, and education within the community.

There are many principles and guidelines for effective CBPR, however one of the most cited was originally synthesized as eight principles (Israel et al., 1998), and then later expanded to nine principles (Israel et al., 2005a, 2008). These are outlined in Table 1. Since CBPR has been used in many projects involving Indigenous communities, it may offer a decolonizing methodology (Smith, 2012) that is responsive to ethical concerns concordant with recommended approaches for community engagement (Canadian Institutes of Health Research, 2010). LaVeaux and Christopher (2009) offered nine additional recommendations for consideration by researchers endeavoring to collaborate with Indigenous communities, and these were later applied as principles in the evaluation of seven CBPR partnerships with Native American communities (Christopher et al., 2011). These are outlined in Table 2. We used the nine CBPR principles outlined by Israel et al. (2005a, 2008) and the nine CBPR recommendations identified by LaVeaux and Christopher (2009), as the basis for comparing the OALE and SLWEREI projects.

Table 1
Principles of CBPR for health[a].

1. Recognize community as a unit of identity
2. Build on strengths and resources within the community
3. Facilitate collaborative, equitable partnerships in all research phases and involve an empowering and power-sharing process that attends to social inequalities
4. Promote co-learning and capacity building among all partners
5. Integrate and achieve a balance between research and action for the mutual benefit of all partners
6. Emphasize public health problems of local relevance and also ecological perspectives that recognize and attend to the multiple determinants of health and disease
7. Involve systems development through a cyclical and iterative process
8. Disseminate findings and knowledge gained to all partners and involve all partners in the dissemination process
9. Focus on a long-term process and commitment to sustainability

[a] Adapted from Israel et al., 2008.

Table 2
Principles of CBPR with Aboriginal communities[a].

1. Acknowledge historical experience with research and health issues and work to overcome the negative image of research
2. Recognize traditional sovereignty
3. Differentiate between band and community leadership
4. Understand community diversity and its implications
5. Plan for extended timelines
6. Recognize key gatekeepers
7. Prepare for leadership turnover
8. Interpret data within the cultural context
9. Utilize indigenous ways of knowing

[a] Adapted from LaVeaux and Christopher, 2009; and Christopher et al., 2011.

3. CBPR and the OALE project

The OALE project was developed over several years (2008–2011) using a CBPR approach (Ritchie et al., 2012, 2010). The OALE addressed a compelling community need to promote adolescent resilience and well-being, using outdoor adventure leadership as the medium. It was developed for Wikwemikong adolescents ages 12–18 yr as an immersive experience in the natural environment. Principles of wilderness adventure therapy were used to develop and implement a proprietary 10-day training program unique to the local context and geography. The program was implemented entirely in the wilderness during a canoe excursion homeward in the community's traditional territory.

Close proximity between collaborating partner locations (Sudbury and Wikwemikong, Ontario) facilitated relatively easy access (170 km/2 h drive). OALE development meetings, presentations, workshops, and training occurred frequently through face-to-face interactions in Wikwemikong and at Laurentian University in Sudbury. Research data validity processes included numerous member check meetings, and co-analysis and review of results by a Community Research Steering Committee with Elder oversight. Well-developed and committed relationships emerged amongst most members of the interdisciplinary team.

Institutional (university) ethics approval was received and maintained throughout the project. Local ethics approval in Wikwemikong was granted through an independent regional committee (Manitoulin Anishinabek Research Review Committee), endorsed by the Health Services Committee in the community, and supported by Chief and Council. Unfavorable historical experiences with research in Wikwemikong has led to well established protocols Blodgett et al., 2010. Findings were disseminated via co-presentation at conferences, co-authorship on papers, and ongoing collaborative program review and development. The OALE program is currently well established, sustainable, owned, and managed entirely by the community. Capacity building is focused on train-the-trainer, summer student training, and community researcher training.

4. CBPR and the SLWEREI project

The Sachigo Lake Wilderness Emergency Response Education Initiative (SLWEREI) was developed over several years (2009–2012) using CBPR (Born et al., 2012; Orkin et al., 2012). The SLWEREI addressed a compelling community need for pre-hospital first response, since there is no paramedic service in Sachigo Lake. It involved a system of curriculum development and training for lay community members so they have the capacity to respond appropriately to medical emergencies on-scene, and gain skills in emergency health management through direct interaction with experienced professional paramedic and physician providers. Principles of wilderness emergency management were used to develop and implement 5-day training program well suited to the local context and community. For instance, the program was modified to include a module on mental health first aid and an enhanced focus on CPR with AED (automatic external defibrillator) support.

As a remote fly-in community, Sachigo Lake presented many challenges related to access (minimum 425 km/costly flight). With the exception of an on-site needs assessment early in the program's development, nearly all SLWEREI planning meetings occurred via telephone and usually involved channeling communication through one or two individuals from the community and research teams. Research data validity processes were very challenging due to lack of proximity of collaborating partners. Relationship building and project development was challenged by the lack of face-to-face meetings. Sustained commitments from technical experts and key champions in the community and on the research team were essential to ensure project continuity and sustainability.

Institutional (university) medical research ethics approval was received and maintained throughout the project. Local ethics review in Sachigo Lake involved verbal approval by Chief and Council, and regional approval from the Nishnawbe Aski Nation and Sioux Lookout First Nations Health Authority. This process reflected previous favorable local experiences with research in Sachigo Lake. Findings were disseminated locally and through academic fora by the university research team. The SLWEREI program is currently well established and managed primarily by committed clinicians and researchers from outside the community. Current capacity building is focused primarily on front-line workers and lay community members through delivery of the SLWEREI program by researchers from outside the community.

5. Comparative results

The OALE and SLWEREI were unique projects, but their similarities permitted a comparison of CBPR approaches. Both projects were multi-day experiential education training programs that evolved over several years. Each program included design, implementation, and evaluation phases, and development was iterative and focused on community systems (health services and education). Resources and strengths within each community directly influenced the projects and programs of research. For instance, community leaders at the Waasa Naabin Community Youth Services Centre in Wikwemikong provided the staff, equipment, meeting location, and resources necessary to manage and develop the OALE. In Sachigo Lake, members of the Emergency Response Team, Crisis Response Team, and Canadian Rangers participated and promoted the SLWEREI within their community. Both projects were characterized by a culture of co-learning and equity, and this resulted in genuine and committed relationships between collaborators extending beyond the research context. This sensitized researchers to varied Indigenous ways of knowing (such as the importance of experiential learning) which influenced program development and delivery. Both projects experienced leadership turnover, delayed timelines, and changing gatekeeper roles; these experiences challenged project development.

Important differences between the two CBPR approaches are outlined in Table 3. The most noteworthy differences were related to the degree of geographical isolation. Sachigo Lake is a small remote community located in Ontario's far north, with very limited Internet connectivity and difficult access due to long costly flights that are only possible in favorable weather. Naturally, the SLWEREI project collaborators had few opportunities for face-to-face interaction. Other research teams using CBPR approaches with Indigenous communities have highlighted challenges, learnings, and recommendations (Caldwell et al., 2005; Holkup et al., 2004; Lardon et al., 2007; Maar et al., 2011; Minore et al., 2004;

Table 3
Key differences related to CBPR.

	OALE (Wikwemikong)	SLWEREI (Sachigo Lake)
History of research	Extensive with many negative experiences[a]	Few experiences; most were favorable
Issue of local relevance	Adolescent mental health	Pre-hospital emergency response
System development to address local issue (need)	Health promotion focus using principles of wilderness adventure therapy to develop a culturally relevant program and medium (nature) for delivery	Health systems focus using principles of wilderness emergency first aid to develop community and context specific curriculum and training
Project approval and review process (ethics)	Review and written approval by regional Manitoulin Anishinabek Research Review Committee Motions of support by Health Services Committee and Chief and Council Community Research Steering Committee provided oversight and guidance Signed formal research agreement	Formal verbal assent by Chief and Council[b] Written support from Nishnawbe Aski Nation and Sioux Lookout First Nations Health Authority Research agreement used as a tool to clarify relationships and expectations
Access and proximity	Primary access by road which is open year round Distance (by road) is 170 km between Wikwemikong and Laurentian University	Primary access by air (flight) in fair weather conditions only; winter road is open a few weeks each year Distance (by air) from Sachigo Lake to Northern Ontario School of Medicine (West Campus) is 640 km and to Laurentian University is 1145 km
Nature of collaboration	Numerous phone calls, e-mails, and face-to-face meetings and presentations in community and at university Numerous dissemination activities within community including invited presentations, open community wide update meetings, and informal ad-hoc meetings	Telephone and e-mail was primary mode of communication usually channeled through one or two key members of the collaborative team Very few face-to-face meetings or presentations in community other than initial onsite needs assessment (in May 2010) and program delivery (in November 2010 and May 2012)

[a] See Blodgett et al., 2010 for a historical perspective of research in Wikwemikong.
[b] Chief and Council preferred providing project support and approval verbally rather than through a motion of support, written resolution, or signed agreement.

Mohammed et al., 2012), but few have explored ways to adapt CBPR practices and principles when partnership communities are located in isolated areas, or distant from research centres.

Castleden et al. (2012) surveyed 15 CBPR researchers involved in collaborations with Indigenous communities, and they identified financial and time constraints as significant barriers, especially for respondents engaged in partnerships with northern and remote communities. Lardon et al. (2007) described the tremendous challenges of CBPR related to their project in remote Indigenous villages in the Yukon–Kuskokwin river delta in Alaska:

> *The geographical remoteness of these villages, combined with weather conditions in the region, an underdeveloped telecommunications infrastructure, a less than reliable power supply, and a host of other factors present researchers with significant challenges that increase costs and time needed to complete research. Since strong kinship and personal, face-to-face communication is the social norm, researchers must spend additional time in villages to make themselves known, trusted, and accepted.* (Lardon et al., 2007, 135)

Despite these challenges, Lardon et al. (2007) went on to describe a committed CBPR strategy that included ongoing e-mail, weekly phone conferences, and village visits eight times per year. Other researchers have indicated that CBPR approaches with smaller Indigenous communities may not be respectful processes of their members' availability to engage in collaborative activities requiring significant time commitments (Castleden et al., 2012; de Leeuw et al., 2012).

In the introductory chapter of their edited text on CBPR, Minkler and Wallerstein (2008b, p.12) stated that "the fight against disparities can be won only if the most oppressed communities can be fully engaged as research partners…". For many researchers this imperative reflects an implicit directive to head north to remote Indigenous communities, armed with CBPR principles, and perhaps oblivious to the challenges of distance. Researchers have identified the importance of building close trusting relationships as an integral part of the CBPR process (Christopher et al., 2011; Maiter et al., 2008; Minkler and Wallerstein, 2008b), yet developing these relationships requires a significant commitment that seems to be confounded by access and distance between collaborating partners. It is clear that such an approach, and the associated financial and convenience factors, favor the implementation of CBPR projects in underserviced communities in close proximity to large academic research centres. Methodologies requiring impractical or unfeasible investments over long distances may result in the exclusion of remote communities from CBPR undertakings, and serve to magnify existing health inequities and research gaps (Born et al., 2012).

5.1. Key learnings

There were five key learnings that emerged from comparing the two CBPR projects.

1. Key community champions and strong relationships with researchers ensured continuity and sustainability in both projects.
2. Core values such as integrity, trust, reciprocity, and mutual respect were foundational elements in both projects.
3. The ethical review and project approval process were unique and vastly different for each community.
4. Communication and face-to-face interaction were necessary for relationship development in both projects, yet they were much more challenging in Sachigo Lake.
5. Geographic distance between collaborating partners, time commitment required, travel and logistics planning, uncertainty related to weather, and extensive costs were major

Fig. 1. Proximity map of collaborating partners and other remote communities.

challenges to CBPR in Sachigo Lake. This required the adaptation of CBPR principles to create a unique methodological approach appropriate for the specific context and collaboration (see Table 3).

It was clear that following CBPR principles and recommendations was much more challenging for research in a remote location such as Sachigo Lake. Although variability in CBPR principles is expected for different projects (Israel et al., 2008), the varied approaches in these two cases highlighted the need for pragmatic and often difficult adaptation to guide the partnerships appropriately.

5.2. *The proximity paradox*

Comparing these two projects highlights a proximity paradox. CBPR principles were easier to follow for the collaboration with a relatively well-serviced community in close proximity (Wikwemikong), and much more challenging to follow for an underserviced community that is not in close proximity (Sachigo Lake). An implicit assumption in the CBPR literature and principles, is that in less serviced communities where the needs are greatest, the use of CBPR approaches are even more appropriate and applicable. Thus, CBPR principles and methods seem to be uniquely suited and recommended for research with small Indigenous communities with distinct cultures; but they are contingent on strong relationships. When you impose geographic distance, challenging and costly travel, and uncertainties associated with climate, relationships are nearly impossible to develop and maintain in remote isolated communities. This highlights a conundrum for potential collaborators. The proximity paradox is the apparent contradiction between needs and ease of application. CBPR principles seem to be strongly encouraged for use in distant or underserviced Indigenous communities, yet they are more difficult to apply in these same communities. Conversely, they are much easier to apply in proximal partnerships where the needs may be less pronounced.

While we have these experiences in Northern Canada, we imagine the context is not unique. So too in other countries where academic hubs are in major urban areas, researchers travel variable distances from university campuses to work with communities with differential health services available. Fig. 1 portrays the effect of distance in a proximity map of collaborating partners (OALE and SLWEREI). Other remote First Nations communities identified on the map are located in the Far North region of Ontario (Ministry of Natural Resources, 2013).

There are potential ramifications to this paradox that lead to a dilemma for the future of CBPR-type research in the far north of Ontario as well as in other isolated Indigenous communities around the world. Aboriginal health researchers committed to CBPR principles and recommendations may: (1) avoid partnering

with remote underserviced communities even though these same communities may benefit or demonstrate the most compelling need for locally-appropriate health research interventions; or (2) partner with remote underserviced communities and navigate the additional challenges and difficulties related to adhering to principles and "best practices" that seem better suited for "convenient collaborations" in more urban areas. Community health leaders in remote locations may: (1) face difficulties attracting and sustaining partnerships with health researchers who may not have the time, resources, or dedication to tackle the methodological challenges related to implementing CBPR-type projects in remote regions; or (2) not have the time, resources, or dedication to invest in a demanding CBPR process with researchers from distant locations. Paradoxically, this situation may perpetuate and entrench the very research gaps and health inequities that CBPR researchers might otherwise seek to address. Best practices in CBPR and other collaborative research approaches must be as flexible and varied as the researchers and communities involved. They must reflect the place and proximity of the collaborating partners.

5.3. Conclusion

We are convinced that the challenge, rewards, commitment, and success of the OALE and SLWEREI projects were all inextricably linked to the foundational relationship development achieved through face-to-face interaction. The proximity paradox is not just about geographical distance and remoteness, but more concisely about the ways that proximity plays out in the social sphere through the foundational relationship building that makes CBPR so successful. New funding models need to recognize and provide financial support for these face-to-face interactions in order for effective collaborations to emerge.

The future of health research in isolated areas of the world requires new paradigms, custom approaches, and modified methods that work for the communities and collaborating partners involved. These approaches may or may not reflect conventional CBPR. For instance, communities may need to network together with large collaborative research teams to access more extensive funding for longer time periods. Emerging cost-effective communication technologies may also help by supplementing face-to-face interaction with web-based tools, social media, and video conferencing from a distance (Jones et al., 2008).

An important CBPR principle is to recognize community sovereignty (LaVeaux and Christopher, 2009; Christopher et al., 2011); this implies that Indigenous communities are heterogeneous. We must be cautious in applying homogeneous CBPR principles (and recommendations) to heterogeneous communities and research imperatives. The choices and approaches taken by committed CBPR researchers must differ across settings. Research methodologists must be equipped to identify, develop, and implement the most appropriate methodologies for unique settings and relationships, rather than seeking to apply a singular approach to all CBPR undertakings. The slogan "this is how we do research in our community" may better reflect a decolonizing approach, support a path towards self-determination, and carry more implicit credibility than the slogan "this project followed the principles of community-based participatory research".

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Developing Supportive Workplace & Educational Environments for Aboriginal Nurses

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Main Messages

- The cultures of Aboriginal people differ greatly, as does individuals' knowledge about them. So, similarity should not be assumed in either regard. It is unfair to expect nursing students or working nurses to be experts about a non-existent pan-Aboriginal culture, although this happens on a routine basis.
- The majority of colleges and universities offer some components of their nursing curricula *via* distance education. However, Aboriginal targeted marketing of this fact is needed. It is an option that will appeal to potential students, especially those who are older and have family responsibilities, or who live in rural/remote areas and are intimidated by the thought of studying in an urban centre.
- It is important to link students to academic and psycho-social supports in a deliberate way from the outset, rather than assuming that they will find needed services on their own.
- Schools of nursing should consider developing curricula based on the Aboriginal cultural competence and cultural safety framework for First Nations, Inuit, and Métis Nursing created by the Aboriginal Nurses Association of Canada, the Canadian Association of Schools of Nursing, and the Canadian Nurses Association.
- Employers should provide in-service education of sufficient depth and breadth so that all staff members are familiar with cultural features of the Aboriginal groups predominant in their catchment area, as well as the social, political and historical factors that may affect their health and well being. This will benefit nurses, other staff and clients of Aboriginal heritage.
- Employers should not rely on general harassment, bullying or discrimination policies to protect Aboriginal nurses or other staff in the workplace. Aboriginal-specific provisions should be developed to make such protections explicit.
- Employers should ask Aboriginal nurses on staff what is needed to make their specific workplace one where they feel welcome and where they know their cultural and nursing knowledge are both respected.
- A lot is being done by the schools of nursing at Ontario's colleges and universities to attract and keep Aboriginal students. So, too, employers across the health system encourage the recruitment of First Nations, Inuit and Métis nurses in the belief that they will benefit clients of similar heritage. Still, Aboriginal people in both sectors have unmet needs that require further attention.

Executive Summary

The exact numbers of nurses and nursing students of Aboriginal heritage in Ontario are not known, but they are disproportionately small relative to the size of the Aboriginal population. To increase the participation of First Nations, Inuit and Métis people in the nursing workforce requires supportive education and work environments where individuals feel safe, respected and in which cultural understandings of health are valued. This study asks what Aboriginal students and nurses themselves believe is essential to make work and school places where they feel welcome and their cultural interpretations are acknowledged. It also documents the challenges of creating such environments, and the strategies to do so in use by schools of nursing and health organizations serving significant Aboriginal populations.

The project was undertaken in collaboration with the Aboriginal Nurses Association of Canada, the Métis Nation of Ontario, the Registered Practical Nurses Association of Ontario, the Sioux Lookout Health Authority, and the North West Local Health Integration Network. Each of these groups was represented on the six member steering committee (along with a nurse educator) that guided the research team, which itself included nurses of Aboriginal heritage. Two of the project research assistants, who did most of the interviews, were First Nations members. Data came from 94 in-depth, open-ended interviews with Aboriginal nursing students and practicing nurses, nursing educators and supervisors or health system administrators.

The traditional beliefs, customs and practices of First Nations, Inuit and Métis Canadians vary considerably, depending on their people's territory and tribal history. However, non- Aboriginal colleagues and supervisors may believe that the Aboriginal nurses with whom they work have cultural knowledge that is pan-Aboriginal in nature. Further, it may be assumed that their mere presence will meet the cultural needs of Aboriginal clients. So they are relied upon as *the Aboriginal experts*. In fact, while these nurses may understand the importance of culture in care, their specific knowledge will likely pertain to their own cultural group to a large extent. Moreover, many of the nurses said they were not knowledgeable about their people's traditions, or, as Christians, felt ambivalent about some of the spiritual beliefs. Nonetheless, when asked by clients or colleagues, the nurses helped as best they could. For example, they might teach others a few phrases of greeting in the local dialect (if they know it).

Nurses' cultural knowledge shapes their practice in four ways: tolerance, advocacy, boundaries and interventions. It gives them greater tolerance and willingness to accommodate clients' culture-linked preferences, even when doing so interferes with usual care giving activities. It also gives them a basis for advocating on behalf of clients, as happened when a maternity nurse intervened to ensure that a miscarried foetus was given to the parents for burial, rather than handled as biomedical waste. However, traditional beliefs can restrict their practice; in one instance a pregnant nurse declined to work in palliative care, in case a death occurred, because of a time-honoured belief that seeing a dead body might endanger her unborn child. Finally, in light of their cultural understanding, these nurses interpretation of symptoms may differ, particularly in the domain of mental health.

The vision statements of most health care facilities embrace inclusive ideals. But often these are not made real in practice. There is a tendency to rely on general policies to protect staff members against workplace harassment, discrimination or bullying. However, Aboriginal specific policy provisions would reduce the likelihood of prejudicial interpretations under broad policies; for example, Aboriginal spiritual beliefs should be explicitly protected under the right of religious freedom.

Students report supportive faculty and generally good relations with their peers. And faculty members laud the contributions Aboriginal students made in the classroom. Unfortunate incidents do occur; an illustrative situation involved non-Aboriginal students making statements that derive from hurtful stereotypes. Some instructors also turn to the Aboriginal students for answers whenever the questions are about Aboriginal health, which makes them feel uncomfortable. This is especially the case since so much of the relevant curricula are negative in nature, focusing on high rates of disease and violent death. Moreover, information is not contextualized, taking into account determinants of health or the assimilation policies of the post- colonial era (like residential schools). A better balance could be achieved by developing course content based on the cultural competence and cultural safety framework for First Nations, Inuit, and Métis Nursing, created in 2009 by the Aboriginal Nurses Association of Canada, the Canadian Association of Schools of Nursing, and the Canadian Nurses Association.

Certainly recruitment of more First Nations, Métis and Inuit people into nursing careers, and retaining those in practice, is essential. But their full participation can occur only in work environments where there is a deep understanding of the cultural dimensions of Aboriginal health, where Aboriginal nurses feel safe in sharing from their culture's perspective, confident that. Aboriginal ways of knowing are respected and welcome, and where their roles are not circumscribed by the assumptions of others. The situation in nursing education is the same. It is not sufficient to recruit Aboriginal students and, if needed, to provide special learning, counseling, or financial supports. Schools of nursing must be places that foster inclusion and encourage the exploration of Aboriginal knowledge and its application to practice.

The results of the study will inform educators and employers about what must be done to create and sustain supportive environments and, hence, recruit and retain Aboriginal students and nurses. Ultimately, Aboriginal clients will benefit from having more nurses who share some of their life experiences and worldviews.

Context

Ontario wants to increase the participation of Aboriginal people – *as Aboriginal people*– in the province's nursing workforce. Italics are added here to emphasize that this is not just a matter of numbers. Increasing participation also means that individuals are able to confidently contribute both their clinical knowledge as nurses and their cultural knowledge as Aboriginal people. Achieving this goal depends on understanding and overcoming the challenges that First Nation, Inuit and Métis individuals often encounter in nursing education and practice. Recruitment and retention – both school and employment – require supportive environments where individuals feel safe, respected and in which cultural understandings of health are valued. The authors believe this study will contribute significantly to the knowledge required to create such environments. By asking nursing students, registered nurses and registered practical nurses of Aboriginal heritage to reflect on their preparation for practice and their on-the-job experiences, it identifies learning and practice needs that are unique to their respective cultural groups. In addition, the organizational challenges involved are addressed through interviews with nursing school administrators/faculty and nursing supervisors/managers/administrators at health care facilities where developing and maintaining Aboriginal-specific supportive environments for staff and clients are priorities.

Aboriginal health human resources research tends to have a deficit orientation, for example, looking at the barriers to educational success. In contrast, by focusing on educational and workplace environments that encourage and sustain Aboriginal participation in nursing, the present study takes a strengths-based, solution oriented approach. Moreover, it shifts from the usual supply (low) / demand (high) analyses of practitioners or students, to look at the relational processes involved in Aboriginal nursing education and practice. This is in keeping with recruitment and retention strategies that encompass the concept of cultural safety, like the nursing education framework proposed by one of our partners, the Aboriginal Nurses Association of Canada, along with the Canadian Association of Schools of Nursing and the Canadian Nurses Association.

The study asks three questions: *1. What constitutes a supportive educational environment for Aboriginal nursing students? 2. What constitutes a supportive work environment for Aboriginal nurses? 3. Are cultural interpretations of health respected in nursing educational programs and workplaces?* As worded, these questions seem deceptively simple. But there are multiple dimensions to each one. The educational environment is not limited to the nursing program, but extends to the host institution as well. And acceptance of students' cultural input is not limited to offering Aboriginal perspectives, but takes into account differences in their style of learning and communication. Similarly, experiences in the workplace are determined not just by the attitudes and expectations of others, but by the nurses' application of their own cultural knowledge when providing care.

Although there are snapshot counts of Aboriginal nurses working in specific Ontario contexts, like First Nation reserve communities (Minore et al.. 2008), or reported as registered in Ontario Schools of Nursing (Gregory and Barsky, 2007), actual totals for the province are not known, since that would require systematic self-identification. Nonetheless, there is no reason to doubt the view that the number is small relative to the size of the Aboriginal population. The situation is the same in other Canadian jurisdictions (Kulig &

Stewart, 2006). Such shortages create particular challenges for the health care system. There is general recognition that Aboriginal clients often have unique care needs that require both clinical and cultural competence (Hunter et al., 2004). Recruitment of more people of Aboriginal heritage into the profession is widely seen as the best way of meeting this dual competency imperative (Minore et al., 2007). For the same reason, there is a need to retain those who are currently in practice (Stewart et al., 2006). Having more First Nations, Inuit, and Métis nurses, especially in leadership positions, would help foster Aboriginal friendly work environments and create role models (Nichols, 2004).

Concerted efforts have been made to increase Aboriginal enrolment in nursing programs in Canada (Ontario, 2005; British Columbia, 2007; Anonson, Desjarlais, Whiteman, & Bird, 2008), including a significant investment through Health Canada's five-year Aboriginal Health Human Resources Initiative created in 2005. While some programs are relatively recent, a few have lengthy track records. For example, to improve the chances of student success, the Native Nurses Entry Program was established at Lakehead University in 1987. This one-year preparatory program was the first one in Canada that enabled Aboriginal students' direct entry into a School of Nursing. The University of Saskatchewan's Native Access Program to Nursing has a parallel history. In creating such post-secondary bridging opportunities, experience has shown that partnering with and taking direction from Aboriginal communities, organizations and people are keys to success (Wilson, 2008). This type of program offsets knowledge deficits that often date back to students' primary education at on-reserve schools. An alternate remedy would see better engagement of elementary and high school students in the math and science classes that are necessary for nursing school entry (Nursing Sector Study Corporation, 2004; Araluk, 2009).

In the case of regular practical nurse and nurse programs, Aboriginal students value instructor accessibility, flexibility, support and advocacy (Arnault-Pelletier, Brown, Desjarlais, &McBeth, 2006). They may have specific financial, learning or family care needs, and have to deal with non-acceptance on the part of non-Aboriginal classmates and instructors (Martin & Kipling, 2006, Vukic et al., 2012). Schools vary, but most have dedicated resource centres which help students to cope by providing academic, social, and cultural support (National Aboriginal Health Association [NAHO], 2004; Hill, 2007). However, with exceptions (Arnold et al., 2008), cultural content of a type relevant to these learners (Curran, Solberg, LeFort, Fleet, & Hollett, 2008) is often missing from the curricula, or is inappropriately addressed from a western epistemological perspective (Kulig et al., 2010). To change this, the Aboriginal Nurses Association of Canada, the Canadian Association of Schools of Nursing, and the Canadian Nurses Association jointly developed the *Cultural Competence and Cultural Safety in Nursing Education: A Framework for First Nations, Inuit, and Métis Nursing* (Aboriginal Nurses Association of Canada [ANAC], 2009). A pilot project was undertaken at six schools to introduce new content based on the identified competencies; it is hoped that the results, published in 2011, will encourage wide-spread adoption of the framework (ANAC).

Research evidence suggests that Aboriginal students tend to conceptualize information holistically and visually, preferring learning environments that emphasize collaboration rather than competition (Hilberg & Tharp, 2002). A review of the literature on recruitment and retention of Aboriginal nursing students documents various strategies, like case-based group

work, to increase levels of comfort, confidence and performance (Smith, McAlister, Tedford- Gold & Sullivan-Bentz, 2011).

As is the case for most new graduates, the transition to practice is challenging. They need help in navigating the job search and exam licensure process (McBride & Gregory, 2005), as well as in adapting to a new workplace (Wikaire & Ratima, 2011) or new role if they are returning to their home community (Katz, O'Neal, Strickland, & Doutrich, 2010).

Understanding the relational processes involved in Aboriginal nursing education and practice is essential (Browne & Varcoe, 2006; Simon, 2006). The nursing concept of cultural safety provides a powerful lens through which to examine the social, economic, political, historical and power dynamics underlying these processes (NAHO, 2008). First articulated in the 1980s by Maori nurse Irihapeti Ramsden (Ramsden, 2002), cultural safety requires that the provision of care to Indigenous peoples be contextualized, taking into account not only cultural distinctions, but also inequities that may affect provider-recipient interactions. In other words, "cultural safety finds expression in caring spaces that are equality seeking and rights oriented" (Dion Stout & Downey, 2006, p.327). This concept extends to Aboriginal nurses in the workplace and Aboriginal students in nursing programs. In either setting they need to feel that they are respected and that their perspectives are welcome and valued – they need to feel, in a word, *safe*. Failure to appreciate the importance of this can have profound effects. For example, every one of the inaugural group of 77 graduates from a Licensed Practical Nurses program for Aboriginal students left their first places of employment in the Prince Albert Health Region, a pattern that changed for succeeding cohorts of graduates only when cultural awareness training was introduced in these workplaces (Saskatchewan Institute of Public Policy, 2007).

Note: This article has been abridged for the purposes of this publication.
For the full article go to www.cranhr.ca/pdf/Aboriginal_Nurses_Study_March_2013.pdf

Community-Based Emergency Care

An Open Report for Nishnawbe Aski Nation

March 2014

Community-Based Emergency Care

This report is dedicated in memory of Jack Tait of Sachigo Lake First Nation.

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People in remote and isolated First Nation communities should have access to excellent community-based first response emergency care.

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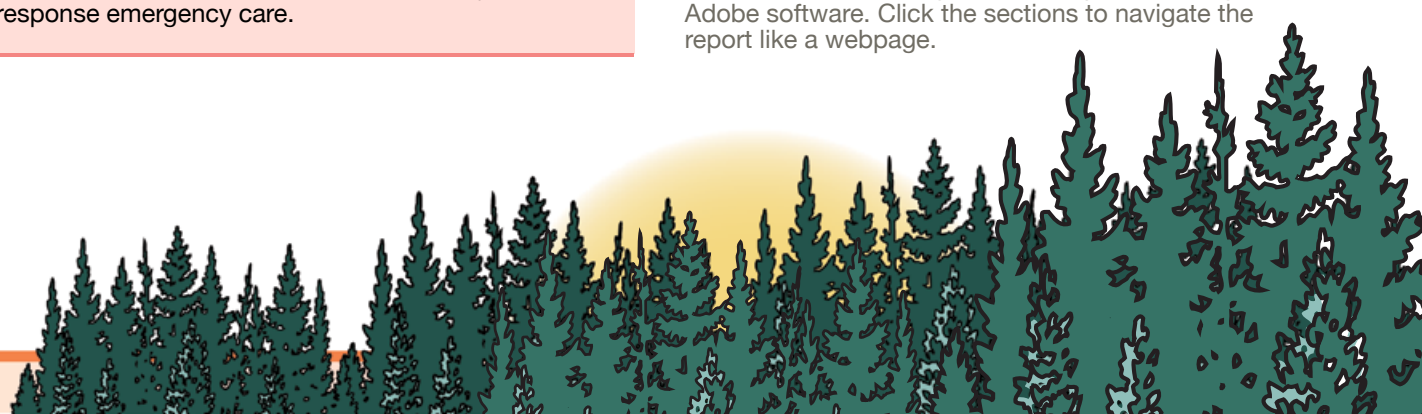
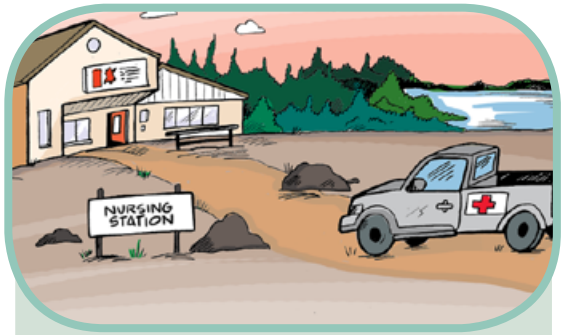


INTRODUCTION & KEY TERMS

This report summarizes the learnings of the Community-Based Emergency Care Roundtable, a two-day *multi-jurisdictional* meeting held in October 2013 in Sioux Lookout, Ontario. The purpose of this meeting was to discuss and address pre-nursing station emergency care needs in remote and isolated First Nation communities in Ontario. Representatives of First Nations' governance and community organizations, Ontario Provincial and Canadian Federal governments, nursing and paramedical services, and non-governmental organizations joined together to develop shared understandings and a vision for the future of emergency care in remote and isolated settings. This report offers a *Vision*, *Key Recommendations* and *Guiding Principles* with which to improve emergency care for all injured and ill people in remote and isolated First Nation communities in Nishnawbe Aski Nation.



Emergency Care

Management of urgent health conditions where timely care is critically important. For example: heart attacks, strokes, mental health crises, and severe injuries. Effective emergency care is an important part of local emergency management capacity, and it is a key element of an equitable health care system.

Remote and Isolated Communities

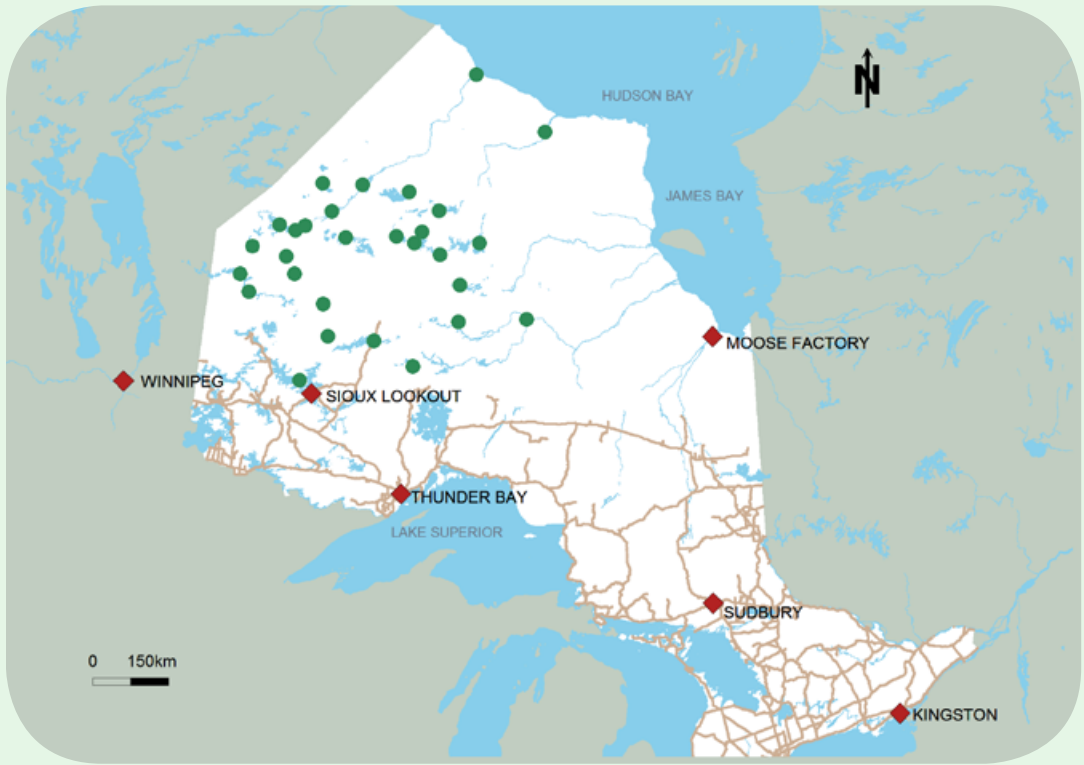
Communities with no permanent road access and communities that are more than two hours by road from an Emergency Department. Many of these communities lack local paramedical and 911 dispatch services. Transportation to an Emergency Department is most often by airplane.

Pre-Nursing Station Care

The initial component of pre-hospital care in remote First Nation communities. This care takes place outside a nursing station and involves the initial on-scene management and transportation of ill or injured patients to a nursing station. "Nursing station" is used interchangeably with "health centre" or "clinic".

STATUS OF REMOTE EMERGENCY CARE

COMMUNITIES WITHOUT PARAMEDICAL & 911 SERVICES



Map data sources: *Statistics Canada, Ministry of Health and Long-Term Care, KNET Keewaytinook Okimakanak*

25,000
Ontarians who need to board a plane to access an emergency department[1]

2,000
Medical evacuations from remote First Nation communities in Ontario in 2012

29
Remote communities in northern Ontario with no formal paramedical or 911 service (as shown on map)

15%
Trauma deaths that can be reduced by pre-hospital services[2]

4
The number of times more likely First Nations people are to experience severe trauma relative to the average Canadian[3]

1. Glazier RH, Gozdyra P, Yeritsyan N. Geographic Access to Primary Care and Hospital Services for Rural and Northern Communities: Report to the Ontario Ministry of Health and Long-Term Care. Toronto: Institute for Clinical Evaluative Sciences; 2011 *http://www.ices.on.ca/file/Geographic_Access_to_Care_Eng.pdf*

2. Mullins RJ, Mann NC. Population-based research assessing the effectiveness of trauma systems. J Trauma.1999 Sep;47(3Suppl):S59-66. *http://www.ncbi.nlm.nih.gov/pubmed/10496613*

3. Karmali S, Laupland K, Harrop AR, Findlay C, Kirkpatrick AW, Winston B, Kortbeek J, Crowshoe L, Hameed M. Epidemiology of severe trauma among status Aboriginal Canadians: a population-based study. CMAJ. 2005 Apr 12;172(8):1007-11. *http://www.ncbi.nlm.nih.gov/pubmed/15824405*

EXISTING INITIATIVES

First Nations Emergency First Response Program:
Provincially funded medical training for First Nation communities. The program relies on community support by way of a Band Council Resolution and a team coordinator to recruit volunteers from the community to be trained in emergency first response, first aid and CPR. The program provides medically vetted training, required medical and communications equipment.

James Bay Ambulance Services:
An accredited paramedic service in Northeastern Ontario that provides paramedical services to five remote communities with dispatch services provided bythe Timmins Central Ambulance Communication Centre. The program also supplies host support services to Weeneebayko Area Health Authority First Response Teams in surrounding communities.

Sachigo Lake Wildnerness Emergency Response Educational Initiative:
A community-based emergency care pilot project in Sachigo Lake First Nation. This collaborative program aimed to build community resilience and local emergency care capacity by delivering and evaluating a comprehensive approach to pre-nursing station health emergencies, including mental health crises. The program trained 6.5% of people in Sachigo Lake.

Community experiences enabling first aid training programs shared by health leaders

"The proper support and coordinations of a team is required to ensure any measure of longevity. Community support is also incredibly important. The Emergency First Response group are dedicated volunteers trained to respond to every medical emergency, it is a daunting task for many citizens."

Capacity Building from Emergency Care Training

"A young woman from Sachigo Lake First Nation participated in a five-day course that was a part of the Sachigo Lake Wilderness Emergency Response Education Initiative Before the training, she'd been uncertain about whether she'd feel comfortable – the sight of blood had never been her favourite. But, being involved in the simulated health emergencies helped and motivated her. She decided to go to college to train to be a paramedic. When she graduates, her goal is to work in remote First Nation communities like Sachigo Lake."

EXISTING NEEDS

Emergency Care:
Remote First Nation communities face elevated rates of emergency conditions, such as heart attacks, stroke, injury and mental health crises[4, 5].

Human Resources:
Nursing stations are staffed by nurses and occasionally by visiting physicians. Many First Nation communities in the Nashinawbe Aski Nation (NAN) region do not have local paramedic or 911-dispatch services (*see map*). It is often the case that healthcare providers are unable to leave the nursing station to provide care.

Layperson Training:
Community members provide first response care and transportation for injured and ill people in these areas. Some communities have sought first aid and CPR training. Resource limitations and distance mean that training is infrequent, inconsistent or unavailable.

4. Fantus D, Shah BR, Qiu F, Hux J, Rochon P. Injury in First Nations communities in Ontario. Can J Public Health. 2009 Jul-Aug;100(4):258-62. *http://www.ncbi.nlm.nih.gov/pubmed/19722337.*
5. Tjepkema M, Wilkins R, Goedhuis N, Pennock J. Cardiovascular disease mortality among First Nations people in Canada, 1991–2001. Chronic Diseases and Injuries in Canada. 2012 Sept; 32(4). *http://www.phac-aspc.gc.ca/publicat/cdic-mcbc/32-4/ar-04-eng.php.*

Challenges shared by health leaders in remote First Nation communities.

"Our community doesn't have a program to address emergency response. We don't have an ambulance response service, and that is required. We make use with what we have. We've been lucky so far."

"There is willingness to pay for janitors to clean schools, but not in paying for first responders to save lives."

ROUNDTABLE VISION

All attendees of the Community-based Emergency Care Roundtable, including participants from the Nishnawbe Aski Nation, Health Canada First Nations and Inuit Health Branch, the Ontario Ministry of Health and Long-Term Care and the Ministry of Aboriginal Affairs, formed consensus and voiced shared commitment around a vision:

People in remote and isolated First Nation communities should have access to excellent community-based first response emergency care.

Potential Benefits of Community-Based Emergency Care:

- Reduced preventable morbidity and mortality from a wide variety of illnesses and injuries.
- Safer, more resilient communities.
- More local health knowledge, local health workers, and local leadership in health services.
- Enhanced emergency response and crisis management capacity.
- Personal and economic development from related service and job opportunities.

RECOMMENDED ACTIONS

These recommendations emerged directly from the conversations that took place at the Roundtable between key partners.

1. Build a Working Group:
The Nishnawbe Aski Nation lead a collaboration with Health Canada and the Ontario Ministry of Health and Long-Term Care to build a Working Group mandated to advance the *Roundtable Vision*. This process will require funding considerations from government partners. Further attention will be needed to develop a framework for this process and to define the relationships of all partners.

2. Represent key partners in this Working Group:
The Working Group considers the following priority representatives: representatives from Nishnawbe Aski Nation communities, the Sioux Lookout First Nations Health Authority, Weeneebayko Area Health Authority, Health Canada First Nations and Inuit Health Branch, Aboriginal Affairs and Northern Development Canada, Ontario Ministry of Aboriginal Affairs, ORNGE Air Ambulance, The Northeast and Northwest Ontario Local Health Integration Networks, Sioux Lookout Regional Physician Services Incorporated, the Northern Ontario School of Medicine, university researchers, and the non-profit sector.

3. Follow Guiding Principles to advance Community-Based Emergency Care:
The Working Group's efforts should be rooted in six *Guiding Principles*: 1. Community-based; 2. Sustainability; 3. Capacity Building; 4. Collaboration; 5. Integration; 6. Excellence.

4. Plan and Test a Model for Community-Based Emergency Care:
Based on these guiding principles, develop, deliver and evaluate a community-based emergency care program in partnership with a selection of remote or isolated First Nation communities.

Perspectives of Roundtable Participants

"Spirit of giving and life exists in the communities. Celebration of doing something is important to bring about ownership."

"There are champions in the community and conveners who are eager to start something. Look at the room, everyone is willing to start something! "

"Sachigo took the plunge, we should all do it. Part of that was the community; leadership being involved in establishing the process."

GUIDING PRINCIPLES

Six key principles emerged during the Community-Based Emergency Care (CBEC) Roundtable as central when advancing solutions in pre-nursing station care in remote First Nation Communities.

1. COMMUNITY-BASED

Identify, respect, and learn from the diversity of remote and isolated First Nation communities. Address individual and population health needs by building on local priorities, relationships, skills, strengths and culture. Develop, deliver and evaluate programs with the community, and for the community.

2. SUSTAINABLE

Strive for lasting and scalable community-based emergency care programs, rooted in sound health, human resources, economic, and community planning. Build on opportunities to develop community resilience and health services as a sustainable and renewable local resource.

3. CAPACITY-BUILDING

Build capacity by providing emergency care training across a large cross-section of community members. Explore opportunities to develop employment opportunities for local emergency care and training.

4. COLLABORATION

Work with partners in healthcare delivery, such as community health workers, nurses, paramedics and physicians in the design, delivery, evaluation and funding of community-based emergency care programs. Develop programs as a collaboration between First Nations and local, provincial and federal governance organizations.

5. INTEGRATION

Ensure that CBEC programs integrate with emergency health services provided by nurses, paramedics and physicians, as well as other community emergency management strategies including Canadian Rangers and Crisis Response Teams.

6. EXCELLENCE

Evaluate and study programs in collaboration with communities, to bring high-quality, equitable, innovative and evidence-based emergency care to ill and injured patients in remote communities.

RECOMMENDED STRATEGIES

Where do we go from here? Building upon the four *Recommended Actions,* Nishnawbe Aski Nation, First Nation communities, federal and provincial governments, as well as other partners should consider the following strategies to develop community-based emergency care (CBEC).

1. DEVELOP GUIDELINES FOR APPROPRIATE EMERGENCY CARE IN REMOTE SETTINGS:

Lead initiatives with remote and isolated First Nation communities to identify appropriate educational and patient care strategies for pre-nursing station emergencies. Standard first aid and emergency medicine guidelines face limitations in remote settings.

2. INVESTIGATE THE HEALTH EFFECTS OF CBEC PROGRAMS:

Study the effectiveness of CBEC programs to understand their impact on community and individual health and wellbeing. Innovative research in remote communities can uncover the best ways to develop CBEC programs to save lives and reduce illness in these settings.

3. UNDERSTAND AND BUILD ON THE ECONOMIC COSTS AND BENEFITS OF CBEC:

Build sound financial strategies for program development and sustainability. Explore and understand the cost-effectiveness of these initiatives as well as their economic and financial impacts on communities.

4. EVALUATE EFFORTS TO DEVELOP AND DELIVER CBEC PROGRAMS:

Work with communities to create and evaluate CBEC systems that address health needs by building on local priorities, skills, strengths and culture. Evaluate programs to improve quality and maintain excellence.

5. DEVELOP PARAPROFESSIONAL POSITIONS FOR CBEC PROVIDERS AND TRAINERS:

Explore opportunities to partner with post-secondary educational institutions to develop and deliver an emergency paraprofessional educational program for residents of remote and isolated First Nation communities. This program could establish a new community emergency health worker, emphasizing CBEC delivery and education. Consider deploying and employing these new paraprofessionals in remote and isolated First Nation communities.

FORCES FOR AND AGAINST PROGRESS

What is working in favor of change? What needs to be overcome? This force field analysis identifies factors that will promote change towards excellent community-based first response emergency care, and factors that might make positive change challenging.

✓ CHAMPIONS:

Community leaders and members, government officials and academics are dedicated to the *Roundtable Vision.*

✓ BODY OF KNOWLEDGE:

There is existing knowledge about the importance of emergency care, and community-based efforts

✓ EXISTING COMMUNITY SERVICES:

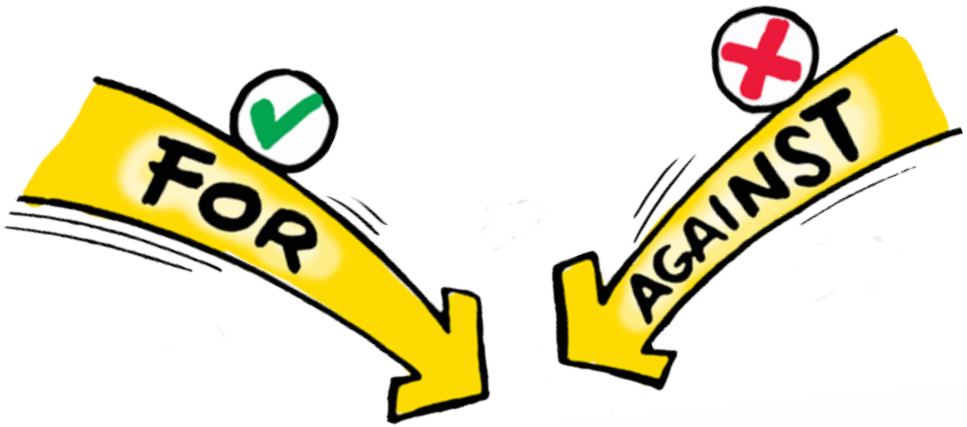
Volunteer Firefighting, Nishawnbe Aski Police Services, Canadian Rangers, First Response Teams, and Crisis Response Teams can guide ongoing efforts.

✓ NEW TECHNOLOGIES:

Telehealth, Global Positioning Systems (GPS), internet and mobile phone services enhance opportunities for training and care.

✓ EXISTING INITIATIVES:

Two established *programs and a pilot project* enhance emergency care in remote communities.



✗ MULTI-JURISDICTIONAL ISSUES:

Lack of clarity regarding responsibility for funding and delivery of pre-nursing station care.

✗ RESOURCE LIMITATIONS:

Human and financial infrastructure is needed to build a sustainable system.

✗ RESOURCE-INTENSITY:

Scale-up could be costly.

✗ SPORADIC EMERGENCY CARE DEMAND:

Communities have a low volume of high acuity cases to maintain first response knowledge and skills.

✗ DIVERSITY OF COMMUNITY NEEDS:

Regional efforts must be adapted to community-specific needs.

ACKNOWLEDGEMENTS

The Community-Based Emergency Care Roundtable was hosted by researchers at the Northern Ontario School of Medicine in partnership with the Nishnawbe Aski Nation. We thank all the participants and communities for contributing to this initiative, and are grateful for the generous support of many other organizations.

This report summarizes the many discussions from the Community-Based Emergency Care Roundtable and was developed in close consultation with with many of the Roundtable participants. While the Roundtable participants' many ideas and voices are represented in this document, it cannot capture all of the important details from this gathering. Ultimately, the Report's specific language is that of the Roundtable Organizing Team and should not be attributed individually to any of the Roundtable participants or the institutions and organizations that they represent.

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Rural residency programs

My case for a community-based curriculum

Megan Bollinger MD

Hey, Dr Megan!" he shouted, with a few aisles of vegetables between us. "It's gallstones!" A patient I had seen in the clinic who was suffering from intermittent abdominal pain was now giving me his ultrasound results at the local grocery store. This is rural medicine, and exactly the residency experience I had hoped for.

My reasoning for doing a rural residency is this: I want to learn in the environment in which I want to work. I want to experience working in diverse settings, practising medicine in a small facility, and having my patients also be my neighbours. I was matched to just such a program at the Northern Ontario School of Medicine in Sioux Lookout, Ont. In June 2012, I packed my worldly belongings into my small hatchback, topped it off with a canoe and bike, and drove from Saskatchewan to Sioux Lookout—a place I honestly had not heard of until that spring. My 2-year residency is based in a town of about 5000 people, with a catchment area of 30 000. I live a 5-minute walk away from the hospital, the lake, the grocery store, and the cross-country ski trails. So the hatchback is parked, and I have settled in.

Reactions to my rural residency have been mixed. Many family members and friends picture me becoming a lonesome hermit in the forests of northern Ontario. When speaking with physicians, some are concerned that I will not get adequate training, be exposed to enough patient volume or pathology, or have the evidence-based teaching that is offered at larger academic institutions. However, many physicians are supportive and see huge benefits to rural-based training. During the past 18 months, my experience has confirmed that rural residencies are everything that I hoped they would be: relevant, engaging, self-directed, and responsive, as well as a lot of fun.

Tools of the trade

The rural clinicians I work with are incredible. They know what I need to know. They teach me what is relevant, like learning how to set ventilator settings in the emergency department, as there are no respiratory therapists in the area. I have been taught how to do procedures in the absence of the prelabeled kit .... MacGyver-style medicine. Mind you, I am not doing paracentesis with a straw, some floss, and a few pieces of duct tape; but I am taught what to do with tools found in most remote clinics. I have covered telephone calls from nursing stations in the north, and learned the complexities and frustrations of trying to transfer northern patients to larger centres. These are uniquely rural learning experiences. The physicians I have met are like pocketknives: compact bundles of widely diverse utility, with those little extra tools that often come in handy—and I do not mean the corkscrew. They practise generalist medicine with extra training in areas like obstetrics, anesthesia, orthopedics, and critical care. They have a variety of skill sets and a broad knowledge base. These physicians have taught me that in rural medicine you are the front line, and when you do not know something you figure it out. They also model a collaborative practice. A smaller, close-knit practice facilitates discussion among health care providers, and I find this reassuring. I know that I will not be alone when I step into practice; that in rural sites I can feel well supported.

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Empowered learning

Rural residencies can be much more responsive to learning goals than larger programs are. There are fewer students to schedule and rotations do not rely on students for service; therefore, scheduling is done to facilitate learning rather than to fill a call schedule. There is freedom to take advantage of learning opportunities where they arise; I have the flexibility to move between surgery clinic and the operating room, depending on the applicability of the case to my objectives. If things are quiet during a hospitalist rotation, I can wander to the emergency department to see a patient with chronic obstructive pulmonary disease. It is never boring. I get to be, and need to be, much more self-directed. As I acquire more responsibility in my training, I learn where my deficiencies lie and try to seek out experiences to improve in those areas. A 2-year residency seems incredibly short; being able to make decisions on how I spend that time is empowering and involves competency-based learning.

Continuity of care happens serendipitously when living in a small community. The patient with gallstones that I mentioned above went for his cholecystectomy while I was on my general surgery rotation. As there were no other learners in line, I assisted with his anesthesia then scrubbed in for the procedure. I go to a family medicine clinic once a month to follow a group of patients and their evolving stories. I enjoy the

connections I have made with patients through this process, and earning their trust over time has been very rewarding. I have even had secret fishing spots shared with me, which I consider a true marker of patient confidence.

The complexity of these patients, especially from remote First Nations communities, creates challenging and interesting medicine. I recently consulted a tertiary centre about a patient with multiple acute medical issues. The specialist sceptically asked if I had heard of Occam's razor and the idea of 1 unifying diagnosis. I had, in fact, heard of this rule but found that it did not always apply in this patient population. An unfortunate combination of poor socioeconomic conditions, rampant addiction issues, and restricted health care access contribute to a high burden of disease and advanced illness among many patients in the north. I do not agree with the perspective that a rural residency cannot provide enough pathology to facilitate sufficient learning in a family medicine residency.

The benefits of a rural residency are huge and often unsung. Rural residency programs offer experiences that cannot be provided in other settings and vastly increase the comfort of residents hoping to practise in rural and remote settings. There continue to be many misconceptions about rural residency experiences and there is much hesitation in resdients leaving the tertiary hospital. Small comprehensive training sites can offer learner-centric experiences, as well as be responsive, educational, and hugely rewarding; they are centres of excellence for family medicine residencies and should not be overlooked.

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Competing interests
None declared

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General Article

Community-based Medical Education: Is Success a Result of Meaningful Personal Learning Experiences?

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ABSTRACT

Background: Community-based medical education (CBME) is the delivery of medical education in a specific social context. Learners become a part of social and medical communities where their learning occurs. Longitudinal integrated clerkships (LICs) are year-long community-based placements where the curriculum and clinical experience is typically delivered by primary care physicians. These programs have proven to be robust learning environments, where learners develop strong communication skills and excellent clinical reasoning. To date, no learning model has been offered to describe CBME. **Methods:** The characteristics of CBME are explored by the authors who suggest that the social and professional context provided in small communities enhances medical education. The authors postulate that meaningfulness is engendered by the authentic context, which develops over time. These relationships with preceptors, patients and the community provide meaningfulness, which in turn enhances learning. **Results and Discussion:** The authors develop a novel learning model. They propose that the context-rich environment of CBME allows for meaningful relationships and experiences for students and that such meaningfulness enhances learning.

Keywords: Community-based medical education, community context, longitudinal integrated clerkships, meaningfulness, situated learning theory

Background

Community-based medical education

Community-based medical education (CBME) refers to medical education, which situates the learner's clinical training in a community setting. It exposes students to patients who are managing their illnesses within their own family, social and community contexts.[1-4] Primary care clinicians and other healthcare providers accept learners into their practice, professional community and local community, where they take on the role of delivering much of the curriculum and precepting learners. Essentially, learning occurs in the community.[3] Such programs typically include having the student follow the patient from office setting into hospital care and back home to community-based homecare.[5]

To date no learning model has been proposed to explain the level of success achieved by CBME initiatives. Developing a learning model to explain successful education programs for healthcare professionals seems like an afterthought. These programs are expanding internationally, and greater thoughtfulness around why this decentralized form of medical education works may teach us something about how we learn to be physicians. A learning model that identifies key components of a new learning environment can allow us to adapt to it and its challenges, as well as dissect failures when they occur. We may further learn important lessons about medical education, which can be transferred or adapted to new learning environments.

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Longitudinal integrated clinical clerkships

One of the recent examples of CBME are longitudinal integrated clerkships (LICs). These year-long clinical placements were pioneered in Australia in the late 1990s.[3,5,6] Canada's newest medical school, the Northern Ontario School of Medicine, places students in rural communities for their third year of 'clinical clerkship'. To date, the outcomes of these LICs have been positive. Students gain strong communication skills and excellent clinical reasoning and management skills and are more likely to subsequently apply to primary care and rural training programs.[7] We suggest in our proposed learning model that CBME and longitudinal integrated programs provide medical students with some key elements that support meaningful personal learning experiences: An authentic professional and social community context for learning. The experience of community, both medical and social, sets up a rich environment for relationships, meaningfulness and, we propose, learning.

Existing learning theories

As learners participate in medical education they change. Learning is both emotional and socially embedded.[8] It is not merely a knowledge acquisition process, but also a socialization process.[9] Upon entering clinical rotations and working regularly alongside clinical teachers seeing patients, learning is facilitated by the students becoming embedded in the subculture of medical practice and the culture of the local community.

Two existing learning theories are relevant to our discussion. Kolb's Experiential Learning Theory combines experience, observation and reflection as elements of medical learning in a clinical setting. Lave and Wenger's Situated Learning Theory describes the apprenticeship model of clinical experience as a participation in a set of social relationships. Learning, they propose, is dependent on participation in these relationships. Their Situated Learning Theory suggests that learning is a by-product of engaging in problem solving 'situated' in a real world environment, enhanced by social interaction and collaboration.[9] This apprenticeship learning model may explain how students adopt values and attitudes of their clinician preceptors and mentors as they seek to 'be' doctors rather than to 'do' medicine. How can experience and socialization in a learning theory best apply to CBME?

Community, relationships with clinicians and graded responsibility

In CBME, particularly longitudinal experiences, medical students are embedded within a small group of clinicians with whom they work closely and come to know well as their professional community. The close working relationships between learners and their clinical supervisors over time allows for the maturation of an apprenticeship relationship.[10] Students judged to be safe and respectful of patients are often able to take on more clinical responsibilities sooner in a known, safe environment.[10] While short term placements result in shared enthusiasm and social inclusion of students by preceptors, students in extended CBME programs describe developing a "sense of companionship".[11] We propose that a personal relationship between student and preceptor, which develops over time, can mature more rapidly in CBME programs, where there are fewer health professionals working closely together and working relationships are more consistent than in most tertiary hospital settings. By contrast, in tertiary care medical education center, students risk experiencing rapidly changing collections of health professionals known as 'negotiated knotworks' rather than teams.[12] This dynamic, depersonalized context risks students experiencing depersonalization themselves.[13]

In CBME, relationships between students and clinical preceptors quickly mature, facilitating preceptor awareness of the clinical growth of their learner. Students are taught and delegated tasks and begin to contribute meaningfully to the healthcare team. Clinical supervisors receive positive reinforcement through effective performance of these clinical tasks by students.[10] Students are likely to receive consistent instruction and feedback because of the continuity of supervision. This consistency of the apprentice relationships enhances entrustment of professional activities,[14] resulting in critical functional changes in the three-way relationship between the preceptor, student and patient during the consultation as students moved from passive to active members of the clinical team.[10]

CBME placements can provide students with a small group of primary care and specialty physicians, nurses and allied health professionals who can welcome a student as a novice member of their team. The student's sense of belonging is enhanced in rural areas where professional and social boundaries are less exclusive.[11] These relationships are enhanced on longer placements,[15] which may explain the success of LICs in community versus tertiary care settings.[7] Length of rotation, continuity of the clinical and teaching team and a welcoming professional environment are key components in this learning environment.

Community, relationships with patients and professional development

In CBME placements, students are introduced to individual patients and to the community in which these patients live. Many CBME programs have developed in areas of workforce need, such as rural locations and low socio-economic outer urban areas.[6,16] Students are recognized as potential future workforce members and are welcomed into the town.[11] Patients are mostly very accepting of having a student involved in their care.[17,18] Within the primary care context, students can

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be given the opportunity to see patients on their own before the general practitioner joins the consultation. This process enables students to develop a relationship with individual patients and contribute to their care.[19] Even in short CBME placements, students have opportunities to follow individual patients through different healthcare contexts (such as clinic to hospital to nursing home) from presentation, investigation, treatment and convalescence. Clinical preceptors are also able to provide students with an entrée into significant patient events such as birth and palliative care journeys. CBME students gain insight into the provision of care to people within the context of their lives, while students in the tertiary hospital setting risk understanding medicine as a context-void skill. Learning from real people with medical conditions who live within a student's own community, rather than about pathology in patients who are short term residents in the tertiary hospital setting, is likely to prevent them losing empathy and objectifying patients, a common outcome in traditional clinical clerkships.[13]

Students in CMBE placements witness and are influenced by leadership roles rural doctors and other health professionals have within their community. They learn about primary care from a broad societal perspective as their preceptors participate in public health programs, health promotion campaigns and advocate to change the social determinants of health within their communities. CBME placements see medical care as a part of the holistic picture of a person's health status and come to recognize how the social determinants of health impact on patient outcomes [Figure 1]. Hence, meaningfulness in the

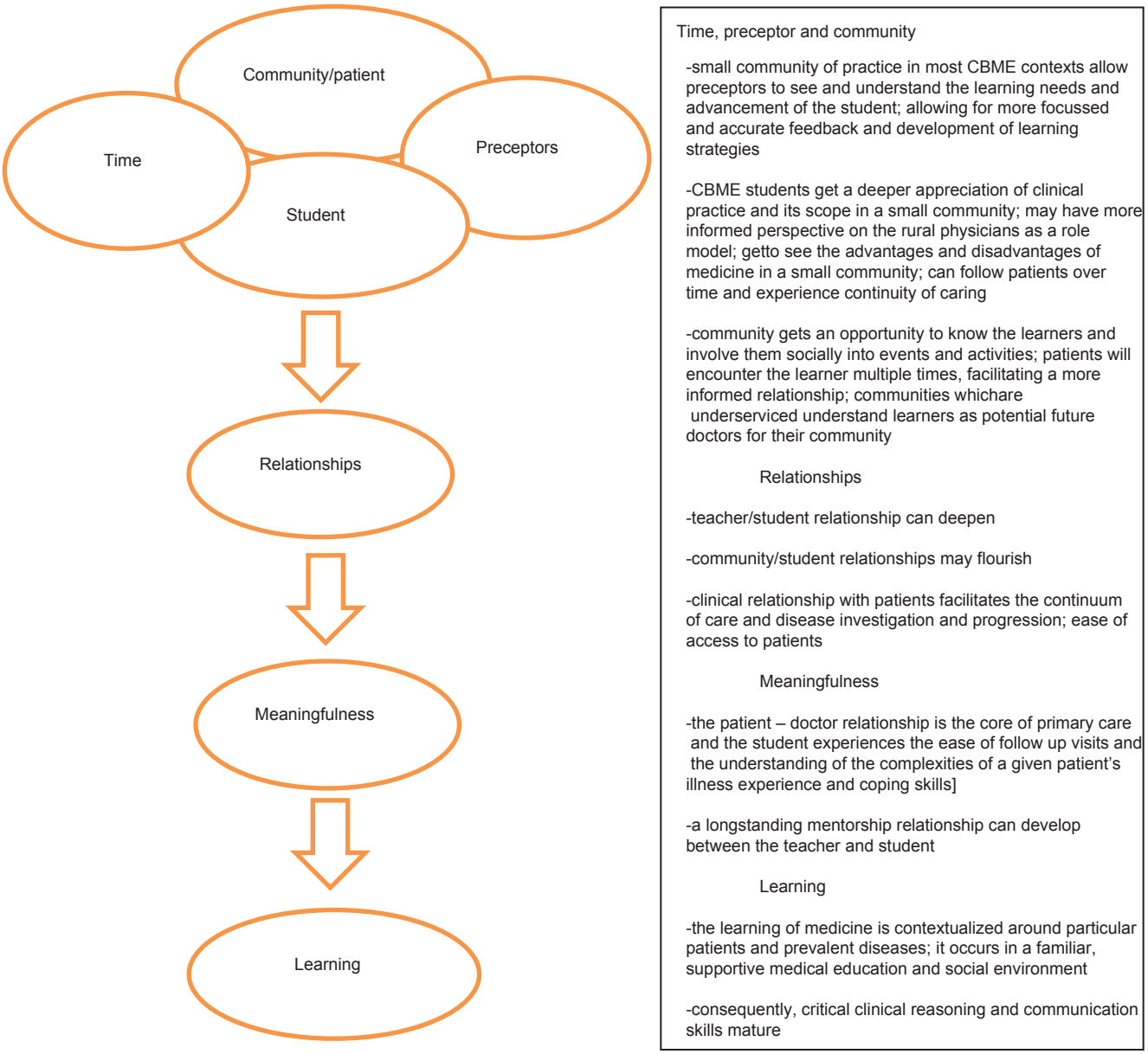

Figure 1: CBME Learning Model

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clinical role of the learner, the relationships with clinical team members and the community itself contribute to learning.

Conclusion

We propose that longitudinal clinical placements provide a breadth of experience, which enhances learning through the development of rich relationships (with preceptors, other healthcare providers, patients and the general community). These relationships can thrive in a community setting and engender meaningfulness, a term not typically associated with medical education. We suggest that this social, personal and professional context enhances learning through the provision of a uniquely meaningful personal learning experience, which matures a learner personally and clinically. A CBME theory needs to encompass the continuity and depth of relationship development as it applies to learning. Meaningfulness is the term we propose to describe the nature of this authenticity and its effect on learning.

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