

# First Nations hepatitis C virus infections

## *Six-year retrospective study of on-reserve rates of newly reported infections in northwestern Ontario*

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### Abstract

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

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

**Setting** Northwestern Ontario.

**Participants** A total of 31 First Nations communities (an on-reserve population of 20901) supported in health care by the Sioux Lookout First Nations Health Authority.

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

**Results** There were 267 HCV Ab+ cases in the 6-year study period. The incidence in 2015 was 324.2 per 100000 population. This is 11 times the rate for all of Ontario. The most common associated risk factor was sharing of intravenous drug use equipment. Women made up 52% of patients with newly reported HCV Ab+ cases. More than 45% of cases were in patients between 20 and 29 years of age.

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

### EDITOR'S KEY POINTS

- Canada's Aboriginal population faces a disproportionate and increasing burden of newly reported hepatitis C virus (HCV) infections. This problem has been increasing in northwestern Ontario since the First Nations leaders declared an "epidemic" of opioid abuse in 2009. In 2015, the rate of newly reported HCV antibody-positive cases was 324.2 per 100 000 in the 31 rural and remote First Nations communities in northwestern Ontario.
- First Nations community members in their 20s comprised more than 45% of newly reported cases between 2010 and 2015. There was a high rate of intravenous drug use among those with newly reported HCV antibody-positive cases (86.5%).
- Much can be learned about the course of HCV infection in isolated communities. Some of these lessons might be applicable to urban-based subcultures with loosely defined geographic and social boundaries. Community awareness, education, and prevention strategies are critical aspects of such clinical and research initiatives and exploration of these questions must move forward within individual community contexts.

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# Les infections au virus de l'hépatite C chez les Premières Nations

*Une étude rétrospective de 6 ans sur les taux d'infections récemment déclarées dans les réserves du nord-ouest de l'Ontario*

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## Résumé

**Objectif** Déterminer les taux de nouveaux cas d'infections au virus de l'hépatite C (VHC) survenus entre 2010 et 2015 dans des communautés éloignées des Premières Nations.

**Type d'étude** Analyse rétrospective de tous les nouveaux cas déclarés positifs aux anticorps du virus de l'hépatite C (VHC).

**Contexte** Le nord-ouest de l'Ontario.

**Participants** Un total de 31 communautés des Premières Nations (représentant 20 901 personnes vivant sur une réserve) qui dépendent de l'Autorité sanitaire des Premières Nations de Sioux Lookout pour leurs soins.

**Principaux paramètres à l'étude** L'ensemble des caractéristiques des cas survenus durant la période de 6 ans (de 2010 à 2015), ce qui comprend l'année de leur déclaration ainsi que l'âge et le sexe des patients.

### POINTS DE REPÈRE DU RÉDACTEUR

- La population autochtone du Canada fait face à une augmentation disproportionnée de nouvelles infections au virus de l'hépatite (VHC). Ce problème n'a cessé d'augmenter dans le nord-ouest de l'Ontario depuis que les chefs des Premières Nations ont déclaré qu'il y avait une épidémie de consommation excessive d'opiacés, en 2009. En 2015, le taux des nouveaux cas positifs aux anticorps du VHC s'élevait à 342,2 pour 100 000 habitants dans les 31 communautés des Premières Nations des régions rurales du nord-ouest de l'Ontario.
- Entre 2010 et 2015, 45% des nouveaux cas d'hépatite C touchaient des membres des communautés des premières Nations âgés de 20 à 29 ans. Il y avait un taux élevé d'injections intraveineuses de drogues dans les cas déclarés positifs aux anticorps du VHC (86,5%).
- Dans des communautés éloignées, il est plus facile de tirer des leçons sur la façon dont évolue l'infection au VHC. Certaines de ces leçons pourraient s'appliquer à des sous-cultures de banlieue dont les limites géographiques et sociales sont imprécises. Les différentes communautés devront mettre en œuvre les stratégies de sensibilisation, de formation et de prévention essentielles aux initiatives cliniques et de recherche et à la compréhension de ce type de problème.

Cet article a fait l'objet d'une révision par des pairs.  
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**Résultats** On a recensé 267 cas de patients testés positifs aux anticorps du VHC au cours de la période de 6 ans. En 2015, l'incidence était de 324,2 pour 100 000 habitants, ce qui est 11 fois plus élevé que le taux pour l'ensemble de l'Ontario. Le facteur de risque le plus souvent associé à cette condition était le partage des instruments servant aux injections intraveineuses. Les femmes représentaient 45% des nouveaux cas trouvés positifs aux anticorps du VHC. Plus de 45% des patients touchés avaient entre 20 et 29 ans.

**Conclusion** Un taux aussi élevé de résultats positifs aux anticorps du VHC dans des communautés éloignées des Premières Nations est inquiétant et exige que de nouvelles ressources soient consacrées à l'instauration de mesures de prévention et au traitement de ces patients. Un aussi grand nombre de cas risque d'entraîner des problèmes de santé et de société plus urgents que ce qu'on pourrait résoudre à partir de l'expérience acquise dans le reste du Canada.

National rates of newly reported hepatitis C virus (HCV) infection in Canada are declining.<sup>1</sup> Despite this reduction, Canada's Indigenous population faces a disproportionate and increasing burden of disease.<sup>2-4</sup> Modeled estimates of HCV prevalence in Canada have shown a 3-fold higher prevalence among the Aboriginal population compared with the non-Aboriginal population.<sup>1</sup>

There is a paucity of robust population-based data on HCV infection in Aboriginal Canadians. Available information largely focuses on urban-based populations. Studies in Winnipeg, Man, and in Vancouver and Prince George, BC, document high rates of HCV infection in "street-exposed" urban Aboriginal people.<sup>5,6</sup> These high rates of HCV infection are associated with intravenous drug use (IVDU), similar to Canada-wide data, which show that 80% of newly reported HCV infections in 2007 were IVDU-related.<sup>7</sup>

In 2009, First Nations leaders in northwestern Ontario declared a state of emergency concerning the widespread use of opioids in their communities.<sup>8</sup> Since then, regional hospital- and community-based programs have been developed to offer treatment for opioid use disorder.<sup>9-12</sup> An important aspect of these programs is increased screening for blood-borne infection. The rising levels of HCV infection encountered by local clinicians prompted clinical and research initiatives.

This study of an on-reserve First Nations population spread across 31 remote communities in northwestern Ontario documents rates of newly reported HCV antibody-positive (Ab+) test results in a rural Aboriginal population over a 6-year period, 2010 to 2015.

## METHODS

In 2015, the Sioux Lookout First Nations Health Authority (SLFNHA) Chiefs in Assembly and the regional Chiefs Committee on Health approved research on HCV infection in their communities.<sup>13</sup> The SLFNHA supports community-based medical services and other health promotion programs in 31 remote First Nations communities in northwestern Ontario.

Aggregate data were received from the Health Canada First Nations and Inuit Health Branch (FNIHB)—Ontario Region on newly reported HCV Ab+ test result notifications from these 31 on-reserve communities. The data consisted of HCV antibody status notifications received by the FNIHB—Ontario Region through the provincial reportable disease system from 2010 to 2015. Case characteristics were collected by the FNIHB through routine case and contact management of reportable diseases. The aggregate characteristic data included year of notification, age range, and sex. Risk factor data were limited to a 5-year period (2011 to 2015). Testing was done both in local community nursing stations and in hospital

settings. The total number of screening tests performed and RNA serology data were not available.

Cases were limited to individuals with HCV Ab+ test results who were reported to the provincial public health system and who lived on reserve in the SLFNHA catchment area. Individuals who lived off reserve were not included in this study. According to Indigenous and Northern Affairs Canada (INAC), the on-reserve population of the 31 communities was 20 901 in 2015. Population counts were estimated by INAC using the Indian Registration System. Age-standardized rates were calculated by the indirect method using the 2006 Canadian population. The population estimate does not account for patient migration and does not include nonregistered community members.

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

## RESULTS

In 2010, 15 notifications for HCV Ab+ status were recorded. This increased to 86 notifications in 2014 and 73 in 2015 (**Table 1**). The age-standardized annual rate of HCV Ab+ test result notifications increased dramatically between 2010 (56.6 per 100 000 population, 95% CI 41.9 to 71.3) and 2015 (324.2 per 100 000 population, 95% CI 288.9 to 359.5). **Figure 1** compares these rates with those of Ontario and Canada.<sup>14,15</sup>

Women accounted for 52% of patients with newly reported HCV Ab+ cases. More than half (54%) of the female patients were in the 20- to 29-year-old age group. Only 41% of HCV infection cases in men were in patients in the 20- to 29-year-old age group, with 52% in the 30- to 64-year-old age group. More than 45% of cases were in patients between 20 and 29 years of age (**Figure 2**).

The most commonly reported risk factor was sharing IVDU equipment, which occurred in 86.5% of cases (**Table 2**).

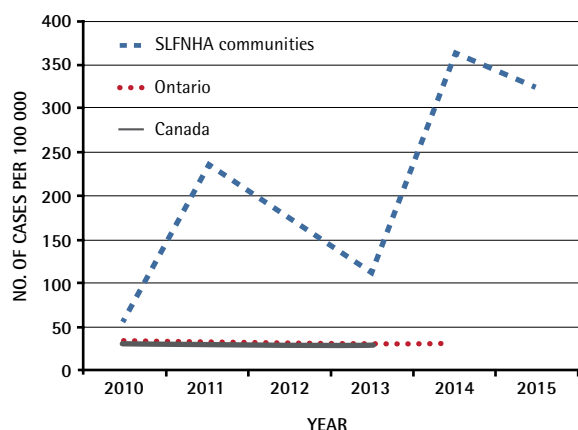
Fewer than 5 new notifications for HIV infection were reported during the 6-year study period.

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

YEAR	ON-RESERVE POPULATION	NO. OF CASES	RATE PER 100 000 (95% CI)
2010	18 536	15	56.6 (41.9 to 71.3)
2011	19 072	27	235.5 (205.4 to 265.6)
2012	19 505	38	169.9 (144.4 to 195.5)
2013	20 076	28	113.1 (92.3 to 133.9)
2014	20 463	86	364.7 (364.3 to 402.1)
2015	20 901	73	324.2 (288.9 to 359.5)

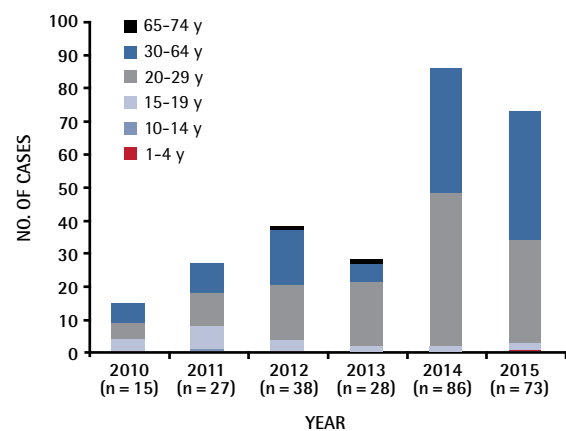
HCV—hepatitis C virus, SLFNHA—Sioux Lookout First Nations Health Authority.

**Figure 1.** Age-adjusted rates (per 100 000 population) of newly reported hepatitis C virus antibody-positive test results among First Nations patients living on reserve in SLFNHA communities by year (2010 to 2015) and corresponding rates in Canada and Ontario



SLFNHA—Sioux Lookout First Nations Health Authority.  
Data from Public Health Ontario<sup>14</sup> and Public Health Agency of Canada.<sup>15</sup>

**Figure 2.** No. of reported hepatitis C virus antibody-positive cases by age group in First Nations communities serviced by the SLFNHA from January 1, 2010, to December 31, 2015



SLFNHA—Sioux Lookout First Nations Health Authority.

## DISCUSSION

In 2015, the rate of newly reported HCV Ab+ cases was 324.2 per 100 000 population in the 31 rural and remote First Nations communities in northwestern Ontario. This is 11 times the 2014 provincial rate of 30.1 per 100 000 and higher than previous estimates for the Canadian Aboriginal population (Figure 1).<sup>5,14,15</sup>

**Table 2.** Risk factors of individuals with HCV antibody-positive test results in SLFNHA communities: Patients often identified > 1 risk factor; there were 252 reported cases from 2011 to 2015.

RISK FACTOR	N (%)
Epidemiologic link to confirmed case	30 (11.9)
Had unsafe sex	19 (7.5)
Shared IVU equipment	218 (86.5)
Other	8 (3.2)
Unknown	17 (6.7)

HCV—hepatitis C virus, IVU—intravenous drug use, SLFNHA—Sioux Lookout First Nations Health Authority.

Previous HCV infection incidence rates calculated for Canadian Aboriginal populations have focused on inner-city First Nations and Metis populations.<sup>5,6</sup> In 2013, Uhanova et al documented the newly diagnosed HCV infection rate at 91.1 per 100 000 population among First Nations living in Winnipeg, which was 2.5 times the provincial rate.<sup>6</sup> In their study, most (73%) Aboriginal participants with HCV infection resided in the inner city. The Cedar Project in British Columbia (2003 to 2009) studied 148 inner-city Aboriginal youth in Vancouver and Prince George who used illicit drugs.<sup>5</sup> They found that 26% of participants became infected with HCV within 2 years of initiating IVU.

Our study documents a high proportion of IVU among those with newly reported cases of HCV infection (86.5%) in remote First Nations communities, which is higher than the present estimated Canadian risk of 80% for newly acquired HCV infection,<sup>16</sup> but is similar to the 58% to 86% range found in many other studies.<sup>7,17-20</sup>

First Nations community members in their 20s comprised more than 45% of newly reported cases between 2010 and 2015 (Figure 2). This is ominous, as progression to hepatic complications is acknowledged to occur over a 20-year period.<sup>21</sup> This age distribution is similar to that in Ontario as a whole, where HCV infection incidence was highest among those aged 25 to 29 years.<sup>1,18</sup> Other population studies demonstrate a younger affected age group among Aboriginal participants.<sup>5,6</sup>

The proportion of newly reported HCV Ab+ cases reported among women 20 to 29 years of age in this review was slightly higher (52%) than that among men in this age group (41%), but the relative number of women tested is not known. This result is similar to other studies of Canadian Aboriginal populations, but differs from the Ontario balance, in which men accounted for 62.2% of newly reported HCV Ab+ cases in 2014.<sup>14</sup> Opioid use disorder is common in our region and community-based opioid agonist therapy (OAT) programs have been recently developed in many communities and include routine screening for blood-borne infections.



Opioid use in pregnancy can occur in as many as 30% of pregnancies in the Sioux Lookout Meno Ya Win Health Centre catchment population. Hepatitis C virus infection screening is therefore regularly added to provincially recommended HIV and hepatitis B testing.<sup>22</sup> This increased testing in the pregnant population might account for some of the preponderance of female patients with newly reported HCV Ab+ cases. Studies in Winnipeg and Prince George also documented overrepresentation of Aboriginal women in the IVDU population.<sup>23,24</sup>

Low rates of HIV infection are reported in this study. Ontario HCV infection models estimate 5% to 10% of people who actively inject drugs are living with HIV, while HCV infection rates are 50% to 75%.<sup>25</sup> It is not clear why the incidence of HIV infection is particularly low in our study population. Establishing surveillance, education, prevention, treatment, and harm reduction strategies for HCV infection will provide capacity for management if increases in HIV infection occur.

Findings of this study are not generalizable to other on-reserve populations. The recent HIV outbreak in on-reserve First Nations communities in Saskatchewan speaks to the vulnerability of isolated communities to public health emergencies.<sup>26</sup> Centralized federal management of on-reserve public health and infectious disease surveillance might be too cumbersome to provide an appropriately efficient, focused response. Well-resourced regional health services might be more able to monitor and respond to serious changes in disease profiles.<sup>27</sup>

In response to changes in drug use patterns and increased rates of HCV infection, an interagency Sexually Transmitted and Blood-borne Infection Working Group was established in 2011. Participants included representatives from the SLFNHA, the Shibogama First Nations Health Authority, the FNIHB, the local provincial health unit, and the Sioux Lookout Meno Ya Win Health Centre, and local physicians.<sup>13</sup> With support from the regional chiefs, early activities included increasing public awareness about blood-borne infections, providing education to health care providers, and making harm-reduction education and needle distribution programming accessible to remote communities. Ongoing responsibility for these initiatives has been assumed by the SLFNHA under Approaches to Community Wellbeing, a developing First Nations-governed public health system for SLFNHA communities. In addition to health promotion activities, the SLFNHA, in collaboration with local primary care physicians, is establishing a program to treat and support individuals with HCV infection.

On-reserve community-based OAT programs were first developed in the Sioux Lookout region in 2011. Since then, opioid addiction treatment programs, often integrating OAT, traditional healing practices, and grief and addiction counseling, have become available in

numerous communities. Programs have demonstrated high retention rates and meaningful community-wide social change including decreases in community criminal charges and child protection cases, and increased school attendance.<sup>11</sup> The obstetric program at the Sioux Lookout Meno Ya Win Health Centre has also responded to high rates of opioid exposure in pregnancy with targeted OAT programming. The program has since experienced a decrease in rates of neonatal abstinence syndrome in opioid-exposed pregnancies.<sup>9,28</sup>

Aboriginal populations have been documented to have an increased risk of HCV infection, but have no known relevant genetic susceptibility.<sup>2-4</sup> "Colonization, racism, social exclusion and a lack of self-determination"<sup>29</sup> affect the alarming disparities in the health of Aboriginal peoples. These ongoing determinants of health play a key role in the high burden of addiction and preventable illness in northwestern Ontario.

Robust, community-based education and case detection, and increased management and treatment capacity will be needed to meet this challenge. Such regional initiatives will need special attention in any national HCV strategy.<sup>30,31</sup> Limited funding for opioid use disorder treatment programs has already taxed many communities' resources and additional support is required for the prevention and management of HCV infection.<sup>32</sup>

Further collaborative research efforts are currently under way. With the support of local First Nations leadership, SLFNHA has recently partnered with researchers at the University Health Network in Toronto, Ont, to examine access to community-based testing for blood-borne infections and to better our understanding of the prevalence of HCV infection in the region. Spontaneous clearance rates, viral genotyping, disease progression, treatment outcomes, re-infection rates, and community attitudes are all potential areas to explore.

According to the 2010 Ontario Burden of Infectious Disease Study, HCV infection accounts for the largest number of years of life lost owing to premature mortality attributed to infectious diseases.<sup>33</sup> Newly available antiviral agents offer successful and well tolerated treatment of HCV infection, which can be delivered in remote communities.<sup>30</sup> These drugs are expensive, and encouraging early treatment should be considered in such isolated communities. This will require support by the federally funded health insurance program.

Much can be learned about the course of HCV infection in isolated communities. Some of these lessons might be applicable to urban-based subcultures with loosely defined geographic and social boundaries. Community awareness, education, and prevention strategies are critical aspects of such clinical and research initiatives and exploration of these questions must move forward within individual community contexts.

## Limitations

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

## Conclusion

We report high rates of newly reported HCV Ab+ cases in 31 remote First Nations communities in northwestern Ontario. This is likely associated with the recent opioid “epidemic” recognized by regional First Nations leaders in 2009 and the resulting increase in testing for blood-borne infections. These communities are geographically remote and the burden of HCV infection in such isolated communities might pose more urgent health and social challenges than can be generalized from the experience in the rest of Canada.

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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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### References

- Centre for Communicable Diseases and Infection Control, Infectious Disease Prevention and Control Branch. *Hepatitis C in Canada: 2005-2010 surveillance report*. Ottawa, ON: Public Health Agency of Canada; 2011. Available from: [http://publications.gc.ca/collections/collection\\_2012/aspc-phac/HP40-70-2012-eng.pdf](http://publications.gc.ca/collections/collection_2012/aspc-phac/HP40-70-2012-eng.pdf). Accessed 2015 Nov 23.
- Sadler MD, Lee SS. Hepatitis C virus infection in Canada's First Nations people: a growing problem. *Can J Gastroenterol* 2013;27(6):335.
- Wylie JL, Shah L, Jolly AM. Demographic, risk behaviour and personal network variables associated with prevalent hepatitis C, hepatitis B, and HIV infection in injection drug users in Winnipeg, Canada. *BMC Public Health* 2006;6:229.
- Rempel JD, Uhanova J. Hepatitis C virus in American Indian/Alaskan Native and Aboriginal peoples of North America. *Viruses* 2012;4(12):3912-31.
- Spittal PM, Pearce ME, Chavoshi N, Christian WM, Moniruzzaman A, Teegee M, et al. The Cedar Project: high incidence of HCV infections in a longitudinal study of young Aboriginal people who use drugs in two Canadian cities. *BMC Public Health* 2012;21:632.
- Uhanova J, Tate RB, Tataryn DJ, Minuk GY. The epidemiology of hepatitis C in a Canadian Indigenous population. *Can J Gastroenterol* 2013;27(6):336-40.
- Remis RS. *Modelling the incidence and prevalence of hepatitis C infection and its sequelae in Canada, 2007*. Ottawa, ON: Public Health Agency of Canada; 2007. Available from: [www.phac-aspc.gc.ca/sti-its-surv-epi/model/pdf/model07-eng.pdf](http://www.phac-aspc.gc.ca/sti-its-surv-epi/model/pdf/model07-eng.pdf). Accessed 2015 Apr 10.
- Resolution updates. Health policy and planning. Resolution #09/92: prescription drug abuse state of emergency. In: Nishnawbe Aski Nation. *2009/2010 annual report*. Thunder Bay, ON: Nishnawbe Aski Nation; 2009.
- Balfour-Boehm J, Rea S, Gordon J, Dooley J, Kelly L, Robinson A. The evolving nature of narcotic use in northwestern Ontario. *Can J Rural Med* 2014;19(4):158-60.
- Dooley R, Dooley J, Antone I, Guilfoyle J, Gerber-Finn L, Kakekagumick K, et al. Narcotic tapering in pregnancy using long-acting morphine. An 18-month prospective cohort study in northwestern Ontario. *Can Fam Physician* 2015;61:e88-95. Available from: [www.cfp.ca/content/cfp/61/2/e88.full.pdf](http://www.cfp.ca/content/cfp/61/2/e88.full.pdf). Accessed 2017 Oct 6.
- Kanate D, Folk D, Cirone S, Gordon J, Kirlaw M, Veale T, et al. 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. *Can Fam Physician* 2015;61:160-5.
- Mamakwa S, Kahan M, Kanate D, Kirlaw M, Folk D, Cirone S, et al. Evaluation of 6 remote First Nations community-based buprenorphine programs in northwestern Ontario. Retrospective study. *Can Fam Physician* 2017;63:137-45.
- Sioux Lookout First Nations Health Authority. *Resolution #15-13. Proposal to research treatment as prevention for hepatitis C in the Sioux Lookout area*. Sioux Lookout, ON: Sioux Lookout First Nations Health Authority; 2015. Available from: [www.slfmha.com/files/9514/4293/3481/15-13-Proposal\\_to\\_Research\\_Treatment\\_as...pdf](http://www.slfmha.com/files/9514/4293/3481/15-13-Proposal_to_Research_Treatment_as...pdf). Accessed 2015 Apr 10.
- Public Health Ontario. *Reportable disease trends in Ontario. 2014. Technical report 2016*. Toronto, ON: Public Health Ontario; 2016. Available from: [www.publichealthontario.ca/en/eRepository/Reportable\\_disease\\_trends\\_in\\_Ontario\\_2014.pdf](http://www.publichealthontario.ca/en/eRepository/Reportable_disease_trends_in_Ontario_2014.pdf). Accessed 2016 May 3.
- Public Health Agency of Canada. *Notifiable disease charts*. Ottawa, ON: Government of Canada; 2017. Available from: <http://diseases.canada.ca/notifiable/charts-list>. Accessed 2017 Oct 16.
- Centre for Communicable Disease and Infection Control. *Epidemiology of acute hepatitis C infection in Canada. Results from the Enhanced Hepatitis Strain Surveillance System (EHSSS)*. Ottawa, ON: Public Health Agency of Canada; 2009. Available from: [http://publications.gc.ca/collections/collection\\_2011/aspc-phac/HP40-41-2010-eng.pdf](http://publications.gc.ca/collections/collection_2011/aspc-phac/HP40-41-2010-eng.pdf). Accessed 2016 Nov 2.
- Patrick DM, Tyndall MW, Cornelisse P, Li K, Sherlock CH, Rekart ML, et al. Incidence of hepatitis C virus infection among injection drug users during an outbreak of HIV infection. *CMAJ* 2001;165(7):889-95.
- Wu HX, Wu J, Wong T, Andonov A, Li Q, Dinner K, et al. Incidence and risk factors for newly acquired hepatitis C virus among Aboriginal versus non-Aboriginal Canadians in six regions, 1999-2004. *Eur J Clin Microbiol Infect Dis* 2007;26(3):167-74.
- Wu HX, Wu J, Wong T, Donaldson T, Dinner K, Andonov A, et al. Enhanced surveillance of newly acquired hepatitis C virus infection in Canada, 1998 to 2004. *Scand J Infect Dis* 2006;38(6-7):482-9.
- Roy E, Alary M, Morissette C, Leclerc P, Boudreau J, Parent R, et al. High hepatitis C virus prevalence and incidence among Canadian intravenous drug users. *Int J STD AIDS* 2007;18(1):23-7.
- Wong T, Lee SS. Hepatitis C: a review for primary care physicians. *CMAJ* 2006;174(5):649-59. Erratum in: *CMAJ* 2006;174(10):1450.
- Kelly L, Guilfoyle J, Dooley J, Antone I, Gerber-Finn L, Dooley R, et al. Incidence of narcotic abuse during pregnancy in northwestern Ontario. Three-year prospective cohort study. *Can Fam Physician* 2014;60:e493-8. Available from: [www.cfp.ca/content/cfp/60/10/e493.full.pdf](http://www.cfp.ca/content/cfp/60/10/e493.full.pdf). Accessed 2017 Oct 6.
- Elliott L, Blanchard J, Dawood M, Beaudoin CM, Dinner K. The Winnipeg Injection Drug Epidemiology (WIDE) study: a study of the epidemiology of injection drug use and HIV infection in Winnipeg, Manitoba: final report. Winnipeg, MB: Epidemiology Unit, Manitoba Health; 1999.
- Callaghan RC, Cull R, Vettesse LC, Taylor L. A gender analysis of Canadian Aboriginal individuals admitted to inpatient substance abuse detoxification: a three-year medical chart review. *Am J Addict* 2006;15(5):380-6.

25. Millson P, Leonard L, Remis RS, Strike C, Challacombe L. *Injection drug use, HIV and HCV infection in Ontario: the evidence 1992-2004*. Toronto, ON: Ministry of Health and Long-Term Care; 2004. Available from: [www.ohrdp.ca/wp-content/uploads/2013/03/Research\\_Report.pdf](http://www.ohrdp.ca/wp-content/uploads/2013/03/Research_Report.pdf). Accessed 2015 Apr 10.
26. Vogel L. HIV in Saskatchewan merits urgent response. *CMAJ* 2015;187(11):793-4. Epub 2015 Jun 29.
27. Martin NK, Foster GR, Vilar J, Ryder S, Cramp ME, Go F, et al. HCV treatment rates and sustained viral response among people who inject drugs in seven UK sites: real world results and modelling of treatment impact. *J Viral Hepat* 2015;22(4):399-408.
28. Jumah NA, Edwards C, Balfour-Boehm J, Loewen K, Dooley J, Gerber-Finn L, et al. Observational study of the safety of buprenorphine and naloxone in pregnancy in a rural and remote population. *BMJ Open* 2016;6(10):e011774.
29. Allan B, Smylie J. *First Peoples, second class treatment. The role of racism in the health and well-being of Indigenous peoples in Canada*. Toronto, ON: Wellesley Institute; 2015.
30. Webster P. "Irresponsible" not to adopt national hepatitis plan. *CMAJ* 2016;188(7):490. Epub 2016 Mar 14.
31. Leston J, Finkbonner J. The need to expand access to hepatitis C virus drugs in the Indian Health Service. *JAMA* 2016;316(8):817-8.
32. Myers RP, Shah H, Burak KW, Cooper C, Feld JJ. An update on the management of chronic hepatitis C: 2015 consensus guidelines from the Canadian Association for the Study of the Liver. *Can J Gastroenterol Hepatol* 2015;29(1):19-34. Epub 2015 Jan 13.
33. Kwong JC, Crowcroft NS, Campitelli MA, Ratnasingham S, Daneman N, Deeks SL, et al. *Ontario Burden of Infectious Disease Study (ONBOIDS): an OAHPP/ICES report*. Toronto, ON: Ontario Agency for Health Protection and Promotion; Institute for Clinical Evaluative Sciences; 2010. Available from: [www.publichealthontario.ca/en/eRepository/ONBoID\\_ICES\\_Report\\_ma18.pdf](http://www.publichealthontario.ca/en/eRepository/ONBoID_ICES_Report_ma18.pdf). Accessed 2017 Oct 17.

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