The hepatitis C virus (HCV) cascade of care in a Canadian provincial prison: A retrospective cohort study with important implications for HCV micro-elimination

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Abstract

Background: Hepatitis C virus (HCV) micro-elimination efforts must target people in prison; however, the HCV care cascade has never been assessed in Canadian correctional facilities. We characterized the HCV care cascade in Quebec's largest provincial prison.

Methods: We conducted a retrospective study of all HCV-related laboratory tests requested at l'Établissement de Détention de Montréal between July 1, 2017 and June 30, 2018. We defined eight cascade steps: 1) total sentenced inmates; 2) HCV screened (via HCV-antibody); 3) HCV-antibody positive; 4) HCV RNA tested; 5) HCV RNA positive; 6) linked to care; 7) initiated HCV treatment; and 8) achieved sustained virologic response (SVR). Proportions of inmates at each step were measured using denominator-numerator linkage. The proportion screened among inmates sentenced for at least one month, during which time screening should be feasible, was also calculated.

Results: Of the 4931 sentenced inmates, 344 (7%) were screened for HCV, 38 (11%) were HCV-antibody positive, 35 (92%) received HCV RNA testing, 16 (46%) were HCV RNA positive, 10 (63%) were linked to care, three (30%) initiated treatment, and two (67%) achieved SVR. Among inmates sentenced for one month (n=1972), the proportion screened increased to 17%.

Interpretation: Our findings confirm that a very small proportion (7%) of men at a Canadian provincial prison were screened using on-demand HCV testing and that ~~. While screening was the major rate-limiting step,~~ treatment initiation was low in the absence of formal HCV cure

pathways. To eliminate HCV in this sub-population, adopting opt-out HCV testing should be considered a necessary first step.

Introduction

Hepatitis C virus (HCV) is the leading cause of cirrhosis, hepatocellular carcinoma, and transplantation, and in Canada, causes more years of life lost than any other infectious disease.[1-4] Provided that highly effective direct-acting antiviral treatment can be expanded, HCV-related sequelae will likely become less frequent over time. Unfortunately, this may not be the case for people experiencing incarceration, who are known to suffer from lower rates of HCV treatment uptake in Canada despite a 40-fold greater HCV-antibody prevalence (indicating previous exposure) compared to the general population.[5-7] Access to direct-acting antivirals for those currently or previously incarcerated would not only have individual-level benefits, but could potentially decrease onward transmission in these highly mobile populations where harm reduction interventions are not necessarily available. Decreased treatment uptake among inmates is multifactorial. At the system-level, it is likely due to absent systematic screening programs in most provincial correctional facilities, resulting in fewer identified cases, as well as a lack of standardized procedures needed to facilitate treatment uptake during incarceration or linkage to HCV care following release for inmates whose sentences are too short to complete treatment during incarceration.[8,9] While Canada is committed to eliminating HCV by 2030, in failing to address the HCV epidemic among people in Canadian provincial prisons – where the majority of Canadian inmates are serving sentences – Canada will never reach this goal.[10,11]

The HCV cascade of care describes successive health care steps specific to chronic HCV infection that result in optimal health outcomes.[12] Screening, the first step of the cascade, lays the foundation for subsequent linkage to care, initiation of treatment, and achievement of cure. Although the Canadian Task Force on Preventive Health Care, the Canadian Association for the Study of the Liver, the Canadian Network on Hepatitis C, and the World Health Organization

recommend HCV screening for *all people who experience imprisonment*, with the exception of British Columbia, all provincial correctional facilities provide testing only upon request.[13-16] Furthermore, the recently released "Blueprint to inform HCV elimination efforts in Canada" stipulates that either HCV treatment and/or linkage to care upon release for those with shorter sentences be provided to all inmates.[15] Federal inmates, who have been sentenced to time in custody of two years or more, can progress from screening to cure during incarceration.[17] However, as a result of shorter sentences in provincial prisons (median: 28 days), achieving all cascade steps prior to release can be challenging for provincial inmates.[18] Therefore, while some inmates may qualify for treatment in provincial prisons, treatment may not be routinely provided.[9] The HCV cascade of care has never been assessed in Canadian provincial correctional facilities. We aimed to characterize the HCV cascade of care among people in Quebec's largest provincial prison, l'Établissement de Détention de Montréal.

Methods

Setting

L'Établissement de Détention de Montréal, also known as Bordeaux, is the largest of 17 provincial prisons in Quebec, with a maximum capacity of 1,357 male adults (over the age of 18 years).[19] In Quebec, the Ministry of Health is responsible for the majority of provincial prion-based nursing services. At L'Établissement de Détention de Montréal, Ministry of Health nurses are mandated to screen and treat sexually transmitted and bloodborne infections, including HCV. "On demand" HCV screening, that is, testing requested by inmates, is available at the majority of provincial prisons in Quebec, including L'Établissement de Détention de Montréal . HCV antibody and RNA tests are performed via venipuncture, with estimated turnaround times of 24

hours and 21 days, respectively at L'Établissement de Détention de Montréal (Joelle Bianco, Ministry of Health nurse, Centre Intégré Universitaire de Santé et de Services Sociaux du Nord-de- l'Île-de-Montréal; personal communication, March 25, 2019). Confirmatory testing for chronic HCV infection via HCV RNA is attempted on all inmates who are HCV antibody positive. All inmates with chronic HCV are offered liver disease assessments by off-site HCV care providers prior to treatment initiation and are systematically informed of treatment options as part of routine post-test counselling; there are no on-site physicians with HCV expertise at L'Établissement de Détention de Montréal. Direct-acting antivirals may be~~are~~ initiated for inmates who serve greater than 12-week sentences to ensure that treatment is completed during incarceration~~-~~. Treatment uptake is further dependent on inmate interest and clinical urgency (presence of advanced fibrosis or cirrhosis). ~~while~~ T~~t~~reatment is postponed until release for inmates serving sentences shorter than treatment duration. ~~For the latter~~Instead, outpatient follow-up appointments with HCV care providers are scheduled by Ministry of Health nurses prior to release.

Design

We conducted a retrospective study of all HCV-related laboratory tests requested by L'Établissement de Détention de Montréal inmates between July 1, 2017 and June 30, 2018. This time period was chosen following a transitional period in early 2017; thereafter, two Ministry of Health nurses with dedicated time to sexually transmitted and bloodborne infections screening were available. We conceptualized the cascade of HCV care as a continuum of eight steps (Table 1): 1. Total sentenced inmates; 2. HCV screened; 3. HCV-antibody positive (indicative of previous exposure); 4. HCV RNA tested; 5. HCV RNA positive (indicative of chronic HCV

infection); 6. Linked to care; 7. Initiated on HCV treatment; and 8. Achieved sustained virologic response (indicative of cure). The total number of sentenced inmates (step 1) during the study period was 4931.[20] HCV screened (step 2) was defined as the number of inmates requesting on-demand HCV screening (via an HCV antibody test) during the study period. HCV-antibody positive (step 3) was defined as the number of inmates with at least one confirmed positive HCV antibody test. HCV RNA tested (step 4) was defined as the number of HCV-antibody positive inmates who had at least one HCV RNA test to confirm chronic HCV infection. We assumed that any inmate who underwent HCV RNA testing as the first screening test was already known to be exposed to HCV and thus also contributed data to steps 2 and 3. HCV RNA positive (step 5) was defined as the number of inmates with at least one confirmed positive HCV RNA test. Linkage to care (step 6) was defined as the number of inmates with chronic HCV infection who were assessed by an off-site HCV care provider. Treatment initiation (step 7) was defined as the number of inmates with chronic HCV infection who were started on HCV treatment during incarceration. Achieved sustained virologic response (step 8) was defined as the number of inmates who were HCV RNA negative 12 weeks following end of direct-acting antiviral treatment.

Sources of data

We obtained de-identified individual-level laboratory data for steps 2 to 5 from Sacré-Coeur Hospital's Optilab information system. Data accuracy was verified by removing duplicates and ensuring each individual had a unique identifier; in addition, data from re-incarcerated inmates were considered to contribute to the cascade only once. -Ministry of Health nurses were then provided with non-nominal identifiers to determine linkage, treatment initiation, and cure rates

(i.e. steps 6 to 8) using L'Établissement de Détention de Montréal prison health records. Due to the highly confidential nature of inmate data, individual-level data was restricted to age and HCV care parameters.

Statistical analysis

We calculated the proportion of inmates at each step of the HCV care cascade using denominator-numerator linkage, whereby data is linked at the individual level within each step and individuals eligible for being in the numerator in a given step are the same individuals in the denominator of the subsequent step. [21] We subsequently calculated the proportion screened (step 2) among inmates sentenced for at least one month (estimated to be 40% of the total number of sentenced inmates), during which time screening and confirmatory testing should be feasible.[18] All analyses were performed in R-3.5.1.

Ethics approval

This study was approved by the Research Institute of the McGill University Health Centre Research Ethics Board (MUHC 2019-5138) and by the Director of the Centre Intégré Universitaire de Santé et de Services Sociaux du Nord-de-l'Île-de-Montréal.

Results

Patient characteristics

All inmates were male. The median age was 35 years.

HCV cascade of care

Of the 4931 sentenced male inmates between July 2017 and June 2018, 344 (7%) were screened for HCV; 38 (11%) were HCV-antibody positive; 35 (92%) received HCV RNA testing; 16 (46%) were HCV RNA positive; 10 (63%) were linked to care; three (30%) were initiated on treatment; and two (67%) achieved SVR (Figure 1a). Among the six who were not linked to care, three refused while the other three were released prior to the scheduling of their HCV care appointments. Among the seven who were not initiated on treatment, three were serving sentences shorter than HCV treatment duration and were therefore denied therapy, two refused, one was transferred to another correctional facility, and one died of a cause unrelated to HCV. One inmate had not yet completed treatment and therefore had not met the timepoint for sustained virologic response. Restricting the analysis to inmates sentenced for at least one month (n=1972) increased the proportion of inmates screened for HCV to 17% ~~(Figure 1b)~~.

Interpretation

~~To our knowledge, this is the first study assessing the HCV cascade of care in a Canadian provincial correctional facility.~~ Our study retrospectively identified that the major bottleneck for engagement in HCV care for ~~people~~ men incarcerated in a large Canadian provincial prison was screening. We observed that screening rates were remarkably low (7%) in the presence of on-demand screening, that the prevalence of HCV antibody positivity (11%) reflects recent provincial biobehavioural studies, and that confirmatory HCV RNA tests were performed on the majority (92%) of individuals with evidence of previous HCV exposure.[22] Conversely, only 10 and three inmates were linked to care and started on HCV treatment, respectively, during the one-year study period. These low numbers likely reflect absent formalized HCV cure pathways as well as deficient follow-up procedures of chronically infected inmates post-release,

shortcomings that are unlikely unique to L'Établissement de Détention de Montréal. Finally, the identified reasons for low linkage and treatment uptake included refusals, short sentences, and prison transfers – all in keeping with other studies and representing unique challenges for HCV care in prison settings.[23, 24]

In order to improve HCV screening at L'Établissement de Détention de Montréal and in other Canadian provincial prisons, systematic opt-out screening should be considered a necessary first step.[5] Admission itself to any correctional facility provides an important public health opportunity to identify chronic HCV cases through screening, and as all distal cascade steps are dependent on this initial step, implementing systematic screening at admission and during incarceration is imperative.[25] Given that a sizeable proportion of incarcerated individuals have been previously exposed to HCV and are unaware of their status, this recommendation seems rational.[22] HCV screening rates in other Canadian provincial prisons are unknown. However, with the exception of British Columbia (where an opt-out screening approach is used), the majority of provincial correctional facilities provide testing only upon request, implying that similarly low screening rates would be expected in the remainder of Canadian provincial prisons. Despite the low screening rates, with on-site nursing, as is available at L'Établissement de Détention de Montréal, we found that a high proportion of HCV-antibody positive inmates underwent appropriate HCV RNA testing to confirm chronic infection. This is in keeping with a recent systematic literature review that found that on-site HCV testing with nurse-led education and counselling had the greatest impact on HCV screening rates.[26] Conversely, over one-third of inmates with chronic HCV were not linked to care, with half being released prior the scheduling of their HCV care appointments. Shortening the turnaround time of HCV RNA tests could help rectify this issue. The Xpert HCV viral load finger-stick point-of-care assay, although not yet

approved in Canada, is able to diagnose active HCV infection in a single visit, with a turnaround time of one hour.[27] This is particularly relevant for correctional facilities whose inmates serve short sentences, as is the case in Canadian provincial/territorial prisons or American jails. Cognizant that provincial prisons' budgets are limited, our findings imply that continuing to adopt on-demand screening approaches will fail to identify an important sub-population who drive the current Canadian HCV epidemic and who are key to HCV micro-elimination.[9]

In order to improve engagement along the HCV care cascade, L'Établissement de Détention de Montréal and other Canadian provincial prisons should explore strategies to increase access to HCV treatment. Prioritizing the treatment of all provincial inmates who remain in custody long enough to allow for the completion of direct-acting antiviral therapy is a reasonable first step.[15] While this may represent a minority of individuals, this is a practical approach owing to lower sustained virologic response rates among inmates who are initiated on treatment but who are subsequently transferred or released.[28] We found that among those who served sentences long enough to complete therapy, there remained a significant proportion of individuals who refused to be assessed for or initiated on treatment. While refusals are not uncommon in prison settings, a recent qualitative study demonstrated that adopting a patient-centred treatment approach, whereby privacy is assured and social support is provided, may enhance HCV treatment uptake among people in prisons.[29] In addition, correctional facilities could facilitate linkage with on-site (rather than off-site) physicians or other qualified health care personnel in order to reduce delays between diagnosis and treatment initiation. For the majority who will not serve sufficiently long sentences, both ensuring receipt of any HCV care while incarcerated and facilitating referral to an HCV care specialist through appointment scheduling have been shown to improve linkage to care following release.[26,30,31] However, both would only

be possible in the presence of dedicated and trained personnel, which again, may not always be the case in many correctional facilities. Furthermore, establishing corridors of service with primary or tertiary care centres would help ensure the availability of dedicated physicians and timely follow-up appointments. Canadian provincial prions have generally provided very little support during the prison to community transitional period, and while primary care may be better suited to address some of these challenges, post-incarceration transition clinics have also emerged as models of care to address these specific barriers in a culturally appropriate manner.[32,33]

Limitations

Our study has several limitations. First, the results of this study are limited to a single year at a single male provincial prison in Quebec. As such, the results may only be generalizable to other Canadian provincial prisons with both on-demand HCV screening and nursing personnel dedicated to HCV care. Our results may also not be generalizable to female or mixed-gender provincial prisons. Adding additional sites would have unlikely changed results due to similar screening protocols (i.e. on demand) in other Quebec provincial prisons. Secondly, as sentence durations were unknown, we may have underestimated the proportion progressing along the HCV care cascade solely as a result of short sentences. While we attempted to address this limitation with our secondary analysis, whereby we ensured sufficient sentence duration to allow for screening, this was impossible to do for cascade steps distal to HCV RNA positivity (i.e. linkage to care, treatment initiation and sustained virologic response). Therefore, right censoring of the data is expected without this consideration. Future cascade work could investigate the role of sentence duration on cascade reporting, allowing for more accurate documentation of

improvements to HCV care engagement among inmates over time. Finally, while we used individual-level data, we were unable to better understand progression (or lack thereof) along the HCV care cascade based on sociodemographic information or liver disease status due to restrictions on inmate data. This limitation underscores the unique challenges that exist when conducting scientifically rigorous research in correctional settings, and helps advocate for improved transparency with health research and research ethics in prisons.

Conclusion

We found substantial missed opportunities for HCV care engagement for inmates in Quebec's largest provincial prison in the presence of an on-demand screening strategy and despite dedicated nursing services. Correctional Service Canada has taken monumental steps towards the micro-elimination of HCV in federal facilities through systematic screening and universal access to HCV treatment; however, similar provincial commitments have lagged, likely driven by short sentences and high turnover rates. While prison settings represent unique environments for the initiation of HCV care, failing to adopt systematic opt-out screening as a first step, as was done in federal facilities, may not only have important individual-level health outcomes, but consequences for Canada's public health. Moving forward, we must engage with all relevant stakeholders, from policymakers to community, in order to prioritize people in provincial prisons in the national HCV elimination agenda.

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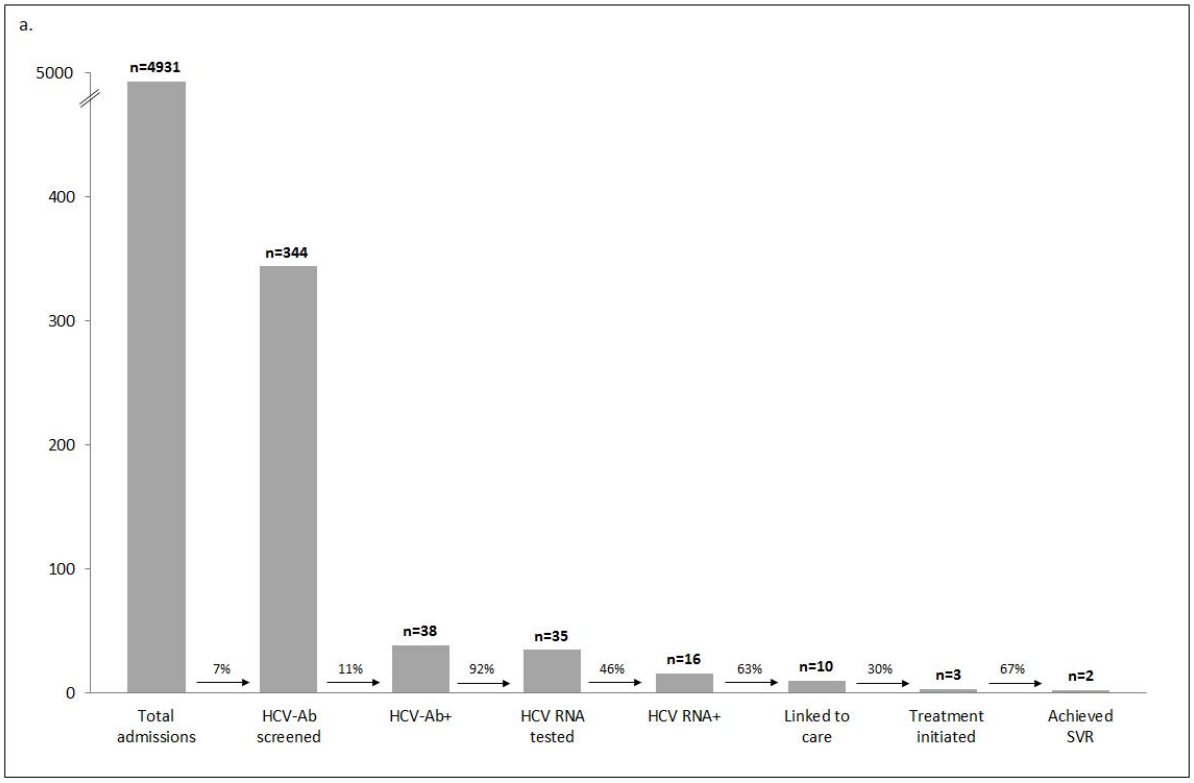
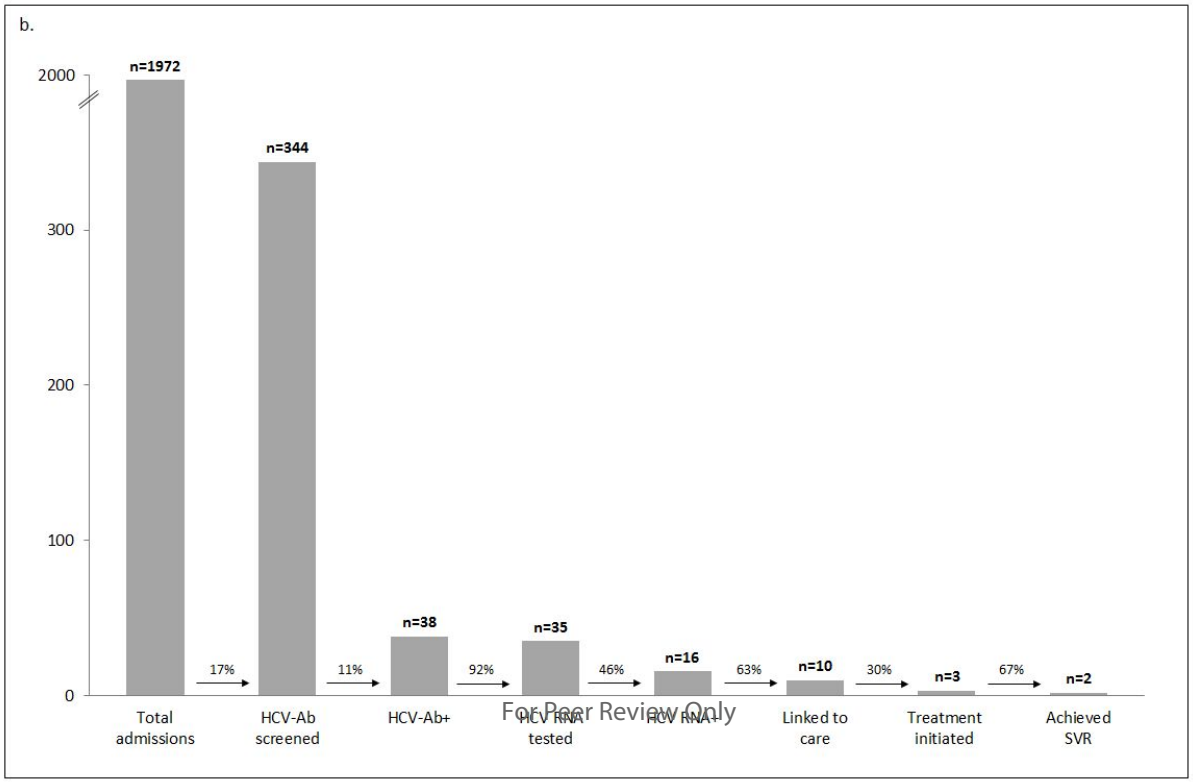
Table 1: Steps of the Hepatitis C virus (HCV) care cascade

Cascade step	Definition
1. Total sentenced inmates	Total number of sentenced inmates during the study period
2. HCV screened	Number of inmates requesting on-demand HCV screening (via an HCV antibody test)
3. HCV-antibody positive	Number of inmates with at least one confirmed positive HCV antibody test
4. HCV RNA tested	Number of HCV-antibody positive inmates with at least one HCV RNA test
5. HCV RNA positive	Number of inmates with at least one confirmed positive HCV RNA test, indicating chronic HCV infection
6. Linked to care	Number of inmates who were assessed by an off-site HCV care provider
7. Initiated on HCV treatment	Number of inmates who were started on HCV treatment during incarceration
8. Achieved sustained virologic response	Number of inmates who were HCV RNA negative 12 weeks following end of treatment, indicating cure

Figure 1: Hepatitis C virus cascade of care among all sentenced inmates (a) and among those sentenced for at least one month (b)





Contributors

Nadine Kronfli, Camille Dussault and Joseph Cox were involved in study conceptualization and design. Nadine Kronfli and Camille Dussault analyzed and interpreted the data. Nadine Kronfli drafted the manuscript. Nadine Kronfli, Camille Dussault, Marina Klein, Bertrand Lebouché, Giada Sebastiani and Joseph Cox critically revised the manuscript for important intellectual content. All of the authors gave final approval of the version to be published and agreed to be accountable for all aspects of the work.

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