Hepatitis C elimination among people incarcerated in prisons: challenges and recommendations for action within a health systems framework

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Hepatitis C virus (HCV) is a global public health problem in correctional settings. The International Network on Health and Hepatitis in Substance Users–Prisons Network is a special interest group committed to advancing scientific knowledge exchange and advocacy for HCV prevention and care in correctional settings. In this Review, we highlight seven priority areas and best practices for improving HCV care in correctional settings: changing political will, ensuring access to HCV diagnosis and testing, promoting optimal models of HCV care and treatment, improving surveillance and monitoring of the HCV care cascade, reducing stigma and tackling the social determinants of health inequalities, implementing HCV prevention and harm reduction programmes, and advancing prison-based research.

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Introduction

Hepatitis C virus (HCV) is a global public health problem in correctional settings. Because HCV is readily transmitted through injection drug use, and individuals with substance use disorders are often incarcerated, there is a disproportionately high prevalence of HCV in correctional settings compared with the general population.[1–3] The incidence of new transmission is also high because of insufficient access to harm reduction measures in correctional settings.[2–4] Each year, more than 10 million men and women worldwide spend time in prisons and other closed settings, most of whom will return to the community.[5] Therefore, incorporating correctional settings into HCV elimination plans will reduce the burden of HCV, both in correctional settings as well as in surrounding communities.[6–9]

The ambitious 2030 global HCV elimination goals set by WHO[10] called for a focus of these efforts in correctional populations. In reality, HCV elimination among people who inject drugs and in the criminal justice system are inextricably linked due to the overlap of these populations. However, compared with the surrounding community, prisons offer a setting with generally lower rates of drug use, and often greater access to health care and improved food and housing security for individuals engaged with the criminal justice system. Therefore, because of these factors, providing care along all steps of the HCV care continuum, including HCV prevention, screening, linkage to care, treatment, and prevention of reinfection, can potentially be optimised in correctional settings. However, current estimates suggest that, of the 124 countries with viral hepatitis testing and treatment plans, only 51 (41%) have proposed interventions dedicated to people who inject drugs and even fewer (n=28; 23%) have interventions for people in correctional settings.[11]

Creation of the working group

The International Network on Health and Hepatitis in Substance Users (INHSU) is an international organisation committed to advancing scientific knowledge exchange and advocacy for HCV prevention and care among people who inject drugs. We established a prisons-focused special interest group (INHSU Prisons SIG) in 2019, with the aim of improving the care of people with HCV in correctional settings. All authors, except for PHT and RL, are members of the SIG executive committee; PHT was solicited for their expertise in HCV care in low-income and middle-income countries and RL was solicited for their expertise in harm reduction. In this Review, we highlight seven priority areas and best practices for improving HCV care in correctional settings to achieve HCV elimination. This Review is not intended to be prescriptive, given that different correctional health-care structures have varied priorities, models of care, and implementation plans.

Changing political will

Health-care provision within prisons often varies between countries and can even vary between states, provinces, or territories within a country. This difference is due to multiple factors, including the administration of prison health via local, state, or federal health authorities, variations in health-care models between correctional facilities, differences in the financial structure of health-care provision, and oversight of health-care provision by relevant government ministries. Therefore, it is imperative that these factors are taken into consideration in strategies for the delivery of HCV-based health care.[12]

To optimise HCV elimination efforts in correctional settings, key stakeholders need to be engaged (panel 1).[12] Ideally, before engaging with policy stakeholders, the prevalence of HCV infection in local correctional centres should be ascertained, or inferred from other regional data. Knowledge regarding the prevalence of HCV helps to formulate the scope of the strategy, to define a practice framework for the response, and to incorporate financial considerations, including negotiations regarding the price of drugs.[14–17] For example, Spain's strategic plan for tackling HCV in the Spanish national health system

***Panel 1*: The role of political will in coordinating prison-based services with the surrounding halfway houses in Singapore**

In many countries, a proportion of prisoners released into supported accommodation as part of the early release programme, which includes drug rehabilitation. Results of the EPIC-Hep C study[13] in such halfway houses in Singapore showed that 107 (30%) of 351 residents were positive for the hepatitis C virus (HCV) antibody. Only 27 (25%) 107 of seropositive individuals were aware of modes of HCV transmission, and only 119 (34%) of 351 had previous knowledge of HCV transmission by injecting drug use.

A multistakeholder meeting was convened to develop and support a pilot programme, including representatives from government (health ministry) and non-governmental organisations (religious charities overseeing the houses), as well as public health authorities and researchers. Halfway-house residents were provided with HCV education, screening, and staging of liver disease. Individuals who were positive for HCV were fast-tracked into secondary care for treatment. Linkage to care was improved by 23% across all levels of the HCV care cascade.[13] Governmental buy-in was instrumental for this multisectoral response to be realised. This project simultaneously empowered prison-based primary care providers through proctorships to increase testing and shared care of HCV within prisons and community-based non-governmental organisations, to provide HCV-focused services for recently incarcerated individuals.

showed the importance of stakeholder engagement by including a detailed budget plan to support treatment allocation, including for individuals in the correctional system, by gaining funding support from the Ministry of Health.[18] In the USA, prisons and jails are in a pool of payer entities used to calculate the so-called best prices for drugs in state Medicaid programmes. Due to constraints in correctional health budgets, many have argued that prisons and jails should be removed from these calculations to allow them to negotiate better drug prices, or that alterative drug purchasing strategies are needed. However, these strategies have been largely unsuccessful in lowering drug prices.[14–17]

In the context of prevalence and cost estimates associated with HCV, multistakeholder forums with national or regional politicians, administrators of health and correctional services, and primary and secondary health-care providers from correctional centres, as well as relevant non-governmental consumer agencies and advocates, should be consulted to obtain buy-in and to develop a framework for HCV elimination in correctional settings. Data from prison-based treatment programmes show that treatment of people who are incarcerated is associated with good clinical outcomes and is cost-effective.[13,19–24] Such successful programmes should be used to guide stakeholder meetings towards incorporating correctional settings into local microelimination or national elimination strategies.

Showing the effect of previously successful programmes on the affected population, and on national elimination aims, is important to overcome concerns regarding logistics, resources, and responsibilities for the various stakeholders and to define specific aims for the correctional system or facility.[25] Further, modelling of the HCV disease burden and the potential effect of various intervention strategies is helpful in guiding priorities in the implementation of HCV testing and treatment programmes, and with health economic assessments, in projecting budget commitments and probable cost benefits of HCV elimination.[26–29] Overall, incorporating correctional settings into national HCV elimination strategies is a key step towards HCV elimination, recognising that each country and each region will have unique challenges. WHO advocates that health ministries, and not justice ministries, should provide and be accountable for health-care services in prisons.[10] After 6 years, an assessment of the quick transfer of health control to the Department of Health and Social Care in the UK concluded that benefits of such an approach include greater transparency, evidence-based assessment of health needs, improved quality of health care, and greater integration with public health programmes compared with health care provision under prison health services.[30]

Ensuring access to HCV diagnosis and testing

In accordance with recognised international standards, although offering testing for active HCV infection is recommended with verbal consent, screening for HCV and other bloodborne viruses in correctional settings is currently done with varied testing strategies.[31] The first strategy is targeted screening, in which the individual is assessed for risk factors (eg, injection drug use) or identified as part of a high prevalence epidemiological group (eg, part of the 1945–65 so-called baby boomer cohort in the USA).[32] The second strategy is universal screening, in which all individuals are eligible for screening. These testing strategies can be administered for individuals who opt in (the individual has to request testing) or opt out (the individual is told they will be tested unless they refuse). Universal opt-out testing has been reported to be more effective and cost-effective than targeted, opt-in testing.[7,33]

Efficient completion of the diagnosis of chronic HCV by testing for HCV RNA, and further assessments with the aim of treatment, can be especially challenging in correctional settings, particularly in those with high turnover rates due to movements between correctional centres or releases from correctional centres. Therefore, it is essential that screening is done at the initial health assessment, which is generally conducted within 24 h of admission, or within a short period thereafter.[34] Testing strategies should also be quick and accessible.[35] The traditional approach of on-site venepuncture and specimen shipment for diagnostic laboratory testing at a distant site typically has a turnaround time of 1–2 weeks. In the case of a 2 week turnaround, reflex testing offers the substantial advantage of avoiding repeated cycles of testing and results over many weeks.[36] Point-of-care tests, which offer results in minutes or hours, are not only efficient but also overcome the common difficulty of poor venous access in people who are incarcerated and inject drugs, and have been shown to be acceptable

among individuals who are incarcerated.[37] These point-of-care tests include antibody detection in saliva and RNA detection via fingerstick blood sampling.[38,39] Another option is screening for HCV antibody and RNA via dried blood spot testing,[40] which facilitates sample collection as well as the opportunity to simultaneously screen for co-infections, such as HIV.[41] Such strategies have been shown to improve screening and treatment uptake in people who are incarcerated (panels 2 and 3).[42,43]

Assessment of the severity of liver disease is recommended before treatment by use of fibrosis prediction algorithms, such as the aspartate aminotransferase-to-platelet ratio index or the Fibrosis-4 index, or by transient elastography (if available).[44,45] Fibrosis assessment guides the optimal duration of direct-acting antiviral treatment, and identifies individuals with cirrhosis to facilitate the management of advanced liver disease, such as variceal and hepatocellular carcinoma screening.

Promoting optimal models of HCV care and treatment

Models of HCV care in correctional settings vary vastly within and between countries. Traditional hospital-based specialist clinics providing care for people in nearby prisons are still common in many places. This model of care involves the escort of individuals who are incarcerated to local hospitals for assessment and treatment; however, this approach is associated with low rates of treatment initiation.[46] To overcome key barriers to linkage to care, particularly transfers between correctional settings and short stays,[23,47] more efficient and targeted models of HCV care should be considered for use in correctional settings.[48] Other barriers to consider include stigma, funding for prison health service infrastructure and for direct-acting antiviral treatments, as well as adequate staffing.[23,47] The key elements sustaining improved models of HCV care include in-reach services, in which clinicians visit correctional centres for on-site clinic sessions, and potentially incorporating consultations via telemedicine, which has been shown to be both acceptable and cost-effective.[19,49] This service model of care shows a move from hospital-based services to the on-site provision of care. Such services are associated with an increased number of individuals completing the HCV care cascade compared with those following traditional models.[19,46]

In prison-based services, tasks might also be transferred; some or all of the elements of the care cascade could be shifted away from specialists to general practitioners or skilled nurses, including direct-acting antiviral prescription in settings where policies allow such transfers.[20] These task transfers should be supported by education of the prison-based health-care workforce, which can be facilitated through telementoring and training (eg, such as that used in Project Extension for Community Healthcare Outcomes [Project ECHO] in the prison system in New Mexico, USA; panel 4).[50] Direct care from providers to patients can also be provided through telemedicine. Although there are no guidelines for integrating telemedicine into the prison health sector, several examples for correctional settings and existing telemedicine guidelines can be adapted to provide HCV and other subspeciality care.[46] In prisons, external internet connections are often not permitted; therefore, specific internal networks often need to be used. Additionally, authorisation for desktop computers to include camera and audio equipment is key.

Combinations of elements from these service models are increasingly common; for instance, nurse-led triage of selected patients with complex conditions for specialist consultation.[22,51] Such decentralised models have resulted in a marked reduction in the time from screening to

Panel 2: Efficient prison-based testing and treatment to eliminate hepatitis C virus (HCV) in a prison in the UK

A highly simplified test-and-treat intervention was implemented in a prison in the UK.[42] The model used rapid point-of-care testing for HCV antibodies and HCV RNA (OraQuick rapid HCV antibody test [OraSure Technologies, Bethlehem, PA, USA] and Xpert HCV Viral Load fingerstick assay [Cepheid, Sunnyvale, CA, USA]), coupled with fast-tracked clinical assessment, including non-invasive transient elastography (Fibroscan [EchoSens, Paris, France]) and treatment with pangenotypic direct-acting antiviral therapy. There were 162 newly incarcerated individuals who were screened through this model within days of arriving in prison, of whom 20 were diagnosed to be HCV viraemic and considered eligible for treatment.

The time from screening to treatment initiation was reduced from 3 months in the conventional model (opt-out dried blood spot testing and referral for clinical assessment and care) to 1 week through the intervention model. Retention in the HCV care cascade in this model was high, with 17 (85%) of 20 eligible individuals initiated on treatment, compared with 13 (21%) of 62 in the conventional model. There was also improved efficiency with reduced time intervals between each stage in the HCV care cascade versus the conventional model, with screening completed within 2 days of arrival (*vs* 6 days), clinical assessment in 3 days (*vs* 14 days), and treatment initiation in a further 1 day (*vs* 36 days).

Panel 3: Universal test-and-treat strategy to eliminate hepatitis C virus (HCV) in Spanish prisons

In Spain, the release of a national plan to tackle HCV included a focus on individuals in prisons as a priority population for testing and treatment. This plan was facilitated by HCV antibody and HCV RNA reflex testing for most of the Spanish prisons.[36] Further, in the JAILFREE-C Project in El Dueso prison in Cantabria, Spain, a universal opt-out screening programme on admission had a 99·5% acceptance rate.[19] All individuals with chronic HCV and an anticipated length of stay of more than 30 days were evaluated by use of telemedicine and initiated on direct-acting antiviral therapy to achieve local elimination. In this project, telemedicine was used to overcome geographical barriers, allowing access to specialist care. Medical staff in the prisons and people who were incarcerated were connected to hepatologists and a multidisciplinary team by use of videoconferencing technology and a public administration network to securely connect both parties. This network is nationally available and free to access for public and governmental institutions, such as health-care systems and correctional facilities, and the telemedicine tool is granted for public services on request. To our knowledge, a growing number of penitentiary centres in Spain have implemented this model and have reproduced the JAILFREE-C Project's results.

Panel 4: Prisoner health is community health: New Mexico's Peer Education Project

New Mexico's Peer Education Project (USA) is a programme developed by Project Extension for Community Healthcare Outcomes (Project ECHO) and is designed to reduce high risk behaviour and hepatitis C virus (HCV) transmission among prisoner populations.[50] Trained peer educators delivered hepatitis education on a monthly basis via interactive face-to-face workshops. Individuals are recruited by peer educators from the general prisoner population. Between 2009 and 2016, 482 peer educators across seven prisons trained more than 8500 prisoners in either peer-led workshops or short educational sessions. The project showed peers to be an invaluable resource for the provision of accessible, culturally appropriate information, and for large-scale knowledge dissemination. Increased respect and trust from both prisoner peers and prison staff were also reported. Evaluation of the effect on HCV transmission, as well as testing and treatment rates, would provide stronger evidence for the use of peer-based services for HCV care in the prison setting.

Panel 5: The use of surveillance to show gaps in hepatitis C virus (HCV) testing and treatment in the USA

For more about **HCV estimates from the HepCorrections group** see http://www.hepcorrections.org/

HepCorrections is a collaboration of academics, public health practitioners, and advocates interested in the elimination of HCV from correctional centres and is funded by the US National Science Foundation. The group has the ambitious aim of providing a national dashboard of testing and treatment in each jurisdiction across the USA. The dashboard presents widely varied HCV prevalence estimates, and similarly widely varied estimates of the proportion of all those incarcerated who initiated treatment. Although data have largely been derived from unpublished estimates and are therefore of uncertain validity, with robust epidemiological data from the prison sector, this endeavour could serve as a model approach for other countries worldwide.

treatment, a substantial increase in retention in care, and successful in-prison treatment initiation.[22] Integration of peers into corrections-based care has been associated with increased knowledge, reduced risk-taking behaviours, and improved engagement with health-care services by reducing fear and stigma, and encouraging mutual trust.[52,53] A 2015 systematic review of peer-based health interventions in correctional settings reported that peer education interventions are effective at reducing risky behaviours among individuals in the correctional setting.[52]

Improving surveillance and monitoring of the HCV care cascade

Given the importance of the prison population to national and global HCV elimination efforts, reliable data regarding prevalence and incidence of HCV in the prison setting, as well as risk behaviours, prevention measures, and treatment provision, are essential (panel 5). Further, as individual countries progress towards HCV elimination, such data need to be representative (recognising the common heterogeneity between individual prisons reflecting differing proportions of people who inject drugs, security classifications, representation of ethnic minorities, and gender). Additionally, the data collection should be integrated within national surveillance systems to best show the movements of groups at high risk for HCV to and from correctional settings, and also to ensure integration with surveillance of other blood-borne viruses and health concerns. Surveillance data also need to be made available in a timely manner and on a regular basis (at least annually). To our knowledge, there are no countries that meet these expectations.

From first principles, such public health surveillance systems can be passive (ongoing reporting of the condition by health facilities), or active (in which health facilities are visited and representative data are obtained by public health workers).[54] For largely asymptomatic conditions, such as HCV infection, passive laboratory-based reporting with individual patient-level identifiers is a key factor for optimal surveillance. However, such laboratory notification systems cannot show individuals who are not tested and do not record risk behaviours, or the uptake of harm reduction and direct-acting antiviral treatments (termed here biobehavioural data). In the absence of such comprehensive surveillance, active biobehavioural sampling of representative subpopulations is commonly undertaken either cross-sectionally for prevalence, or longitudinally for both prevalence (at baseline) and incidence. Both approaches are labour-intensive but offer the potential to concurrently show biobehavioural data and prevalence and incidence data. For incarcerated populations, unique challenges for surveillance programmes include the high turnover of individuals to and from the community, the concentration of ethnic minorities in prisons (which necessitates adequate sampling), and the custodial barriers to regular surveillance (such as reliable access to individuals for testing).

In the prison setting, the most commonly used surveillance strategy is prevalence surveys among recent prison entrants, with screening via HCV antibody testing and brief behavioural questionnaires; however, such screening is rarely universal or opt out, and therefore of uncertain representativeness.[55] A recent systematic review[56,57] of such prevalence data for the period 2005–15 showed that only 46 (23%) of 196 countries had HCV antibody prevalence data, with regional pooled estimates among all prisoners ranging from 20% in eastern Europe and central Asia, to 16% in western Europe and 15% in North America, and 5% in Latin America. Only 19 (10%) countries had prison data for people who inject drugs, which showed far higher prevalence rates compared with non-injecting prisoner

populations (ranging from 8% to 95%).[57] There were substantial data gaps, particularly for incarcerated female individuals and ethnic minorities. Additionally, data regarding temporal trends in prevalence of HCV are scarce, but there is evidence of reductions in HCV prevalence during this time period in correctional centres in Spain and in Australia.[58,59]

Only three incidence estimates of HCV were reported during a similar period from Australia, Scotland, and Spain, with widely varied rates (ranging from 0·9% per annum in Scotland to 14·1% in Australia).[60–62] The follow-up estimate from the Australian prospective cohort showed a sustained annual HCV incidence of 11·4%, over a decade of surveillance.[63] A more recent cross-sectional survey of Danish prisoners done in eight correctional centres by use of a dried blood spot method showed that HCV antibody prevalence was 7·4% (59 of 801 tested) an HCV RNA prevalence was 4·2% (34 of 801 tested).[64] Based on individuals with HCV RNA-positive and HCV antibody-negative status, the analysis also included an estimate of HCV incidence of 0·7–1·0% overall, and 18–24% among people who inject drugs. In combination, these data show wide variation in HCV prevalence and incidence in prisoner populations, and the need for improved surveillance in the prison sector, including concurrent data collection regarding risk factors, prevention, and engagement with the HCV care cascade. The WHO Health in Prisons European Database is an important surveillance initiative showing the existing data (and the many gaps) in national prison health services and health surveillance among people who are incarcerated in Europe, including testing and treatment of HCV.[10]

Reducing stigma and tackling the social determinants of health inequalities

Key contributors to the low uptake of HCV-related services in correctional settings are perceived stigma toward incarcerated individuals and poor awareness of both HCV and advances in HCV treatment. People who are incarcerated often fear being stigmatised by correctional staff, health-care workers, and their peers, leading many to forgo the uptake of existing testing and treatment services.[65,66] Moreover, many incarcerated individuals have misconceptions about their diagnosis and are unaware of the newer direct-acting antiviral therapies that are well tolerated and have fewer side-effects compared with interferon-based therapies.[65,67] Offering education to individuals who are living with HCV might alleviate the stigma that some individuals experience while seeking HCV care in correctional settings.[52,53,65,68,69] As mentioned previously, peer mentorship could be particularly effective in increasing the uptake of HCV screening and treatment because this approach has been associated with improved engagement with health-care services by reducing stigma.[52,53]

Uptake of HCV care in correctional settings also requires addressing the social determinants of health that many people in the criminal justice system face before, during, and after incarceration. Such social determinants include insufficient social support, but extends to homelessness, food and housing insecurity, and mistrust in the health system.[70–73] Some of these factors act as barriers to HCV treatment uptake while in prison, but they tend to have a greater effect once the incarcerated individual returns to the community.[68,74] Most people who are on remand (or those incarcerated in jails in the USA) are incarcerated for only days or weeks,[75] which is less than the standard length of direct-acting antiviral treatment. Although HCV treatment is feasible even in short-term correctional settings for individuals with lengths of stay that permit it,[24,76] incarceration is often too short to complete or even initiate treatment for many individuals. If HCV treatment cannot be initiated in correctional settings, connecting individuals living with HCV to care after incarceration requires mitigation of the social determinants of health in the transition to the community. Discharge planners or patient navigators have been used with some success to connect individuals to local partners for treatment initiation on their release back into the community. Such programmes tend to be more effective when discharge plans also include linkage to mental health, substance use, and housing services to address behavioural and structural determinants of health. These programmes have been more widely used among people living with HIV and have been shown to improve linkage and retention in HIV care.[77] Leveraging existing discharge planning programmes is a promising way to address linkage to HCV care after incarceration (panel 6).[78] Complementary strategies to engage people in HCV care after release also include decentralised services outside of traditional medical clinics, such as mobile clinics, needle exchange centres, and drug rehabilitation

Panel 6: **Transitional care coordination to improve linkage to hepatitis C virus (HCV) care in New York City**

In the New York City (NY, USA) jail system, a combined transitional care coordination and patient navigation intervention was shown to be effective in linking individuals who were incarcerated and HCV positive to care in the community on release.[78] The programme built on the existing transitional care coordination intervention model for individuals who were positive for HIV.[77] Although linkage to care was timely (31% of individuals were linked to HCV care within a median of 20·5 days), rates of linkage to care were lower in the HCV pilot than the traditional HIV-focused programme.[77,78] Lower rates might be due to the earlier response of health-care systems to the HIV epidemic, more preincarceration relationships between patients living with HIV and HIV providers, relatively longstanding availability of effective antiretroviral therapy, and more resources allocated specifically for people living with HIV, such as housing and medical services provided through the national Ryan White HIV/AIDS Program. This pilot programme showed a need for an improved HCV linkage to care model for individuals who are incarcerated that builds on the traditional transitional care coordination strategy and integrates resources to address social determinants of health, such as case workers or patient navigators to assist with obtaining health insurance, food stamps, and housing before release or early in the re-entry period.

***Panel 7*: Prisons needle and syringe programmes to reduce to hepatitis C virus transmission in prisons in Moldova**

Moldova has been a regional leader in the implementation of prison needle and syringe programmes, which were established initially in response to the emergence of HIV among detainees. Prison needle and syringe programmes are operating in 13 of 17 prisons in Moldova.[87,88]

The Moldovan prison system also pioneered the use of peer-based syringe distribution, in which teams of prisoners are trained as peer health workers and have a key role in providing health information and distributing harm reduction materials, including sterile syringes. Despite the resistance of some prison staff to the prison needle and syringe programmes, there has been an increase in workplace safety and no instances of syringes used as weapons.[89] Finally, the prison service also introduced opioid agonist therapy (methadone) into its harm reduction response,[89] and substitution treatment is now available in 13 of 17 correctional centres.[88]

Because needle and syringe programmes and opioid agonist therapy are also available in the community, Moldova provides an example of good practice in continuity of harm reduction services inside and outside prison.

centres.[79] Engaging incarcerated individuals before release in co-located, integrated care, including harm reduction and treatment of substance use disorders, might be a way to improve engagement in HCV care. Connecting individuals with chronic HCV with a community partner on release not only maintains continuity of care but also is an effective and necessary solution to curtail HCV among transmission networks of people who inject drugs and are involved with the criminal justice system.

Implementing HCV prevention

Harm reduction measures, including needle and syringe exchange programmes and opioid agonist therapy, have been a key factor of the global prevention strategy for HIV, along with condom use, and more recently, antiviral treatment as prevention. Needle and syringe exchange programmes and opioid agonist therapy, which are also fundamental for HCV prevention among people who inject drugs, are now available in at least 86 countries.[80] However, the acceptance of such harm reduction measures in the community has rarely been followed by their implementation in prisons, despite evidence showing that these types of services in the correctional setting reduce engagement in risky behaviours (ie, illicit drug use and sharing of drug paraphernalia) and probably contribute to a reduction in the transmission of blood-borne viruses.[31,81] Currently, only eight countries provide needle and syringe exchange programmes in at least one prison, whereas 54 offer some type of opioid agonist therapy.[80] These harm reduction measures are denied to most people in detention centres worldwide, largely because of little political will for implementation, suggesting that the success of community-based needle and syringe exchange programmes and opioid agonist therapy could be supported through partnerships with nearby correctional settings, to encourage service use among individuals re-entering the community. The gap between the levels of access in the community and prisons exists despite the fact that providing harm reduction measures in places of detention is acknowledged as best practice by WHO, the United Nations Office on Drugs and Crime, and UNAIDS, among other expert bodies.[82] The provision of harm reduction measures is also supported by European bodies, including the European Centre for Disease Prevention and Control and the European Monitoring Centre for Drugs and Drug Addiction.[83] Additionally, although tattooing has been significantly associated with HCV transmission,[84] in most jurisdictions, tattooing in prisons is illegal and safe tattooing initiatives are rare, with only one prison-based programme ever evaluated.[85] Despite the widespread practice of prison tattooing, a 2018 systematic review concluded that knowledge of good practice responses was inadequate.[86]

Although the effectiveness of harm reduction programmes in prisons and their successful implementation in many different countries and custody settings is well evidenced,[85] opposition to include harm reduction programmes in prisons is common in many countries. This opinion is primarily based on the belief that the provision of harm reduction runs counter to the so-called drug free ethos of prison systems, and that providing sterile injecting equipment represents an admission of failure by the prison service. Needle and syringe exchange programmes are often opposed on the belief that syringes could be used as weapons, thereby compromising the safety of staff and prisoners.[87] However, international experience shows that needle and syringe exchange programmes and opioid agonist therapy can be safely and effectively applied in closed custody settings (panel 7),[87,89,90] and that these interventions contribute to decreased syringe sharing, and thereby likely reduced risk of transmission of blood-borne viruses.[85]

With regard to treatment as prevention, the Surveillance and Treatment of prisoners with hepatitis C (SToP-C) study evaluated the reduction in HCV incidence associated with scale-up of HCV testing and direct-acting antiviral treatment in four prisons in Australia.[91] This 5 year study enrolled approximately 70% of all prisoners in the centres in which opioid agonist therapy (but no needle and syringe exchange programmes) was available, and showed a significant decline in the incidence of HCV. This outcome was consistent with the effect predicted by a modelling study of the same setting, which also argued for scale-up of both direct-acting antivirals and harm reduction as being essential to achieving prison-based elimination of HCV.[92]

Advancing prison-based research

The fundamental principle of equity of health care for prisoners is stipulated in the so-called Nelson Mandela rules: "prisoners should enjoy the same standards of health care that are available in the community, and should have access to necessary health-care services free of charge without discrimination on the grounds of their legal

status."[93] Best practice health services in the prison setting are not only supported by this principle but also by research.[94,95] However, prison-based research faces numerous challenges and obstacles beyond health research in other settings. The reason is primarily due to a troubled history of forced exploitation of incarcerated populations, primarily in the USA, for health research during the second half of the 20th century, such as the infamous Tuskegee syphilis study.[96] Indispensable federal and institutional regulations were introduced to promote the safety and security of people in prison;[97] however, a perhaps unintended consequence was that correctional settings became far more challenging environments for research. Common challenges in prison-based research include gaining access to the research setting, obtaining research review and approval, navigating the research settings' policies and procedures, and managing interruptions and delays due to the setting.[98] Another commonly cited barrier includes the recruitment of participants, impeded by unanticipated logistical delays related to lockdowns or the inability to move without supervision, a scarcity of private interview areas, and the unavailability of participants due to court dates, mealtimes, etc.[98] Studies that seek to follow-up with individuals after incarceration also report high levels of attrition despite postrelease monetary incentives, due primarily to incorrect contact information, recidivism, and the presence of competing priorities at the time of release.[98,99] These challenges have probably contributed to the modest number of HCV studies done in prison settings.

There are also unique ethical challenges that exist in conducting prison-based research. First, because correctional settings were not designed to promote privacy, ensuring confidentiality (which is often cited as the most important ethical challenge facing prison-based researchers) can be particularly difficult.[100] Ensuring confidentiality is of the highest importance with HCV given its association with stigmatisation and the potential for harm through disclosure of an individual's status. Second, because autonomy is sacrificed with incarceration, the ability to decide freely to participate or not in research, particularly in the context of financial incentives that can result in undue influence, is compromised.[100] Third, obtaining consent among people in prison can be difficult as a result of lower educational and literacy levels and higher rates of mental illness and substance misuse than in the general population.[101,102] Finally, ensuring that people in prison are not coerced into participation as a result of power imbalances, incentives, or to access better medical services or care is another important ethical dilemma.[103]

Despite the numerous challenges that exist, advancing prison-based HCV research is an essential step towards HCV elimination. This advancement cannot be done without the recognition of incarcerated individuals as a key population for inclusion in global HCV research.[95] Open and honest dialogue among all stakeholders should be promoted to facilitate the process, manage the challenges encountered in a timely manner, and ensure the maintenance of a high ethical code for health research in prison settings.[97,104] These three key factors for research in prison settings can be achieved by incorporating a governance and stakeholder engagement strategy within the research study, with the aim of active partner engagement. This proactive process could seek to involve various stakeholders (from study investigators to correctional staff and people with lived experience of incarceration) to identify possible concerns for study participants, address potential risks that study participants might encounter, maximise safety, and ascertain the implications for those involved in the study and for the community at large. An additional aim might be to infuse partners' experiences and preferences into the study design, such that the methods used and the data shown are person-centric and meet the needs of all partners. Efforts should be made to involve community members (eg, currently or previously incarcerated individuals) during this process to ensure that the research done is culturally sensitive and ethically appropriate.

Conclusions

In conclusion, HCV is a global health problem that is associated with criminal justice systems internationally. The priority areas outlined in this Review are not only supported by the Nelson Mandela rules (ensuring that prisoner health care is consistent with community standards)[5] but also by state obligations under international and regional human rights law.[105] Prisons and prisoners are also increasingly important for national and global HCV elimination efforts. Optimising both in-prison testing and treatment strategies and connections to HCV care in the community are essential for this endeavour. Not only are correctional facilities ideal settings to engage individuals in care while they are incarcerated, they also provide an opportunity to address the social determinants of health that might benefit overall health outcomes of individuals who have been incarcerated as they return to their communities.

Search strategy and selection criteria

To identify potential priority areas, a literature review of the PubMed database was done regarding the topic of prisons and HCV. Search terms included those relating to prison settings (eg, prisons, jails, custodial, corrections, and incarceration) and HCV. The search was limited to consider literature published between Jan 1, 2005, and Nov 1, 2020, in English only. Members of the working group appraised the evidence and iteratively discussed priority areas and best practices during the conception of this Review. Each study author was responsible for conducting their own search strategy for their chosen priority area; best practices were agreed on as a group.

Contributors
MJA, NK, JC, YS, and ARL were involved in the conceptualisation, writing, review, and editing of this Review. PHT and RL were involved in the writing and review. All authors approved the final version.

Declaration of interests
NK reports grants and personal fees from Gilead Sciences, Merck, AbbVie, and ViiV Healthcare, outside of this Review. ARL reports grants from Gilead Sciences and AbbVie, outside of this Review. All other authors declare no competing interests.

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