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Research Paper

# Feasibility of implementing viral hepatitis services into a correctional service facility in Cape Town, South Africa

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ABSTRACT

*Background:* Hepatitis B virus (HBV) and hepatitis C virus (HCV) are estimated to be of the most prevalent infectious diseases in correctional settings worldwide. However, viral hepatitis services have not been routinely integrated into South African correctional facilities. We aimed to assess prevalence of HBV infection and HCV infection among people accessing HIV services and assess the feasibility of viral hepatitis service integration in a South African correctional centre.

*Methods:* Voluntarily participating people in a correctional services facility were offered free hepatitis B surface antigen (HBsAg) and anti-HCV point-of-care testing in addition to routine HIV testing and treatment services on a first-come, first-served basis during June 2021–March 2022. Off-site laboratory testing (HBV and HCV molecular testing and non-invasive liver fibrosis staging) and screening for hepatocellular carcinoma informed further management. A general practitioner at the facility managed participants, with virtual support from hepatologists. Data on age and history of injecting was collected and point-of-care and laboratory results were recorded. Data were analysed using descriptive statistics.

*Results:* The median age of the 765 people who participated was 32.5 years (IQR 27.5 – 38.2), with 2.2% (17/765) reporting having ever injected a drug. The sample prevalence was 3.9% (30/765) for HBV infection, 0.5% (3/665) for HCV infection, and 1.2% (9/765) for HIV-HBV coinfection. Thirty people had reactive HBsAg point-of-care tests. Among those with reactive HBsAg point-of-care tests 90.0% (27/30) received work-up, among whom 48.1% (13/27) were monitored, 44.4% (12/27) were placed on treatment and two people were released before a management plan could be finalised. Of those treated 33.3% (4/12) started tenofovir/emtricitabine and 66.7% (8/12) antiretroviral therapy. Of the eligible participants, 27.3% (201/735) received at least one hepatitis B vaccine dose and 26.9% (54/201) received three doses. All three participants who had confirmed HCV infection were started on direct-acting antivirals. Of the two completing treatment one achieved sustained virological response at 12 weeks (SVR12), one person was released before SVR12 was done. One person was lost to follow-up. No clinical adverse events were reported.

*Conclusion:* There was a notable viral hepatitis burden among people in this correctional centre and integration of viral hepatitis services into the existing HIV services was acceptable and feasible. Further efforts to sustain and expand access to viral hepatitis services in South African correctional centres could catalyse national viral hepatitis elimination efforts.

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## Introduction

Hepatitis B virus (HBV) and hepatitis C virus (HCV) are of the most prevalent infectious diseases in correctional settings worldwide (Dolan, Wirtz, Moazen, Ndeffo-mbah, et al., 2016). Injecting drug use, tattooing, the sharing of razors or hair clippers, sexual activity, and physical violence may involve exposure to blood and are risk factors for HBV and HCV transmission in correctional settings (WHO, 2022a; WHO, 2022b). Recent systematic reviews found that the prevalence of HCV infection in correctional settings ranges from 0.3% - 74.4% (Busschots et al., 2022) compared to 1.8% (95% confidence interval 1.4 – 2.3%) (Salari et al., 2022) in the general population. In South Africa 150 056 people are incarcerated (2023) (Fair & Walmsley, 2024). Currently there is little data on HBV or HCV prevalence among people in correctional settings in South Africa, (Dolan, Wirtz, Moazen, Ndeff, et al., 2016; Ahmadi Gharaei et al. 2021) and viral hepatitis services are not routinely provided.

The World Health Organization recommends a package of interventions for HIV, viral hepatitis and sexually transmitted infection (STI) prevention, diagnosis, and treatment for people in prisons (WHO, 2022b). This package includes harm reduction programmes, specifically needle and syringe programmes, opioid agonist maintenance therapy and naloxone, as well as availability of condoms and lubricant, HBV vaccination, HIV pre-exposure prophylaxis (PrEP), HIV and STI post-exposure prophylaxis and HIV, HBV and HCV testing and treatment (WHO, 2022b). Increasing access to this package of comprehensive services is a crucial step towards the elimination of these infectious diseases as public health threats (WHO, 2022b).

Decentralised models of care that provide point-of-care-testing, non-invasive assessment of liver fibrosis, liver cancer screening and treatment within correctional centres enable more people to be effectively managed compared to traditional hospital-based liver clinics (Akiyama et al., 2022; WHO, 2022a). Telemedicine was first used to support HCV management in prison contexts in the United States in the early 2000s (Arora et al., 2011). Telemedicine is now used in many high income country settings, including in Spain, where its use has increased the efficiency of HCV testing and treatment in carceral settings (Cuadrado et al. 2018).

For a range of reasons, and despite elevated risk, people in prison settings generally have lower hepatitis B vaccination coverage than people in the general population (Vicente-Alcalde et al. 2020). Therefore, the integration of viral hepatitis testing, vaccination and treatment services into existing HIV services is likely to improve efficiencies in the implementation of integrated viral hepatitis services (Akiyama et al., 2022). However, effective linkage to care post-release can be challenging (Mabuto et al., 2020). Active referral strategies such as notifying community health facilities and booking appointments prior to release can improve retention in care (Vroling et al., 2018). Engaging people who inject drugs in harm reduction programmes and substance use disorder treatment while incarcerated, and then linking them to community-based services on release could also improve continuity of care (Akiyama et al., 2022; WHO, 2022b).

Viral hepatitis services are well established in correctional health systems in several high income countries. For example, HCV opt-out testing was initiated in the United Kingdom's correctional system in 2015 and significantly increased the uptake of HCV testing and diagnosis (Perret, Pimmer, & Craine, 2020). Opt-out viral hepatitis testing services have had comparable successes in North America (McNamara, Furukawa & Cartwright, 2024; Kronfli et al., 2019). Similarly, the utilisation of HCV test-and-treat initiatives have proven to reduce HCV incidence in correctional settings in Australia (Hajarizadeh et al., 2021). To date access to HBV and HCV testing in African prison settings remains limited.

### *South African context*

Hepatitis B is endemic in South Africa, with a prevalence estimate in community settings of 6.7% (Schweitzer, Horn, Mikolajczyk, Krause, & Ott, 2015). HBV prevalence in two South African correctional centres in the northern parts of the country in 2018 was estimated at 3.2% (The Aurum Institute & National Institute of Communicable Diseases, 2020). Anti-HCV prevalence in the general population (2020) was estimated in a modelling study at 0.4% (Blach et al., 2022). Specific studies in South Africa estimated anti-HCV prevalence in people who inject drugs in community settings to be 54.7% (Scheibe et al., 2019) and in two correctional centres (2018) to be 4.4% (The Aurum Institute & National Institute of Communicable Diseases, 2020).

In South Africa, the possession of drugs may result in a fine or a five-to-fifteen-year sentence, with dealing or selling resulting in higher sentences (South African Government, 1992). Data on drug-related arrests in South Africa is limited. In July 2022, there were a total of 3 135 drug-related incarcerations across the country and, of those, 1 675 were unsentenced. And in the Western Cape for that month, there were 798 remand detainees and 642 convictions for drug-related crimes (Maliti, 2022). In Cape Town, there is a sizeable population of people who inject drugs; 1 447 people who inject drugs accessed community-based harm reduction services from January to June 2022 (South African Medical Research Council, 2023). There is also a significant HCV burden among people who inject drugs in the city, with anti-HCV seroprevalence estimated to be 64.1% in 2017 (University of California San Francisco, Anova Health Institute, National Institute for Communicable Diseases, 2018). Local research has shown that many men who inject drugs enter correctional service facilities. For example, 85% of the male participants who injected drugs (n=124) participating in a cross-sectional survey in Cape Town in 2013 reported previous incarceration (United Nations Office on Drugs and Crime, 2015).

In keeping with the 2016 World Health Organization's call to eliminate viral hepatitis by 2030 (WHO, 2021), South Africa embarked on the development of a national elimination plan (Hecht et al., 2018). This was adopted through the National Health Council in 2018 and national guidance was published in 2019 (South African National Department of Health, 2019). A multiphasic approach of preventive services, screening, testing and treatment was outlined with plans specifically targeting key populations such as people who inject drugs and those who are incarcerated. Given COVID-19 and other challenges, no programmatic implementation has been initiated to date.

Immunisation against HBV has been provided in South Africa since 1995 (South African National Department of Health, 2019). People in correctional centres are considered a high-risk group that should be screened for HBV and vaccinated if needed (South African National Department of Health, 2019).

Harm reduction coverage in South Africa is limited. By the end of 2023, community-based needle and syringe programmes operated in eleven health districts and opioid agonist maintenance therapy was available in eight districts, while harm reduction services were absent in correctional centres (SACENDU, 2024). Access to viral hepatitis viral load testing is limited and most people with reactive screening tests are referred to specialised clinics. The prescription of tenofovir for monotherapy treatment of HBV is currently limited to hospitals (National Department of Health, 2019). The prescription of tenofovir containing HIV PrEP and antiretroviral therapy can be prescribed by nurses and doctors in the primary care setting (National Department of Health, 2018). In December 2022, the first directly acting antiviral (DAA) regimen became locally available. Prior to this, access was only available through an importation authorisation from the South African Health Products Regulatory Authority (a "Section 21 application") (South African Health Products Regulartory, 2023).

This pilot project aimed to assess prevalence of HBV and HCV infection among people accessing HIV services within Goodwood Correctional Centre, and to assess the feasibility of integrating viral

hepatitis services into routine HIV services from 1 June 2021 to 31 March 2022.

## Methods

### *Setting*

Goodwood Correctional Centre is a medium security facility in Cape Town, South Africa. The centre was established in 1997. It serves adult males (≥21 years). The average daily census is approximately 2 600 people, of which roughly 600 are sentenced and 2 000 are unsentenced. HIV services are well established and have been integrated into the South African Department of Correctional Services primary health care model. There is an average of 175 people accommodated in the centre who are on ART at any one time.

This project took place during the coronavirus disease of 2019 (COVID-19) pandemic. The correctional centre conducted COVID-19 screening and vaccination and other health services were affected. By the end of 2022, 76 COVID-19 cases were recorded at the centre, with 75 recoveries and one death. During the study period, only six COVID-19 infections were recorded, with all recovering.

### *Population, sample and sampling*

Existing resources allowed for provision of viral hepatitis services to approximately 750 people in the correctional centre. People presenting for HIV testing services, PrEP work-up or antiretroviral therapy provision during the study period were invited to participate in the pilot. There were no additional inclusion or exclusion criteria.

### *Procedures*

Prior to implementation, relevant clinical staff were trained on the clinical management of HBV and HCV infection in alignment with the South African National Department of Health's Viral Hepatitis Clinical Guidelines (South African National Department of Health, 2019). These viral hepatitis services were integrated into routine HIV testing, prevention and treatment services. A trained HIV, STI and TB lay counselor was responsible for sensitisation, counseling, and testing of people accommodated in the centre. A fulltime Department of Correctional Services-employed medical officer was responsible for the clinical management of people accommodated in the centre and was supported by the centre's nursing team. Specialist support for clinical management was provided by hepatologists at Groote Schuur Hospital/University of Cape Town. Processing and result reporting on blood specimens were done through an off-site private laboratory. For administrative reasons linked to invoicing processes, it was not possible to use the National Health Laboratory Service, which would be standard practice.

The HIV, STI and TB lay counselor offered viral hepatitis testing as part of the existing HIV testing services. The routine HIV testing service includes the offering of HIV testing within 24 hours of admission to the centre, as part of health campaigns, and upon request of clinical staff from the correctional services.

The HIV, STI and TB lay counselor obtained informed consent and then collected participant socio-demographic characteristics (name; date of birth; contact details of someone outside of the correctional centre), risk practices (ever injected an illicit drug (if yes, <3; 3 – 12; >12 months ago), and provided counselling and point-of-care testing using capillary blood. HBsAg rapid testing was conducted using Determine™ HBsAg 2 point-of-care test (Alere Inc., MA, USA), and HCV antibody rapid testing was conducted using SD BIOLINE HCV test (Standard Diagnostics, Inc. Korea/ Abbott).

Participants were tested on a first-come, first-served basis. Participants with reactive point-of-care tests for HBV or HCV were referred to the medical officer and underwent further clinical assessment and basic laboratory testing to confirm the diagnosis, stage the disease, assess the extent of liver damage, and determine risk for hepatocellular carcinoma. Additional tests were performed during treatment to monitor response to therapy.

Participants infected with HBV who were clinically eligible to receive therapy were initiated on an appropriate tenofovir-containing treatment regimen either for treatment of HBV or as part of an HIV PrEP regimen (which included emtricitabine). Those who did not require therapy were monitored via six-monthly clinical and laboratory assessments. Participants who tested negative on the point-of-care HBsAg test were offered a three-dose vaccination course (month 0, 1 and 3) using Euvax B® (LG Chem) recombinant hepatitis B vaccine. Additional testing of immune status was not conducted.

Participants with current HCV infection were treated with a 12-week course of sofosbuvir 400mg/daclatasvir 60mg daily and a qualitative HCV molecular test was performed 12 weeks post-treatment completion to confirm cure (sustained virologic response (SVR12) defined as no HCV RNA detected). Sofosbuvir and daclatasvir are unregistered medications in South Africa. Medication was obtained and supplied in terms of a named patient approval basis (section 21 certificate, South African Health Products Regulatory Authority).

Complex clinical cases were presented and discussed with hepatologists on the University of Cape Town's Project ECHO *Viral Hepatitis in sub-Saharan Africa iECHO clinics.* Project ECHO is a virtual case-based clinical training and mentorship platform. Participants with an aspartate aminotransferase to platelet ratio index (APRI) score above 0.65 and 2.0 with HBV and HCV infection respectively (Johannessen et al., 2023; Lin et al., 2011), and participants with AFP levels higher than upper limits of normal were discussed with hepatologists for potential additional investigations and/ or follow-up.

People on treatment for HBV or HCV infection who were transferred or released during the study period were provided with a referral letter to facilitate continuity of their treatment at another correctional centre or at a public sector community clinic, as appropriate.

### *Data management and analysis*

Participant clinical data was captured from paper-based patient folders and specific project tools. De-identified data was captured and used for analysis. Monthly data audits were conducted to assure data quality. Data was analysed using descriptive statistics, medians and interquartile ranges (age; HBV DNA viral load; APRI score; AFP level), and proportions (injecting history; point-of-care and laboratory test results, and management approach). The APRI scores for people with HBV infection were categorized in relation to a cut-off of 0.65, which has been shown to have a sensitivity of 56.2% (50.5-62.2) and a specificity of 90.0% (89.0-91.0) as a cut-off for further investigation of cirrhosis in African contexts (Johannessen et al., 2023). APRI scores for HCV infection were categorised in relation to a cut-off of 2.0. Data on follow-up visits until the end of the study period were included in the analysis (31 March 2022).

### *Ethical considerations*

Approval to conduct this project was obtained from the Department of Correctional Services Research Ethics Committee, the University of Cape Town Human Research Ethics Committee (reference number 538/ 2020) and the United States Centers for Disease Control and Prevention Office of Scientific Integrity (PR-2020-7). This project was reviewed in accordance with United States Centers for Disease Control and Prevention Science human research protection procedures and was determined to be research, but United States Centers for Disease Control and Prevention investigators did not interact with human subjects or have access to identifiable data or specimens for research purposes. Participants provided written informed consent. No remuneration was provided.

## Results

A total of 765 people were approached and all people consented to participate. Overall, 765 underwent HBV point-of-care testing and 665 underwent HCV point-of-care testing. One hundred participants (of the 765) did not receive HCV point-of-care tests as a result of loss of HCV test kits during transit to the centre.

The median age was 32.5 years [interquartile range (IQR) 27.5 – 38.2], with 2.2% of people reporting to have ever injected an illicit drug. None of the participants reported being aware of previous HBV vaccination or of previous HBV or HCV testing during the screening process. The sample prevalence was 7.6% (58/765) for HIV infection, 3.9% (30/765) for HBV infection and 0.5% (3/665) for HCV infection. Overall, 1.2% (9/765) of people had HIV-HBV coinfections. No coinfections with HCV were identified (Table 1).

A total of 30 people had reactive HBsAg point-of-care tests, among whom 27 (90.0%) received work-up and management plans. Three people were released from the centre before work-up could be done. The median HBV viral load was 2 215 (IQR 251 – 254 895). One participant did not have detectable HBV DNA. The median APRI score was 0.24 (IQR 0.19 - 0.40), with 7.4% (2/27) having an APRI above the threshold level of 0.65. Two people were released before management plans could be finalised. Overall 48.1% (13/27) of people were monitored, among whom 61.5% (8/13) were HBV mono-infected, had HBV DNA viral loads of between 2000 and 20 000 IU/ml, had normal ALT levels and APRI scores <0.65. The remaining 44.4% (12/27) of participants were initiated on treatment, with 33.3% (4/12) on tenofovir/emtricitabine and 66.7% (8/12) on antiretroviral therapy (Table 2). Also, 14.8% (4/27) of people were discussed with a hepatologist via email, 18.5% (5/27) were presented as cases at virtual iECHO clinics, and 7.4% (2/27) were referred for further workup at the Groote Schuur Hospital Liver Clinic (Liver Clinic). The one person referred to the Liver Clinic was on second line antiretroviral therapy and had kidney failure and obtained access to tenofovir alafenamide through a Section 21 application done by the Liver Clinic. The other person had a raised AFP level and was referred for further workup, including ultrasound and computerised tomography scan. Six-monthly follow-up blood tests were done for one person within the study reporting period and the rest were released prior to the six-month follow up or had follow-ups due after the reporting period for this manuscript.

HBV vaccination: Overall, 27.3% (201/735) of eligible participants received at least one hepatitis B vaccine dose. In addition to operational restrictions limiting the number of people to be vaccinated in the context of clinical service focus on COVID-19; 0.7% (5/735) of people who were offered vaccinations refused, and 5.2% (38/735) had been released before they could be vaccinated. Further, 48.8% (98/201) of people received a second hepatitis B vaccine dose; 7.4% (15/201) of people were released; 0.5% (1/201) of people refused the second dose, and 43.3% (87/201) were not offered additional doses due to operational constraints. Overall, 26.9% (54/201) of people received all three doses.

In addition 0.5% (3/665) of participants tested had reactive anti-HCV point-of-care tests. Two of the three participants reported a history of drug injecting (one within the past three months and the other more than 12 months ago). HCV RNA was detected in all cases. None of the participants had an APRI above 2. All three participants were initiated on sofosbuvir/daclatasvir. One participant was released and provided with the remaining month's supply of medication. A community corrections official visited the released person's home to deliver the second month supply, and found that the participant had left home with no forwarding address and was considered lost to follow-up. The second participant completed treatment while in the correctional centre and was released shortly thereafter and subsequently was lost to follow-up. The third participant was transferred to another correctional centre, completed treatment, and the SVR12 was conducted after the end of study reporting period and confirmed to be achieved in that person.

No clinical adverse events were noted.

**Table 1**
Participant age, reported history of injecting and point-of-care testing results (n=765).

| Variable | | n | % |
|---|---|---|---|
| Age (in years) | Median | 32.5 | - |
| | 25th percentile | 27.5 | - |
| | 75th percentile | 38.2 | - |
| Reports previous drug injecting | Never | 748 | 97.8% |
| | Ever injected | 17 | 2.2% |
| | > 12 months ago | 11 | 1.4% |
| | 3 - 12 months ago | 3 | 0.4% |
| | < 3 months ago | 3 | 0.4% |
| HIV positive | (n=765) | 58 | 7.6% |
| HBsAg reactive | (n=765) | 30 | 3.9% |
| HCV RNA detected | (n=665) | 3 | 0.5% |
| HIV-HBV coinfection | (n=765) | 9 | 1.2% |

HBV: hepatitis B virus; HBsAg: hepatitis B surface antigen; HCV: hepatitis C virus; HIV: human immunodeficiency virus

**Table 2**
Laboratory results and HBV management among participants with HBsAg and receiving work-up (n=27).

| Laboratory results | n | % |
|---|---|---|
| HBeAg present | 9 | 33.3% |
| HBV DNA detectable | 26 | 96.3% |
| Median HBV DNA viral load (IQR) | 2 215 (251 - 254 895) | |
| HBV DNA < 2000 IU/mL | 8 | 29.6% |
| HBV DNA 2000 – 20 000 IU/mL | 14 | 51.9% |
| HBV DNA > 20 000 IU/mL | 5 | 18.5% |
| ALT > ULN (41 IU/L) | 7 | 25.9% |
| APRI ≥ 0.65 | 2 | 7.4% |
| Median APRI (IQR) | 0.24 (0.17 - 0.39) | |
| AFP > upper limit of normal (8.8 ug/L) | 3 | 11.1% |
| Median AFP (IQR) | 2.7 (2.0 - 6.4) | |
| **HBV management** | | |
| Monitored (HBV mono-infection) | 13 | 48.1% |
| HBV DNA undetectable; ALT <ULN; APRI < 0.65 | 1 | 7,7% |
| HBV DNA 2000 – 20000; ALT <ULN; APRI < 0.65 | 8 | 61.5% |
| HBV DNA >20000; ALT <ULN; APRI < 0.65 | 3 | 23.1% |
| HBV DNA 2000 – 20000; ALT >ULN; APRI < 0.65 | 1 | 7,7% |
| Released before management plan could be finalised | 2 | 7.4% |
| HBV DNA < 2000; ALT >ULN; APRI < 0.65 | 1 | 50.% |
| HBV DNA 2000 – 20000; ALT <ULN; APRI < 0.65 | 1 | 50.% |
| Received treatment for HBV | 12 | 44.4% |
| Tenofovir/emtricitabine for HBV mono-infection | 4 | 33.3% |
| HBV DNA <2000, ALT <ULN & APRI < 0.65 | 1 | 25.0% |
| HBV DNA 2000 - 20000, ALT <ULN & APRI < 0.65 | 2 | 50.0% |
| HBV DNA >20000, ALT <ULN & APRI < 0.65 | 1 | 25.0% |
| ART for HIV/HBV co-infection | 8 | 66.7% |
| TLD | 6 | 75.0% |
| TLD + AZT | 1 | 12.5% |
| ABC, 3TC, DTG, TAF | 1 | 12.5% |

ABC: abacavir; AFP: alpha fetoprotein; APRI: aspartate aminotransferase to platelet ratio index; ART: antiretroviral therapy; AZT: zidovudine; DTG: dolutegravir; HBV: hepatitis B virus; HBeAg: hepatitis B e antigen; HBV DNA: HBV deoxyribonucleic acid; TAF: tenofovir alafenamide; TLD: tenofovir disoproxil, lamivudine, dolutegravir; ULN: upper limit of normal; 3TC: lamivudine.

## Discussion

To our knowledge, this is the first project to demonstrate the feasibility of integrating viral hepatitis and HIV services in correctional settings in Southern Africa. This study adds to the knowledge base around viral hepatitis in correctional settings, with an HBV infection prevalence similar to estimates for the general population in the province where the study took place (Blach et al., 2022). The study also highlights issues of relevance to inform policy, namely: the feasibility of viral hepatitis service integration; the importance of continuity of care; the need for harm reduction interventions, and telemedicine for healthcare worker

capacity development and support. The important issues relevant for policy are discussed below.

Firstly, the study showed that it was feasible to reach a notable number of people who were sentenced and in remand through existing HIV services in a South African correctional centre. The study showed the overall acceptability among participants with no notable resistance to the integration of viral hepatitis services. This reflects the experiences of hepatitis service integration in other prison contexts globally (EMCDDA & ECDC, 2018). Importantly, the study included aspects in relation to hepatitis B vaccination, as well as testing and treatment of HBV and HCV. The evidence on HBV vaccination strategies in prison settings is limited, but an accelerated programme has been shown to be acceptable and feasible to implement in a European context (Stasi et al., 2022). A US study showed that a screen and treat or vaccinate programme is cost-effective in reducing the burden of HBV infection among people in correctional settings (Chahal et al., 2019). While full coverage of HBV vaccination was not possible, a notable proportion of people were vaccinated for HBV infection. The value of this in the correctional centre highlights the potential value of correctional settings to augment HBV vaccination among adults; further supporting elimination goals. The approach implemented aligns with the South African guidelines for HBV screening and vaccination of people in correctional centres (South African National Department of Health, 2019).

The existance of a strong HIV service provided a good framework for integration. In South African and other contexts, the integration of viral hepatitis services into HIV services is important due to the shared transmission routes of these viruses, and the compounding of morbidity and mortality if not appropriately managed (WHO, 2022b). The availability of tenofovir/emtricitabine, due to current HIV PrEP expansion efforts in correctional settings, and HIV antiretroviral therapy that includes tenofovir, facilitated management of participants with HBV infection requiring and accepting treatment.

At the time of implementation, DAAs for HCV infection were not available through the public sector. The use of a short course, all oral pangenotypic DAA made the management of the three people with HCV infection simple. It is notable that integration of viral hepatitis services in South African correctional settings has not taken place sooner, in light of the high risk environment for blood borne infections and the global normative (WHO, 2022a) and national guidance (South African National Department of Health, 2019) recommending this.

The loss to follow-up along the treatment cascade due to release and transfer is common in correctional settings (Vroling et al., 2018). The risk of hepatitis flares in people who have treatment interruptions exists and highlights the need for additional efforts to support continuity of care. In the South African context, many people released from correctional centres have limited social support and their movements and barriers to continuity of care are also influenced by limited licit employment opportunities and social factors linked to criminalised behaviours and criminal activity. In other contexts, like Spain, challenges with linkage to care among people serving non-custodial sentences have been overcome through the use of peer navigation, telemedicine and access to harm reduction services (Cabezas et al. 2021).

Interestingly, the number of HCV infections was lower than anticipated and may relate to the low prevalence of injecting drug use amongst the participants, with only 2.2% reporting a history of ever injecting. This finding differs from other contexts, where history of injecting among people in prisons and other closed settings is higher, with one review identifying injecting prevalence to be 20.2% in the Asia Pacific region and 17.3% in Eastern Europe and Central Asia (Moazen et al., 2018). In light of increased heroin use in South Africa in recent years (Harker et al., 2020), it is likely that higher HCV prevalence may be expected in other correctional centres with a higher proportion of people entering those centres who use and inject heroin. There is limited documentation of injecting drug use within prison settings in South Africa, but it has been reported.[i] The provision of viral hepatitis services in correctional facilities, along with access to harm reduction services, specifically opioid agonist maintenance therapy and needle and syringe programmes would likely further the country's efforts towards viral hepatitis elimination.

Currently, the South African Department of Correctional Services does not provide harm reduction services for people who inject drugs nor does it provide opioid agonist maintenance therapy to treat people with opioid dependence. In other contexts, opposition to harm reduction measures is often based on the belief that these programmes run counter to the drug-free ethos in prisons and that, if needles are provided to people in prison, they could be used as weapons (WHO, UNODC & UNAIDS, 2007). However, despite potential controversy, sufficient evidence of effectiveness, and limited harms, informs the inclusion of these interventions in the package of essential HIV, viral hepatitis and STI services for people in prison, as recommended by the World Health Organization (WHO, 2022b). A recent systematic review and meta-analysis (2024) demonstrated the reduction in mortality as a result of opioid agonist maintenance therapy in correctional settings (Macdonald et al, 2024), and a review of European data suggests that needle and syringe programmes as part of comprehensive services may lead to a reduction in blood borne virsuses (EMCDDA & ECDC, 2018).

The emphasis on building the capacity of primary-level clinical staff working at the correctional centre reduced the need for people to be transferred outside the centre for additional management. Internal management is likely to have reduced the costs related to transfers and reduced the potential safety risks thereof. Project ECHO, as an example of telemedicine, has its roots in supporting prison-based clinicians to effectively manage HCV infection (Arora et al., 2011). The virtual support provided by hepatologists and multi-disciplinary learning was an important contributing factor to the project's success. Medical and security staff working in correctional settings could benefit from increased awareness around viral hepatitis, and innovative and cost-efficient ways to achieve this capacity building remain important. The use of telemedicine in other contexts has confirmed its important role in enabling the scale-up of hepatitis services in prison contexts (Jiménez-Galán et al. 2019).

In summary, and from a policy perspective, the study highlights the potential value of integrating viral hepatitis services into HIV programmes in South African prison contexts, with the utilisation of an opt-out, test and treat/ vaccinate approach that is supported by telemedicine. Policy that aims to address the challenges associated with continuity of care outside of prisons settings remains important, particularly for longer term management and harm reduction.

## Limitations

The pilot project was restricted to one correctional centre and used a sample size that was determined by available resources. Data was not captured on the location where the integrated viral hepatitis testing was provided (i.e., testing upon admission to the centre or as part of healthcare services provided to people already accommodated in the centre) or if the person accessing testing was in remand or sentenced. Information on differential uptake of integrated testing would have provided useful insights into operational planning. Operational factors, potential differences between the included correctional centre and other centres and convenience sampling limit the generalisability of the findings. Nevertheless, a notable number of people with viral hepatitis were identified and received appropriate management. It was not possible to confirm continuity of hepatitis treatment upon release due to

[i] Personal communication with programme staff from various correctional centres at a virtual viral hepatitis training session on 16 September 2022

the lack of mechanisms to monitor continuity of healthcare services between correctional services and community-based public health services. Despite the methodological and operational limitations, the project provides additional information on the burden of viral hepatitis in a South African prison setting.

There was reliance on self-reporting around injecting practices, which could have resulted in information bias. Drug injecting remains stigmatised in South Africa and participants may have under-reported this practice (Shelly et al., 2017). However, the low HCV prevalence points towards a low prevalence of drug injecting among people in the correctional centre where the study took place.

The implementation of the study in a correctional setting may have influenced participation, with people having their right of movement restricted. Efforts were made by staff to appropriately counsel people and support autonomous decision making to ensure informed consent. However, it is possible that some people may not have participated in this work if it was not in a correctional setting or for fear of legal consequences.

## Conclusion

This study has shown that the integration of viral hepatitis services using point-of-care testing with off-site laboratory and technical support is feasible, acceptable and required. Future research priorities include enhancing linkages to public health facilities to ensure continuation of care among people who are released from correctional settings who are living with viral hepatitis; the scale-up of DAA implementation in correctional settings; and the feasibility and effectiveness of harm reduction services. In addition, efforts could be made to further assess the cost-effectiveness of the integration of viral hepatitis services in correctional settings compared to the status quo. Additional research could address the paucity of data in relation to HBV and HCV in correctional settings in South Africa and other African and low and middle-income country contexts. The scale-up of viral hepatitis services in correctional settings could catalyse efforts towards viral hepatitis elimination.

## Disclaimer

The findings and conclusions in this paper are those of the authors and do not necessarily represent the official position of the funding agencies.

## Ethics approval

The authors declare that they have obtained ethics approval from an appropriately constituted ethics committee/institutional review board where the research entailed animal or human participation.

Approval to conduct this project was obtained from the South African Department of Correctional Services Research Ethics Committee, the University of Cape Town (UCT) Human Research Ethics Committee (reference number 538/2020) and the CDC Science Integrity Branch (PR-2020-7).

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## CRediT authorship contribution statement

**Andrew Scheibe:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Conceptualization. **Joel Steingo:** Writing – review & editing, Writing – original draft, Project administration, Methodology, Conceptualization. **Gaynor Grace:** Writing – review & editing, Writing – original draft, Investigation. **Helen Savva:** Writing – review & editing, Writing – original draft, Conceptualization. **Mark Sonderup:** Writing – review & editing, Conceptualization. **Harry Hausler:** Writing – review & editing, Conceptualization. **C. Wendy Spearman:** Writing – review & editing, Conceptualization.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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