SITUATIONAL ANALYSIS OF FACTORS ASSOCIATED WITH HIV AND VIRAL HEPATITIS INFECTION IN TWO SOUTH AFRICAN CORRECTIONAL CENTRES

FINAL REPORT

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Acronyms and abbreviations

DBS	Dried Blood Spot
DCS	Department of Correctional Services
DNA	Deoxyribonucleic acid
ELISA	Enzyme-linked immunosorbent assay
FGD	Focus group discussion
HBV	Hepatitis B virus
HCV	Hepatitis C virus
HIV	Human immunodeficiency syndrome
HTS	HIV testing services
IDI	In-depth interviews
IDU	Injection drug use
MAT	Medication-assisted treatment
NSP	Needle and syringe programs
POCT	Point-of-care testing
PEP	Post-exposure prophylaxis
PrEP	Pre-exposure prophylaxis
PWID	People who inject drugs
RNA	Ribonucleic acid
STI	Sexually transmitted infections
UTT	Universal test and treat
VL	Viral load
VLS	Viral load suppression

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1 Background

1.1 Epidemiology of HIV and viral hepatitis among people who are incarcerated

South Africa has a generalized human immunodeficiency virus (HIV) epidemic with a disproportionately high burden among key populations, including people in correctional facilities (1). In addition, South Africa has a high incarceration rate (280 per 100,000 population) (2) which in 2018 ranked 11 among the 15 countries with the highest number of people who are incarcerated globally. In many regions of the world, correctional centers concentrate large numbers of people living with HIV (PLHIV) or at risk for HIV infection. In southern African correctional facilities, the HIV prevalence among people who are incarcerated ranges from 7.2%–34.9% compared with 4.7%–18.9% in the general population (3, 4). Practices such as needle sharing during tattoo imprinting, intravenous drug use, and unprotected consensual or forced sexual encounters, elevate the risk of HIV infection among incarcerated individuals (5-7).

Hepatitis B virus (HBV) and hepatitis C virus (HCV) are chronic viral infections, which have similar transmission routes to HIV, increasing the chances of co-infection (9). In South Africa, HBV prevalence is higher in rural (20%) compared to urban areas (5%), and HBV-HIV co-infection is estimated at 7.1% (8-10). A recent study among people who inject drugs found an HCV prevalence of 93% in Pretoria and 63% in Cape Town (11). Globally, viral hepatitis infections are higher in correctional facilities than in general populations, particularly in people who are incarcerated who engage in intravenous drug use (12), men who have sex with men (MSM)(13), and people who share needles or razor blades (13).

1.2 Prevention programmes for HIV and viral hepatitis in South Africa

South Africa has established a comprehensive package for HIV, TB, and STI prevention, care, and treatment activities in correctional facilities providing several of the United Nations Office of Drugs and Crime (UNODC) recommended interventions for people in prisons or enclosed spaces (14). Services for people who are incarcerated include: HIV education, training to be peer educators, and provision of HIV testing services (HTS), condoms and lubricants, post-exposure prophylaxis (PEP), voluntary medical male circumcision (VMMC) , and, most recently, universal test and treat (UTT) (7). Roll out of Pre-Exposure Prophylaxis (PrEP) started in 2021. In addition, the World Health Organization (WHO) recommends providing educational materials on HIV prevention to both staff and people who are incarcerated in these settings (15).

Since 1995, HBV vaccination has been part of the South African expanded program on immunization (EPI), which is recommended for staff and people who are incarcerated; however, implementation of this program is sub-optimal to non-existent in South African correctional facilities. A pilot study on screening, testing, and providing HBV vaccinations and HCV treatment has begun in one correctional centre in the Western Cape. This pilot aims to provide evidence of best practices, and data will be used to improve policy. Gaps also exist in the delivery of UNODC recommended interventions such as prevention of sexual violence, drug dependence treatment, and needle and syringe programs.

1.3 Justification for the study

While there have been significant strides in strengthening HIV treatment programmes within correctional settings, programmatic data show that prevention interventions among people who are incarcerated have lagged. Furthermore, the magnitude of HBV and HCV in correctional settings is understudied in a context where morbidity and mortality from these infections is projected to increase (13). Although South Africa provides a relatively comprehensive suite of services compared to other countries in the Southern Africa Development Community (SADC), uptake of existing services is low (5). This may be due to the lack of privacy and confidentiality associated with overcrowding and security escorts (16). Unpublished findings from a recent study point to the role of stigma and its adverse effects on health-seeking behavior in correctional facilities (17). In addition, there is an absence of best practices to guide HIV prevention in correctional settings within the South African context. The South Africa National Strategic Plan, 2017-2022 (14), acknowledges that people who are incarcerated are critical to HIV epidemic control but provides little guidance on HIV prevention programs for this population. UNODC has developed comprehensive prevention guidelines for people in enclosed spaces (7), but implementation is variable and non-standardized in South African correctional facilities.

1.4 Study aims

The overarching aims of this study were:

- To describe the state of prevention programs for HIV and viral hepatitis in correctional facilities.
- To examine the factors that influence the delivery and uptake of prevention programmes for HIV and viral hepatitis in correctional facilities.

1.5 Study objectives

The main objectives of the study were:

- To measure the prevalence of HIV among people who are incarcerated in two selected correctional facilities.
- To measure the prevalence of HBV and HCV infection among people who are incarcerated in two selected correctional facilities.
- To identify risk factors for HIV, HBV, and HCV infection among people who are incarcerated in two selected correctional facilities.
- To explore the barriers and facilitators to the utilization of prevention programs for HIV and viral hepatitis in correctional facilities.

1.6 Site selection

The situational assessment was conducted in two correctional facilities purposefully selected to represent urban and rural male and female inmate populations.

1. **Kgosi Mampuru II Correctional Centre**
   Kgosi Mampuru II (KMII) Correctional Centre is in Gauteng Province, an urban province in South Africa. KMII is divided into male and female sections. In these sections, people who are incarcerated are further split into different sections by incarceration status, either sentenced or still awaiting trial. At the time of the study KMII had an inmate population of 7,608 adult people who are incarcerated (≥ 21 years). Of these 7,322 were men and 286 were women. In addition, there were 166 juveniles (<21 years). Of these 163 were men and 3 were women.

2. **Polokwane Correctional Centre**
   Polokwane Correctional Centre is in Limpopo Province, a predominantly rural province in South Africa. The correctional centre is divided into male and female sections. In these sections, people who are incarcerated are further split into different sections by incarceration status, either sentenced or still awaiting trial. At the time of the study, the correctional centre had an population of 829 adult people who are incarcerated (≥ 21 years). Of these, 797 were men, and 32 were women. In addition, there were 241 juveniles (<21 years), and all were men.

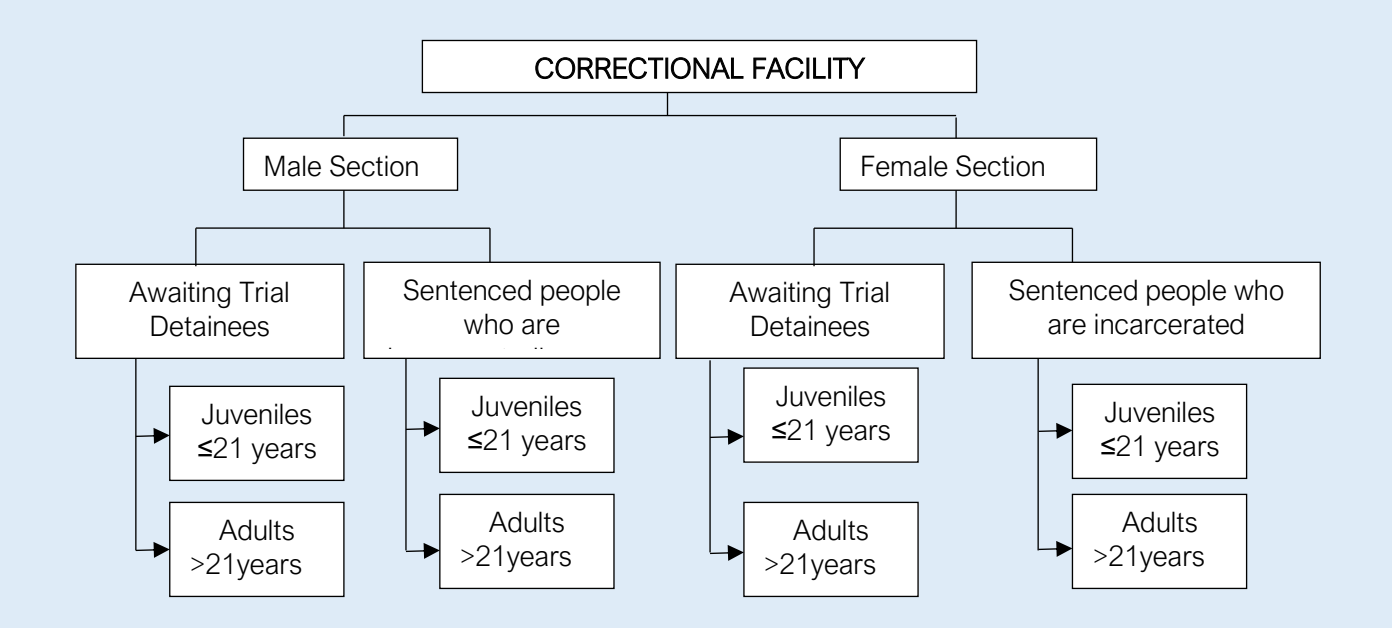

Figure 1: Organization of selected correctional facilities

Both correctional centers have existing health units called 'hospitals.' These hospitals have a reception area and five basic rooms: a hospital admission room equipped with at least two beds, three consultation rooms with running tap water, and a filing room to secure patient records storage. There are separate hospitals for the male and female sections of the correctional center. Health care services were provided by a team of professional nurses, medical doctors, and social workers. Hospital services were offered between 8:30 am and 12:00 noon, after which additional hospital administration activities (e.g., filing of patient files or data capturing) and data entry continued up to 2:30 pm. These rooms were locked at the end of the working day. The selected correctional facilities have an on-site pharmacy managed by DCS pharmacists.

2 METHODOLOGY

The DCS Correctional Centre Managers at Polokwane Correctional Centre offered up to three rooms within the correctional centre for the implementation of study activities. Two of the rooms were used for counselling and testing and a third room used for conducting in-depth interviews with participants. The rooms were equipped with lockable cabinets for storage of study supplies and participant records and refrigerators to store biological samples. At Kgosi Mampuru II, correctional managers offered the study team a large hall in the male section to conduct study procedures. In the female section, the study team conducted procedures in a room assigned for study activities. After study procedures were completed for the day, study supplies were stored in cabinets in a lockable office. Electronic equipment such as audio recorders and tablets were used by study staff within the correctional center, following approval from the Correctional Center Manager and approval of the study protocol by the DCS Research Ethics Committee. The Aurum Institute provided technical support to DCS correctional facilities in these provinces until 30 September 2019. The study team therefore leveraged the support of existing partner relationships and prior experience in navigating the DCS regulatory requirements in these provinces post-September until December 2019.

2.1 Study design

The study adopted a cross-sectional exploratory sequential mixed-method study design (Figure 2). Data from the quantitative study component were used to guide the development of interview guides for the qualitative study component (18, 19). The data analysis for the different strands was performed separately, but the overall interpretation of the findings was combined.

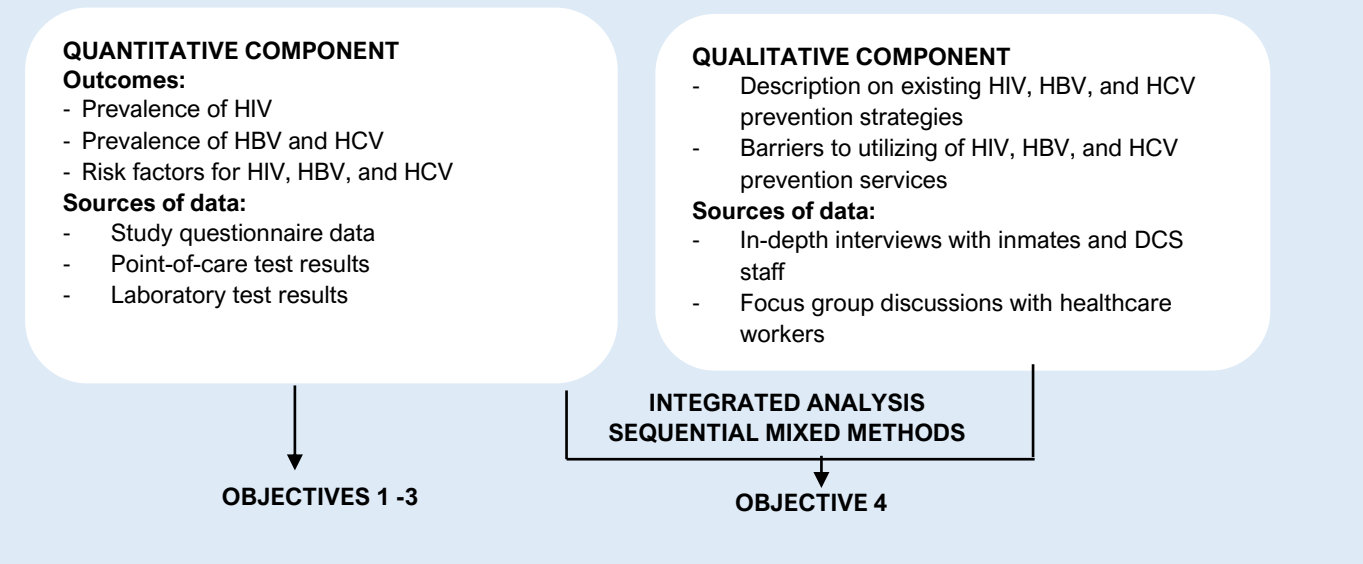

Figure 2: Overview of quantitative and qualitative components of the study

2.2 Study population

a) Participation in the **quantitative sub-study** was based on the following eligibility criteria:

- Inmate (sentenced or awaiting trial) at the two facilities.
- Aged ≥ 18 years (Juveniles 18-21; Adults >21 years)
- Inmate incarcerated in the centre for at least three months at the date of screening to ensure that the inmate has interacted with the health system in the correctional centre
- Inmate is not expected to be released or transferred from the correctional centre within six weeks from the date of study enrolment to ensure that they are available for the return of their laboratory results.
- Consents to all the following:
    - Administration of the study questionnaire
    - Providing a blood specimen for:
        - Point of care (POC) and laboratory testing for HBV
        - POC and laboratory testing for HCV
        - Laboratory testing for HIV antibodies and measurement of HIV viral load (if required).
    - Receiving results from all POC and laboratory tests performed.

- Participants who declined to undergo HIV POC testing were required to consent to provide a blood specimen for antibody testing and measurement of HIV viral load in the laboratory when required and receiving these results from the laboratory within six weeks.

b) Participation in the **qualitative sub-study** was based on the following eligibility criteria:

i. The following inclusion criteria were applied for people who are incarcerated:
- Age ≥ 18 years.
- Has been incarcerated in the centre for at least 3 months at the time of study enrolment.
- Consents to participation in IDIs and audio recording of IDIs.

ii. The following inclusion criteria were applied for **DCS staff**:
- Age ≥ 18 years.
- Consents to participation in IDIs and audio recording of IDIs.
- Has worked in a participating correctional centre for at least six months at the time of study enrolment as a security staff or healthcare worker.

2.3 Sample size calculations

We used a proportional allocation sampling approach (Table 1).

- Firstly, the inmate population at the correctional centre was divided into two broad categories: awaiting trial detainees and sentenced people who are incarcerated (primary sampling unit (PSU)). This was the natural distribution of people who are incarcerated within DCS facilities. Section 1.6 provides the population sizes of the PSUs. Awaiting trial detainees are people who are incarcerated not yet been sentenced and housed separately from sentenced people who are incarcerated.
- In each category, people who are incarcerated were further divided into sub-categories based on, biological sex (male or female). Further categorization was performed by age group: juveniles (18 – 21 years) and adults (> 21 years of age).
- The number of people who are incarcerated to be randomly sampled in each category was calculated applying the same sampling rate to all sub-groups/categories to ensure that people who are incarcerated in each stratum have equal probability of selection irrespective of the size of the category. This ensured that the percent distribution of the selected sample among the different sub-groups was identical to the corresponding distribution for the population. A correction for finite population sizes (20) was applied within the different categories for each correctional centre (Table 1). Noteworthy, juveniles and female who are incarcerated form a small proportion of the inmate population (approximately 3%) in these correctional settings(21). Therefore, we anticipated that all people who are incarcerated falling within these sub-groups/categories were selected for study enrolment from the respective lock-up lists.
- The sample size calculations (see Table 1) determine the number of participants required to estimate a syphilis prevalence of 10%, a margin of error of 5%, and a confidence level of 95% in each of the correctional centres. A conservative 10% non-response rate was applied to account for participants who may refuse to visit the study site office for potential recruitment and people who are incarcerated who may have been transferred out of the facility at the time of study recruitment. This inflation factor was based on the experiences of some investigators on this study protocol who have conducted studies among people who are incarcerated in South African correctional centres and additional consensus on the plausibility of this estimate has been obtained from DCS partners. The overall sample size was estimated as 650 with variations in the different sub-groups as shown in Table 2.

Table 1: Formulae for sample size calculation

Formula for infinite population size $n_0 = \frac{Z^2 p(1-p)}{e^2}$	Where: - n_0 =proposed sample size without considering FPC - Z= Standard normal deviate for the 95% confidence level (1.96) - e = margin of error - p = assumed syphilis prevalence in the survey population.
Formula (adjusted finite population correction factor (FPC)): $n_{fpc} = \frac{n_a N}{n_a + (N-1)}$	Where: 1. n_a = minimum adjusted target sample size for all respondents, regardless of syphilis status. 2. N = estimated population size

Table 2: Sample sizes for quantitative component

Study location	Adult males	Adult females	Juvenile males	Juvenile females	Total
Kgosi Mampuru Correctional Centre	153	105	70	10	338
Polokwane Correctional Centre	144	56	112	*0	312
Total sample size	297	161	182	10	650

**no juvenile females in Polokwane Correctional Centre; sample inclusive of both sentenced and awaiting trial people who are incarcerated and represent the minimum adjusted target sample size for all respondents regardless of syphilis status (n_a)*

2.4 Partner engagement

A partner engagement plan was developed in May 2019 to improve the relevance and efficiency of the partner engagement process. Partner engagement began at a national level through submission of the protocol to the DCS REC and the relevant Directorates overseeing inmate care. This was conducted during a high-level meeting between Aurum, CDC, and DCS, where the study was first introduced. Soon after the first ethics approval from Wits HREC, the study management team held meetings with DCS staff at various levels, including:

- Regional heads in charge of HIV coordination.
- Commissioners in charge of the correctional facilities.
- Heads of security at the correctional facilities; and
- Heads of centers at centre level.

This process included visits to the correctional facilities to meet with relevant centre officials to:

- Introduce the study,
- Identify centre staff who will facilitate access to participants, and
- Seek permission to conduct the study in the facilities.

Meetings with various nurses, social workers, psychologists, and security staff were also held as a way of informing the different staff providing services to people who are incarcerated about the study and leveraging on their knowledge to provide support to the study teams.

3 FIELDWORK PROCEDURES QUANTITATIVE SUB-STUDY

3.1.1 Training of field staff

Before study commencement, all study staff received training on good clinical practices for conducting research, obtaining informed consent, point-of-care testing, and other role-specific standard operating procedures. All study staff were based at the correctional centres, with allocated workspace.

3.2 Recruitment

Study awareness activities included holding meetings with heads of health and security in the correctional facilities. In Polokwane, the study team held a meeting with people who are incarcerated during one of their daily parades. In KMII, the study team relied on peer educators, to mobilize people who were incarcerated and inform them about the study. The research assistants provided study information leaflets in English, seSotho, and sePedi to create awareness of the study among people who were incarcerated. The leaflets contained information on HIV, HBV, and HCV transmission, prevention, and management.

3.3 Sampling and enrolment procedures

Due to the high rate of movement of people who are incarcerated within the correctional centre and administrative delays in accessing lock-up lists, we employed convenience sampling instead of the proposed probability as the most feasible sampling approach due to logistical challenges associated with accessing lock-up lists and access to other sections/cellblocks in the facilities. In KMII, study staff relied on peer educators to approach interested participants from cellblocks. Each day, at least 25 males who were incarcerated were accompanied by three peer educators for screening and enrolment procedures from the 10 cellblocks in the male centres. Also, healthcare workers in the female centres referred women who were incarcerated attending the clinic for routine healthcare checks to the study staff. In Polokwane Correctional Centre, DCS staff approached interested participants from cells in each of the four sections of the centre. The staff accompanied at least 20 people who were incarcerated each day for screening and enrolment procedures.

3.4 Questionnaire administration

Quantitative behavioral data were collected using a standardized questionnaire programmed for electronic data capture and administered by interviewers (Appendix 3). The questionnaire domains were designed to collect information on demographics, clinical data, incarceration history, tattooing practices, piercing practices, injectable drug use, grooming practices, STI history, HIV knowledge, testing and treatment, HBV and HCV knowledge and testing, circumcision uptake, condoms and lubricant uptake, post-exposure prophylaxis.

3.5 Testing for HIV

3.5.1 Point-of-care HIV testing

Participants were offered and separately consented for on-site point-of-care (POC) HIV rapid testing. However, participants who declined POC-HIV testing still qualified to participate in the survey (participants declining POC-HIV testing were required to consent for laboratory-based HIV testing). For POC-HIV testing, counsellors first collected about 4 mL of blood from the arm into an anticoagulant-coated blood tube. This blood specimen was also used for HBV and HCV POC tests. After blood collection, study staff provided pre-test counselling that included discussions on HIV infection and transmission, the meaning of test results, risks associated with sexual behaviours, as well as means to prevent and treat HIV and STIs. HIV testing was conducted by study research nurses using a serial testing algorithm per the South Africa national testing guidelines and using commercial kits approved at the time of survey implementation [38]. Participants were first screened for HIV using Abon HIV ½/O Triline Rapid test (Abon Biopharm, Hangzhou, China). Non-reactive results were considered HIV negative, and reactive results were confirmed using First Response HIV1-2.0 Card test (Premier Medical Corporation Private Limited, Mumbai, India).

3.5.2 Laboratory HIV antibody testing

Participant specimens for laboratory testing were collected on DBS cards. The DBS cards were prepared by spotting 75µL of whole blood in dotted circles of Whatman 903 filter paper using capillary tubes. Five spots per specimen (one card) were prepared and labelled with bar-coded labels containing the PID. After adding the blood specimen to the DBS cards, they were left to dry overnight at room temperature and then stored in zip-lock bags with desiccant and humidity indicators. The bags were stored in waterproof containers at the survey sites at 2-8°C and shipped at least once a week to the laboratory for HIV antibody testing and HIV viral load testing. Upon receipt of blood specimens, the laboratory staff linked the PIDs to uniquely generated numbers allocated to each specimen by the Laboratory Information System (LIS). In the laboratory, specimens were stored at -20oC.

Dried blood spots (DBS) were punched into a test tube pre-labelled with the corresponding laboratory testing barcode number. The puncher was decontaminated by punching 4 blank spots after each DBS to ensure no carryover. Each filter paper disc was eluted overnight at 4˚C with phosphate buffered saline (PBS, pH 7.3-7.4). An aliquot of the eluted sample was then used for performing the HIV testing assay. A 4th Generation HIV immunoassay was used for HIV antibody detection. Non-reactive results were considered negative for HIV infection. A 4th Generation Enzyme-linked immunosorbent assay (ELISA) (Diasorin Murex HIV Ag/Ab Combo, Dartford, UK) confirmed any reactive ELISA result. All positive results were confirmed for HIV infection by Western blotting (GS HIV -1 Western Blot, WB, (Bio-Rad Laboratories, Redmond, WA 98052, USA)).

3.5.3 Laboratory HIV viral load testing

HIV-1 ribonucleic acid (RNA) testing of DBS samples was performed using the Abbott m2000 HIV Real-Time System (Abbott Molecular Inc., Des Plaines, Illinois, USA). The Abbott platform for HIV viral load (VL) determination utilized an RNA-specific extraction procedure that minimizes the problem of DNA contributing to the VLs. The Abbott m2000sp and m2000rt instruments were used for automated extraction/sample preparation and real-time amplification/ detection, respectively. An open mode protocol was applied. One full disc equivalent to ~70µl- dried whole blood was excised from the DBS card, placed into a 50ml Falcon® tube with 1.7ml lysis buffer, and incubated for 1 hour at room temperature. The total volume of lysate was transferred into an m200sp reaction tube and loaded onto the m2000sp instrument for RNA extraction. A viral load count result was labelled LDL if no RNA was detected or <839 if less than 839 HIV-1 copies/ml were detected in the sample.

3.6 Testing for HBV infection

3.6.1 Point-of-care HBV testing

POC-HBV testing was performed using Determine™ HBsAg point-of-care test (Alere Inc., MA, USA). The Alere Determine™ HBsAg is an in vitro, visually read, qualitative immunoassay for detecting hepatitis B surface antigen (HBsAg) in human serum, plasma, or whole blood. To perform the test, study staff used a sample of blood collected in the EDTA coated tube and added it to the sample pad. If HBsAg was present in the sample, the antigen was bound to the antibody-selenium colloid and to the antibody at the patient window (T), forming a red line at the patient window site. If HBsAg was absent, the antibody-selenium colloid flowed past the patient window and no red line was formed at the patient window site. To ensure assay validity, a procedural control bar is incorporated in the assay device.

3.6.2 Laboratory testing for HBV infection

Blood specimens for participants testing positive on the POC-HBV test were sent to the laboratory for HBV DNA testing to assess for active chronic hepatitis B infection, and hepatitis B “e” antigen testing for active chronic hepatitis B infection. Serological tests for the HBV envelop antigen (HBeAg) were performed on the Abbott ARCHITECT platform that uses chemiluminescent immunoassays (CMIA) for the qualitative detection of HBeAg in human adult serum and plasma. The presence or absence of HBeAg in the sample was determined by comparing the chemiluminescent signal in the reaction to the cut-off signal determined from an ARCHITECT HBeAg calibration. A sample was considered non-reactive if the chemiluminescent signal of the reaction was less than the cut-off signal.

Viral load testing for HBV was performed using the COBAS Ampliprep TaqMan (Roche). The COBAS AmpliPrep/COBAS TaqMan HBV Test is a nucleic acid amplification test for quantitating HBV deoxyribonucleic acid (DNA) in human serum or plasma. Specimen preparation was automated using the COBAS AmpliPrep Instrument with Amplification and detection automated using the COBAS TaqMan 96 Analyser. The test quantitates HBV DNA over the range of 15 – 100,000,000 IU/ ml. Samples with HBV DNA >10,000 IU and HBeAg positive was considered an indication of active HBV infection, whereas HBV DNA ≤10,000 IU but HBeAg negative was considered an indication of carrier status. Other interpretations are summarized in Table 3.

Table 3: Interpretation of laboratory HBV test results

HBeAg	HBV DNA	Interpretation
Positive	Positive (>10,000 IU)	Active infection
Negative	Positive (≤10,000 IU)	Carrier
Positive	Negative	Early acute infection
Negative	Negative	Immune

HBeAg: hepatitis B e antigen; HBV: hepatitis B virus; DNA: deoxyribonucleic acid

3.7 Testing for HCV infection

3.7.1 Point-of-care HCV testing

POC-HCV testing was conducted using OraQuick HCV Rapid Antibody (OraSure Technologies, Inc, Bethlehem, PA USA). OraQuick® HCV Rapid Antibody Test is an immunoassay for the qualitative detection of IgG antibodies to hepatitis C virus (anti-HCV). Study staff used a specimen loop to collect an aliquot of whole blood from the EDTA coated specimen tube and to apply it to the test device. This was followed by the addition of a developer solution that enabled the capillary flow of the specimen along the assay strip. If HCV antibodies were present, they were bound by a gold colorimetric reagent present on the assay strip at the HCV test zone (T Zone) – this resulted in a reddish-purple line. In the absence of HCV antibodies, no line was observed in the T Zone. A line in Control (C Zone) was expected for all valid tests, regardless of whether the ample is positive or negative for HCV antibodies. As per manufacturer instructions, test results were interpreted between 20 – 40 minutes (28).

3.7.2 Laboratory testing for HCV

Tests for the presence of HCV antibodies were performed using the Abbott ARCHITECT Anti-HCV platform, a chemiluminescent immunoassay (CMIA) for the qualitative detection of immunoglobulin G (IgG) and immunoglobulin M (IgM) antibodies to HCV in human adult serum and plasma. A minimum of 150µL and an additional 20µL were used for a single anti-HCV test. In the absence of HCV antibodies (S/CO value <1.00), the sample was reported as non-reactive for HCV antibody, and no further action was required. The presence of HCV antibodies was determined by a cut-off value ≥1.00. In the presence of HCV antibodies, additional tests for HCV ribonucleic acid (RNA) were performed to identify current HCV infections. Viral load testing for HCV was performed using the COBAS Ampliprep TaqMan (Roche). Specimen preparation was automated using the COBAS AmpliPrep Instrument with Amplification and detection automated using the COBAS TaqMan 9Analyser. The COBAS AmpliPrep/COBAS TaqMan HCV Test Version 2.0 used reverse transcription and PCR amplification primers that defined a sequence within a highly conserved region of the five untranslated regions of the HCV genome. The nucleic acid sequence of the primers was optimized to yield comparable amplification of HCV genotypes 1-6. The test quantitates HCV RNA over the range of 20–100,000,000 IU/ ml. The lowest detection limit was 20 IU/ml. A positive anti-HCV and detectable viral load confirmed HCV infection; a positive anti-HCV and undetectable viral load indicated cleared infection, and a negative anti-HCV and undetectable viral load indicated a possible false positive anti-HCV from POC.

3.8 Data management

Data were collected and managed using REDCap® (Research Electronic Data Capture) hosted by The Aurum Institute (22). All data were treated confidentially, with all protections applied to research data. The database was password-protected, and each study staff provided a unique password and permissions to view and edit assigned accordingly. Participant data were not stored on any local drives on the laptops/tablets. Instead, paper

records, including logs, laboratory reports, and informed consent forms, were kept in secure locked cabinets in study rooms provided by the correctional facilities staff.

The first level of quality control procedures included a review of the survey questionnaire for completion and correctness by the site team leaders before uploading it to the REDCap® database which was in the Aurum Head Office on a secure server. The Data Manager performed the second level of data checks. Data queries to find inconsistent entries, missing information, and incorrect entries from the database were generated every two weeks and sent electronically to site team leaders for resolution.

The data manager developed a data dictionary to describe the database's contents, format, and structure. The Aurum Institute and CDC-South Africa will maintain archival copies of the de-identified study database for at least 15 years after publication the final report.

3.9 Data analysis

Descriptive statistics were performed on socio-demographics, risk factors, and prevalence estimates for HIV, HBV, and HCV infection reported with 95% confidence intervals (CI) using the exact method. Missing observations were summarized and referred to as “Not provided” in the tables. Continuous variables were summarized using means with standard deviation or medians with interquartile range. Since the outcomes were dichotomous in nature, univariable and multivariable logistic regression models were separately performed for each infection to identify risk factors.

For HIV, HBV, and HCV infection, crude odds ratios and their corresponding 95% CI were calculated. Statistically significant variables in univariable regression were entered in the final multivariable model using a pre-specified p-value level ($p < 0.1$). Specifically, the following independent variables were assessed: age, self-reported STI, injection drug use, sharing razors, and tattoos. Statistical analyses were performed using STATA version 15 (College Station, TX, USA)

4 FIELDWORK PROCEDURES QUALITATIVE SUB-STUDY

4.1 Training of field staff

Training of study staff was conducted before study implementation. All study staff were trained on the protection of participants, including patient-data confidentiality and how to obtain informed consent from participants, and all study procedures as indicated for their role in the study. Emphasis was made of probing skills and actively listening during the collection of qualitative data. Field staff were also trained in the transcription of qualitative data.

4.2 Recruitment and enrolment

At each study site, participants were recruited for in-depth interviews (IDI) through a purposive sampling technique.

1. Ten people who were incarcerated per centre: This included males and females with undiagnosed HIV, diagnosed with HBV/HCV infection, and reported having a previously diagnosed STI infection in the correctional centre.
2. Two security officials per centre: These are correctional staff that have worked in the correctional facilities for at least 6 months and who are responsible for inmate supervision and assuring compliance to correctional centre rules.
3. One peer educator per centre: This included peer educators who facilitate health programs in the correctional facilities.

Similarly, three focus group discussions (FGD) with between six and ten healthcare workers (both DCS and non-DCS) were conducted. *A priori* categories of DCS correctional officers that were targeted for participation and included:

1. DCS clinic staff (nurses and doctors) who are responsible for the implementation of health programs within correctional centers.

2. DCS social workers, who are responsible for providing social support services and participate in the rehabilitation of people who are incarcerated.
3. Non-DCS staff who contribute to direct service delivery of correctional centre health programs. The Aurum Institute and SA Partners have counsellors who support HIV testing services (HTS) delivery and teams that support voluntary male medical circumcision (VMMC) in these correctional centers.

4.3 In-depth interviews

IDIs were conducted with participants in a private and secure place by trained research assistants. All interviews were conducted in English or the local language of a participant's choice using a study approved IDI guide aimed to elicit discussions on issues listed below:

- Perception of an inmate's personal susceptibility to HIV, HBV, and HCV infection.
- Benefits and barriers to accessing and utilizing HIV, HBV, and HCV services within the correctional centre.
- Types of behaviors that place people who are incarcerated at risk of HIV, HBV, and HCV infection.
- Perceived access to and availability of illegal drugs, types of illegal drugs, and methods of use within the correctional centre.
- Perceived role of peers that influence an person who is incarcerated's risk or protective behaviours with regards to HIV, HBV, and HCV infection; and
- Other individual, social, and structural motivators, or barriers to accessing HIV, HBV, and HCV services within the correctional centre.

All IDIs were digitally audio-recorded with the written consent of participants, and each lasted up to 90 minutes. Translations and transcriptions of audio recordings were performed by trained interviewers in preparation for qualitative data analysis. Transcripts were done on verbatim renderings of English, or an English translation of local languages.

4.4 Focus group discussions

All FGDs were conducted in a private and secure room dedicated to this purpose using study-approved guides. Two trained interviewers (a primary moderator/interviewer and a note-taker) made a brief introduction of the survey and obtained written informed consent from each participant to audio record sessions lasting up to 60 minutes. Prior to beginning each session, participants were instructed not to use their names or names of other participants; however, they could use an alias. Furthermore, participants were reminded of the shared responsibility in maintaining the entire group's confidentiality of all participants and the contents of discussions.

FGDs elicited individual responses within the context of a group on issues listed below:

- Inmate access to HIV, HBV, and HCV service delivery within the correctional centre.
- Types of behaviours that place people who are incarcerated at risk for HIV, HBV, and HCV infection.
- Perceived access to illegal drugs, types of illicit drugs, and methods of use within the correctional centre.
- The perceived role of peers that influence people who are incarcerated's risk to HIV, HBV, and HCV infection; and
- Other social and structural motivators or barriers to accessing HIV, HBV, and HCV services within the correctional centre.

During the sessions, the moderator generated memos as the discussion unfolded to help formulate follow-up questions and probes. At the end of each session, the interviewers recorded thoughts, questions, and concerns in the form of debriefing notes. Within these debriefing notes, interviewers recognized elements and themes emerging within the focus group discussions and ensured that the data collection process remained responsive to the information gathered. In addition, the interviewers provided constructive feedback on better ways to probe participants and facilitate FGDs, including interviewing techniques to ask open-ended questions and engage with participants to ensure the discussion remains focused.

4.5 Data management

Data collected from audio recordings were uploaded to a secure folder stored on the Aurum file transfer protocol (FTP) server. After completing qualitative interviews, this was done immediately once the research assistants left the correctional centre. Once the audio recording was uploaded to the Aurum server, the recording from the digital recorder was deleted. All audio recordings were translated verbatim and transcribed in preparation for

analysis. At no time was personally identifiable information contained in the transcribed notes. The transcripts and notes were stored in password-protected electronic folders with restricted access to study staff. The audio-recording saved on the Aurum server had restricted access and was backed up. Transcriptions took place by sharing audio files with the research assistants from the password-protected Aurum server.

4.6 Data analysis

Qualitative data were analyzed using QSR NVIVO 10 qualitative analysis software (QSR International, Victoria, Australia) and manual reviewing. Thematic analysis was used to describe themes and any new themes that emerged. Steps to develop the codebook included word frequency tabulation, text searches, highlighting statements that entail the frequently occurring words, linking statements to the deductive themes, further inductive review of the text, associating sub-themes to main themes and coding to index the transcript. Coding progressed from broad to focused coding. For reliability, the original transcript and codebook were sent to two independent reviewers. During a round table discussion, the reviewers categorized the original transcripts according to the codebook and suggested new codes where applicable. The codebook was revised, and the finalized themes were displayed as direct quotes in the results.

5 ETHICAL CONSIDERATIONS

5.1 Ethical approvals

The Human Research Ethics Committees (REC) of the University of the Witwatersrand (Wits HREC) granted the initial ethical approval (16 January 2019). In addition, the study was approved by the Department of Correctional Services (DCS) Research Ethics Committee (REC) approved the study on 13 March 2019. The study was reviewed and approved by the Human Research Ethics Committee.:(Medical) of the University of the Witwatersrand. This activity was reviewed by CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy[1].

5.2 Return of test results

All POC-HIV, HBV, and HCV test results were returned immediately within 30 minutes after specimen collection and post-test counselling was provided immediately by study staff. Post-test counselling messages were individualized to suit each participant's HIV, HBV, and HCV results and risk profiles. The messages included goals, means, and strategies for behavioral risk reduction; maintenance of risk reduction; and explanation of risk reduction methods (e.g., not sharing needles, syringes, or razors). Post-counselling messages for female participants with positive HBV results emphasized the importance of providing an HBV vaccination within 24 hours of the birth of any children. Additional counselling for participants with POC-HIV, HBV, or HCV positive results included: interpretation of the laboratory results, information on additional tests to be performed, assessment of psychosocial needs, discussion of living with HBV infection, treatment, and care, and issues related to discrimination. Participants with positive rapid HCV results were informed that a second test (laboratory) was needed to confirm whether the infection was active or resolved. The test results were returned within eight weeks of sample transportation to the laboratory. HBV and HCV transmission to partners and strategies for behavioral change were addressed.

Participants with laboratory HIV, HBV, and HCV test results indicating infection were provided with a referral letter to the local DCS clinic for linkage to care. Counselling sessions were held with all participants who received reactive laboratory results.

6 RESULTS: QUANTITATIVE SUB-STUDY FINDINGS

6.1 Study population

We screened and enrolled 633 participants evenly distributed between the two correctional facilities between August and December 2019 (Table 4). Most study participants were male (86.7%), of median age 36 years (interquartile range (IQR]): 29–41), South African (88.8%), and Black African (90.2%). A small proportion

[1] See e.g., 45 C.F.R. part 46; 21 C.F.R. part 56; 42 U.S.C. §241(d), 5 U.S.C. §552a, 44 U.S.C. §3501 et seq.

reported sexual activity while incarcerated (5.1%), sharing body piercing tools (2.9%), whereas most (75.0%) reported sharing injecting needles. In addition, about a third of respondents reported sharing grooming items including razor blades for shaving. Most participants had undergone HIV testing in the correctional centre (80.7%) and similarly, most were initiated on ART (68.8%) in the correctional centre.

Table 4: Overall participant profile by correctional centre; Situational analysis of factors associated with HIV and viral hepatitis infection in two South African correctional facilities

Characteristics	Total (N=633)			Kgosi Mampuru II (N=316)			Polokwane (N=317)		
	n	(%)	95% CI	n	%	95% CI	n	%	95% CI
Sex									
Male	549	86.7	83.8–89.3	264	83.5	79.0–87.2	285	89.9	86.1–92.8
Female	84	13.3	10.7–16.2	52	16.5	12.8–21.0	32	10.1	7.2–13.9
Age (years)									
Median (IQR)	36	29–41		39	33–45		32	27–37	
Citizenship									
South African	534	84.4	81.3–87.1	295	82.0	84.9–92.1	275	86.8	83.8–91.0
Non-South African	70	11.0	8.7–13.8	32	10.1	7.9–15.1	38	11.9	8.9–15.1
Missing	29	4.6	3.1–6.5	25	7.9	5.2–11.5	4	1.3	0.3–3.2
Race									
Black African	571	90.2	87.6–92.4	265	83.9	86.5–93.3	306	96.5	95.3–98.9
Non-Black African	35	5.3	4.0–17.6	28	8.9	6.7–13.5	7	2.2	1.1–4.6
Missing	27	4.3	2.8–6.1	23	7.3	4.7–10.7	4	1.3	0.3. 3.2
Marital status at time of incarceration									
Never married	472	74.6	71.0–77.9	227	71.8	66.5–76.7	245	77.3	72.3–81.8
Ever married	135	21.4	18.2–24.7	67	21.3	16.8–26.1	68	21.4	17.1–26.4
Missing	26	4.1	2.7–6.0	22	7.0	4.4–10.4	4	1.3	0.3. 3.2
Highest level of education									
No schooling	14	2.2	1.2–3.7	3	1.0	0.2–2.7	11	3.5	1.7–6.1
Primary level	96	15.2	12.5–18.2	51	16.1	12.3–20.7	45	14.2	10.5–18.5
Secondary level	409	64.6	60.7–68.3	180	57.0	51.3–62.5	229	72.2	70.0–77.1
Tertiary level	81	12.8	10.3–15.7	53	16.8	12.8–21.4	28	8.8	5.9–12.5
Missing	33	5.2	3.6–7.2	29	9.2	6.2–12.9	4	1.3	0.3. 3.2
Incarceration status									
Sentenced	282	44.6	40.6–48.5	209	66.1	60.6–71.3	73	23.0	18.5–28.1
Awaiting trial	152	24.0	20.7–27.5	-	-	-	152	48.0	34.0–45.0
Missing	199	31.4	27.8–35.2	107	33.9	28.7–39.4	92	29.0	24.1–34.4
Previous incarceration history									
Yes	163	25.7	22.4–29.3	60	19.0	14.8–23.8	103	32.5	27.4–38.0
No	267	42.2	38.3–46.1	147	46.5	40.9–52.2	120	37.9	32.5–43.4
Missing	203	32.1	28.4–35.9	109	34.5	29.3–40.0	94	29.6	24.7–35.0

Characteristics	Total (N=633)			Kgosi Mampuru II (N=316)			Polokwane (N=317)		
	n	(%)	95% CI	n	%	95% CI	n	%	95% CI
Duration of incarceration (months)									
Median (IQR)	29.3 (10.5-91.3)			77.3 (25.9–142.0)			13.7 (7.8–28.2)		
Sexual activity while incarcerated									
Yes	22	3.5	2.3–5.2	11	3.5	1.8–6.1	11	3.5	1.7–6.1
No	411	64.9	61.1–68.6	197	62.3	56.7–67.7	214	67.5	62.0–72.6
Missing	200	31.6	28.0–35.4	108	34.2	29.0–39.7	92	29.0	24.1–34.4
Consensual sex (n=22) *									
Yes	14	63.4	40.7–82.8	8	72.7	39.0–94.0	6	54.6	23.4–83.3
No	1	4.6	0.1–22.8	0	0.0	-	1	9.0	0.2–41.2
Declined to answer	7	31.8	14.9–54.9	3	27.3	6.0–61.0	4	36.4	10.9–69.2
Shared tattooing tools (n=334) **									
Yes	82	24.5	20.2–29.5	48	31.0	28.8–38.9	34	19.0	13.5–25.5
No	248	74.3	69.2–78.9	105	67.7	60.0–75.0	143	79.9	73.3–85.4
Declined to answer	4	1.2	0.3–3.0	2	1.3	0.2–4.6	2	1.1	0.1–4.0
Shared piercing tools (n=137) **									
Yes	4	2.9	0.8–7.3	2	3.0	0.4–10.4	2	2.9	0.3–9.9
No	132	96.4	91.7–98.9	64	95.5	87.5–99.1	68	97.1	90.1–99.7
Declined to answer	1	0.7	0.0–4.0	1	1.5	0.0–8.0	0	0.0	-
Shared injection equipment among those who reported injecting drugs (n=20) **									
Yes	15	75.0	50.9–91.3	14	87.5	61.7–98.4	1	25.0	0.6–80.6
No	5	25.0	8.7–49.1	2	12.5	1.6–38.3	3	75.0	19.4–99.4
Shared shaving equipment/razor (n=402) **									
Yes	140	34.8	30.2–39.7	40	24.1	17.8–31.3	100	42.4	36.0–47.0
No	262	65.2	60.3–69.8	126	75.9	68.7–82.2	136	57.6	51.0–64.0
Last HIV test done in a correctional centre (n=553)									
Yes	446	80.7	77.1–83.9	225	84.5	83.6–91.9	191	71.3	65.4–76.6
No	107	19.3	16.1–22.9	30	15.5	8.1–16.4	77	28.7	23.4–34.6
ART initiated in a correctional centre (n=93)									
Yes	64	68.8	58.4–78.0	54	79.4	67.9–88.3	10	40.0	21.1–61.3
No	29	31.2	22.0–41.6	14	20.6	11.7–32.1	15	60.0	38.7–78.9

n: total number of individuals in the sample; CI: confidence interval; IQR: interquartile range; ART: antiretroviral treatment; *among those who reported sexual activity while incarcerated; ** respondents were those who reported ever getting a tattoo, obtained a piercing, used injections for drug use, used razors and other equipment for grooming practices whilst incarcerated in the participating correctional facility in the HASH study

6.2 HIV prevalence

Overall, HIV prevalence was 19.6% (95% CI: 16.5%–22.7%) and significantly higher in Kgosi Mampuru II (25.6%; 95% CI: 22.1%–32.5%] than in Polokwane (13.6%; 95% CI: 9.7%–17.7%) (Table 5). Further, HIV prevalence differed by incarceration status with a higher prevalence among sentenced people who were incarcerated compared with those awaiting trial; those who reported STIs during the current incarceration period compared with those who did not report ever having an STI during the incarceration period; and those who self-reported ever injecting drugs compared with those who did not report ever injecting drugs (Table 5). HIV prevalence significantly differed by sex; with the prevalence among males (15.6%; 95% CI: 12.6%–19.4%) lower than females (50.0%; 95% CI: 34.9%–57.1%).

Table 5: HIV status stratified by selected participant characteristics; Situational analysis of factors associated with HIV and viral hepatitis infection in two South African correctional facilities

Characteristic	Overall (n=633)			HIV-negative (n=509; 80.4%)			HIV-positive (n=124; 19.6%)			Chi² p-value Rank sum test
	n	(%)	95%CI	n	(%)	95%CI	n	(%)	95%CI	
Sex										
Male	549	86.7	83.8–89.3	467	85.1	81.8–87.9	82	14.9	12.1–18.2	<0.01
Female	84	13.3	10.7–16.2	42	50.0	38.9–61.1	42	50.0	38.9–61.1	
Age (Years)										
18-21	20	3.2	1.9–4.8	19	95.0	75.1–99.9	1	5.0	1.1–2.5	0.11
22-34	263	41.6	37.8–45.5	223	84.8	79.9–88.9	40	15.2	11.1–20.1	
≥35	338	53.4	49.4–57.3	267	79.0	74.3–83.2	71	21.0	16.8–25.7	
Marital Status										
Never married	472	74.6	71.0–78.0	382	80.9	77.1–84.4	90	19.1	15.6–22.9	0.17
Ever married	133	21.0	17.9–24.4	102	76.7	65.6–83.6	31	23.3	16.4–31.4	
Incarceration status*										
Sentenced	387	61.1	57.2–65.0	298	77.0	72.5–81.1	89	23.0	18.9–27.5	<0.01
Awaiting trial	152	24.0	20.7–27.5	140	92.1	86.6–95.9	12	7.9	4.1–13.4	
Correctional CDC/GHC/OD										
Kgosi Mampuru II	316	49.9	46.0–53.9	235	74.4	69.2–79.1	81	25.6	20.9–30.8	<0.01
Polokwane	317	50.1	46.1–54.0	274	86.4	82.2–90.0	43	13.6	10.0–17.8	
Citizenship										
South African	534	84.3	81.3–87.1	432	80.9	77.3–84.1	102	19.1	15.9–22.7	0.11
Non-South African	70	11.1	8.7–13.8	51	72.9	60.9–82.8	19	27.1	17.2–39.1	
Duration of current incarceration (months)										
Median (IQR)	19 (7–56)			19 (7-57)			23 (7-53)			0.98

Characteristic	Overall (n=633)			HIV-negative (n=509; 80.4%)			HIV-positive (n=124; 19.6%)			Chi² p-value Rank sum test
	n	(%)	95%CI	n	(%)	95%CI	n	(%)	95%CI	
				7–57			7–53			
Self-reported STI in the current incarceration period										
No	534	84.4	81.3–87.1	442	82.8	79.3–85.9	92	17.2	14.1–20.7	
Yes	12	1.9	1.0–3.3	7	58.3	27.7–84.8	5	41.7	15.2–72.3	0.01
Shared tattooing tools in correctional centre (n=332)										
No	240	71.9	66.7–76.6	201	83.7	78.5–88.2	39	16.3	11.8–21.5	0.40
Yes	82	24.6	20.0–29.5	64	78.0	67.6–86.4	18	22.0	13.6–32.5	
Shared piercing tools in correctional centre (n=135)										
No	131	97.0	90.7–98.4	103	78.0	70.0–84.8	29	22.0	15.2–30.0	0.86
Yes	4	3.0	0.8–7.3	3	75.0	19.4–99.4	1	25.0	0.6–80.6	
Ever injected drugs for recreational use										
No	569	89.9	87.3–92.1	460	80.8	77.4–84.0	109	19.2	16.0–22.6	<0.01
Yes	27	4.3	2.8–6.1	14	51.9	31.9–71.3	13	48.1	28.7–68.1	
Ever shared injecting equipment in correctional centre (n=19)										
No	5	26.3	8.7–49.1	3	60.0	14.7–94.7	2	40.0	5.3–85.3	0.35
Yes	14	73.7	40.8–84.6	5	35.7	12.8–64.9	9	64.3	35.1–87.2	
Ever shared razor blade/ shaving equipment in correctional centre (n=402)										
No	262	65.2	60.3–69.8	217	82.8	77.7–87.2	45	17.2	12.8–22.3	0.85
Yes	140	34.8	30.2–39.7	117	83.6	76.4–89.3	23	16.4	10.7–23.6	
Ever used HIV PrEP										
No	588	92.9	90.6–94.8	473	80.4	77.0–83.4	115	19.6	16.4–23.0	0.20
Yes	2	0.3	0.1–1.1	2	100.0	-	0	0.0	-	
Don't know	7	1.1	0.4–2.3	7	63.6	30.8–89.1	4	36.4	10.9–69.2	
Circumcised										
No	48	7.6	5.6–9.9	37	77.1	62.7–88.0	11	22.9	12.0–37.3	0.14
Yes	473	74.7	71.1–78.1	403	85.2	81.7–88.3	70	14.8	11.7–18.3	

*Missing observations; IDU: injection drug use; PrEP: pre-exposure prophylaxis; IQR: interquartile range; Overall column % may not add to 100% due to missing data. Row %s reported for variables stratified by HIV status

6.2.1 Prevalence by age and sex

Overall, HIV prevalence was higher in females than males (50.0% vs. 14.9%, respectively, p <0.01) (Table 6). The HIV prevalence in males and females in Kgosi Mampuru II correctional centre was significantly higher than in Polokwane (Table 6). Study findings also showed the highest prevalence in participants ≥35 years (21.9%). When stratified by centre, participants aged between 21 and 34 years in Kgosi Mampuru II reported the highest prevalence (29.4% [95% CI: 20.1%, 40.0%]). In Polokwane, the highest reported prevalence was in the older age group (≥35 years) (17.6% [95% CI: 11.8%, 25.6%]).

Table 6: HIV prevalence by correctional centre, stratified by age and sex; Situational analysis of factors associated with HIV and viral hepatitis infection in two South African correctional facilities

Indicator	Overall			Kgosi Mampuru II			Polokwane		
	n	N	Point Estimate %, 95% CI)	n	N	Point Estimate, (%, 95% CI)	n	N	Point Estimate, (%, 95% CI)
HIV Positive	124	633	19.6 (16.6–22.9)	81	316	25.6 (21.1–30.8)	43	317	13.6 (10.2– 17.8)
Sex									
Male	82	549	14.9 (12.1–18.2)	54	264	20.5 (16.0–25.8)	28	285	9.8 (6.9–13.9)
Female	42	84	50.0 (38.9–61.1)	27	52	51.9 (38.4–65.2)	15	32	46.9 (30.3– 64.2)
Age group									
18-21 years	1	19	5.2 (0.1–26.0)	0	1	-	1	18	5.3 (0.7–30.7)
21-34 years	48	271	17.7 (13.4–22.8)	27	92	29.4 (20.1–40.0)	21	179	11.7 (7.8–17.4)
≥35 years	75	342	21.9 (17.7–26.7)	54	223	24.2 (19.0–30.3)	21	119	17.6 (11.8–25.6)

N = total number included in the denominator; n = number with the measured outcome
CI: Confidence Interval

6.2.2 95-95-95 Care cascade`

The overall proportion of HIV-positive participants who were aware of their positive status at the time of the study was 79.0% (95%CI: 80.4%–93.2%). Of those aware of their diagnosis, 93.4% (95% CI: 87.1%–97.7%) were on treatment and, of these, 80.4% (95% CI: 70.6%–88.0%) achieved viral load suppression (Table 7). In Polokwane, the proportion of people living with HIV and aware of their HIV status (60.4%) was lower than in Kgosi Mampuru II (88.9%). There were similarities between the two sites in terms of the proportion of people aware of their status and on ART, and the proportion of people on ART and virally suppressed.

Table 7: 95-95-95 cascade for people who are incarcerated and living with HIV; Situational analysis of factors associated with HIV and viral hepatitis infection in two South African correctional facilities

	n[b]	N[b]	Point estimate % (95% CI[c])
Overall			
Aware of HIV status[d]	98	124	79.0 (70.8–85.8)
Aware of HIV status and on ART[e]	92	98	93.9 (87.1–97.7)
On ART and virally suppressed	74	92	80.4 (70.9–88.0)
Kgosi Mampuru II			
Aware of HIV status[d]	72	81	88.9 (80.0, 94.8)
Aware of HIV status and on ART[e]	67	72	93.1 (84.5, 97.7)
On ART and virally suppressed	55	67	82.1 (70.8, 90.3)

	n[b]	N[b]	Point estimate % (95% CI[c])
Polokwane			
Aware of HIV status[d]	26	43	60.4 (44.4, 75.0)
Aware of HIV status and on ART[e]	25	26	96.1 (80.4, 99.9)
On ART and virally suppressed	19	25	85.4 (54.8, 90.6)

a) 95-95-95 cascade has three targets aimed at ensuring that 95% of all PLHIV know their HIV status; of these, 95% receive ART; and of these, 95% have viral suppression
b) Depending on the outcome reported; N = total number included in the denominator; n = number with measured outcome
c) 95% CI (confidence interval) indicates the interval within which the true population parameter is expected to fall 95% of the time from repeated surveys of the same design.
d) Awareness of HIV status was defined as self-reporting HIV-positive status and/or detection of antiretroviral drugs in the participant's blood specimen.
e) Being on antiretroviral therapy (ART) was based on participant self-reporting that they were taking ART.
f) Viral load suppression is defined as HIV RNA <1,000 copies/mL of plasma among people living with HIV.

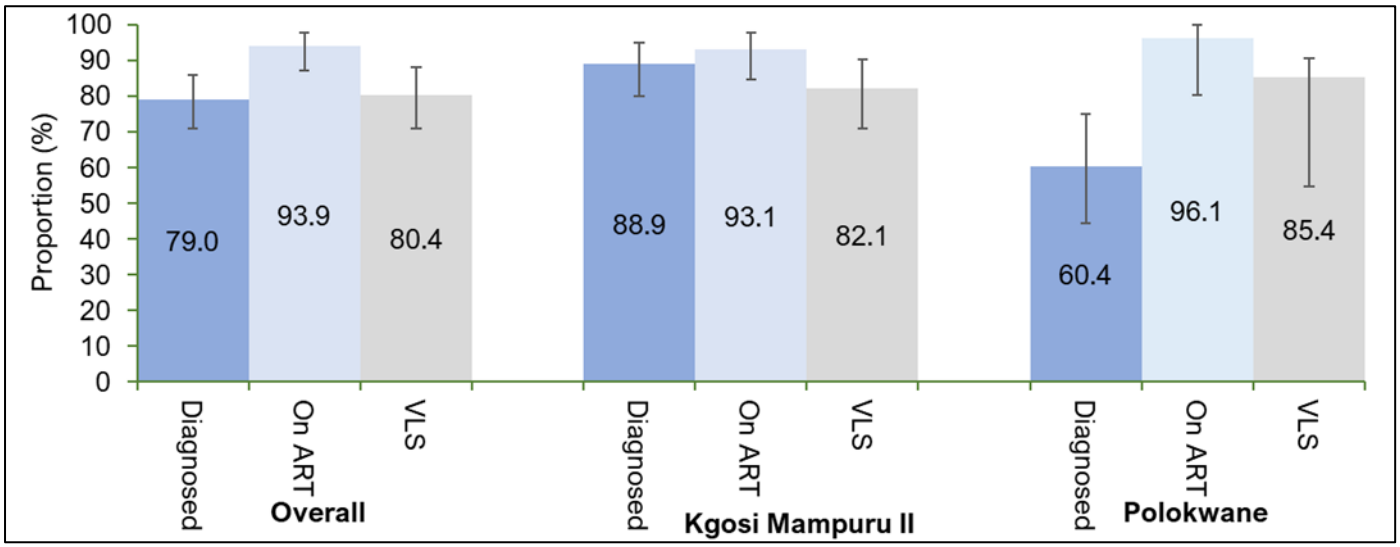

Figure 3: ***95-95-95 cascade for people who are incarcerated and living with HIV; Situational analysis of factors associated with HIV and viral hepatitis infection in two South African correctional facilities***.

The figure shows the proportion of PLHIV who know their HIV status (diagnosed); the proportion of PLHIV aware of their status and receiving ART (on ART); and the proportion on ART who have an HIV viral load <1,000 copies/mL (VLS).

6.2.3 Risk factors associated with HIV infection

Our study findings show that sex, age, history of STIs, and history of injecting drug use were independently associated with increased odds of reporting HIV infection. Females were more likely to be HIV-positive than males (AOR: 4.5; 95% CI: 2.4–8.4). Participants who reported ever having an STI during the incarceration period were more likely to be HIV-positive than those who had not reported an STI in their current incarceration period (AOR: 4.3; 95% CI:1.2–16.0). Finally, participants who reported ever injecting drugs for recreational use were about four times more likely to be HIV-positive compared to those who never reported injecting drug use (AOR: 3.8; 95% CI: 1.5–9.6) (Table 8).

Table 8: Risk factors for HIV infection in correctional facilities; Situational analysis of factors associated with HIV and viral hepatitis infection in two South African correctional facilities

		Univariate models		Adjusted models	
		Unadjusted OR (95% CI)	**p-value**	**Adjusted OR (95% CI)**	**Overall p-value**
Age (years)		1.0 (1.0,1.1)	0.02	1.0 (1.0–1.1)	0.03
Sex	Male	**1 (Reference)**		**1 (Reference)**	
	Female	5.7 (3.5–9.3)	<0.01	4.5 (2.4–8.5)	<0.01
Incarceration status	Sentenced	**1 (Reference)**		**1 (Reference)**	
	Awaiting trial	0.3 (0.2–0.5)	<0.01	0.6 (0.3–1.1)	0.11
Self-reported STI in the current incarceration period	No	**1 (Reference)**		**1 (Reference)**	
	Yes	3.4 (1.1–11.1)	0.04	4.3 (1.2–16.0)	0.02
Marital Status	Single/never married	**1 (Reference)**		-	
	Married	1.4 (0.9–2.2)	0.17	-	-
Ever injected drugs for recreational use	No	**1 (Reference)**		**1 (Reference)**	
	Yes	3.9 (1.8–8.6)	<0.01	3.8 (1.5–9.6)	<0.01

*OR: Odds Ratio; CI: Confidence Interval; STI: Sexually transmitted infections

6.2.4 Awareness of transmission routes and prevention methods

Most of the people who were incarcerated were aware of how HIV can be transmitted through unprotected anal sex, oral sex, and sharing of needles, razors, or tattoo equipment. In addition, most of the people who were incarcerated were aware of the benefits of condoms in reducing the risk of HIV transmission. In both correctional centres, participants were least aware that HIV could be spread from having oral sex, compared with the self-reported awareness to other questions explored on HIV transmission (Table 9). The proportion aware that HIV could be transmitted from having oral sex was: 74.9% in Kgosi Mampuru II and 58.5% in Polokwane.

Table 9: Awareness of HIV transmission routes and prevention methods; Situational analysis of factors associated with HIV and viral hepatitis infection in two South African correctional facilities

	Overall (N=633)		Kgosi Mampuru II (N = 316)		Polokwane (N = 317)	
	N	Point Estimate, % (95% CI)	n	Point Estimate, % (95% CI)	n	Point Estimate, % (95% CI)
Aware that HIV can be spread through unprotected anal sex	513	81.0 (77.8–84.0)	278	88.3 (84.2–91.4)	235	73.9 (68.8–78.4)
Aware that HIV can be spread from having oral sex	422	66.7 (62.8–70.3)	236	74.9 (69.9–79.4)	186	58.5 (53.0–63.8)
Aware that HIV can be spread through sharing needles, razors, or tattoo equipment	563	88.9 (86.2–91.3)	279	88.6 (84.6–91.6)	284	89.3 (85.4–92.2)
Aware that condoms reduce risk of HIV transmission	516	81.5 (78.3–84.5)	258	81.9 (77.3–85.8)	258	81.1 (76.5–85.1)

CI: Confidence Interval; n=number of individuals reporting awareness of the different HIV transmission routes

6.2.5 HIV prevention programs

Most males who were incarcerated were circumcised (74.7%, 95% CI: 71.1%, 78.1%) (Table 10). The proportion of people who are incarcerated circumcised within a correctional centre was higher in Kgosi Mampuru II (22.2%, 95% CI: 18.0–27.1) than Polokwane (7.2%, 95% CI:4.9–10.6). Overall, slightly above 10% people who were incarcerated perceived that obtaining condoms in the correctional centre was not easy. However, about 2 in 10 participants perceived that it was not easy to obtain lubricants in the correctional centre. In both sites, less than half of the participants had received any contact from peer educators in the three months preceding the survey. In Kgosi Mampuru II, 32.3% (95% CI: 27.5%–37.7%) reported contact with a peer educator in the past three months preceding the survey, compared with Polokwane, where 9.8% (95% CI: 7.0%–3.5%) had been in contact with a peer educator in the same period. Awareness of the use of PrEP was low in both facilities, with only about 1 in 10 participants aware of the use of PrEP to prevent HIV transmission.

Table 10: Access to and awareness of HIV prevention programs in correctional centres; Situational analysis of factors associated with HIV and viral hepatitis infection in two South African correctional facilities

	Overall (N = 633)		Kgosi Mampuru II (N = 316)		Polokwane (N = 317)	
	N	Point Estimate, (%, 95% CI)	n	Point Estimate, (%, 95% CI)	n	Point Estimate, (%, 95% CI)
Circumcision						
Reported to be circumcised	473	74.7 (71.1–78.1)	209	66.3 (60.8–71.6)	264	83.0 (78.4–87.0)
Circumcised within correctional center	93	19.7 (16.2–23.5)	70	22.2 (18.0–27.1)	23	7.2 (4.9–10.6)
Condoms and lubricants						

Perceive that it is not easy to obtain condoms in the correctional center	79	12.5 (10.0–15.3)	28	8.9 (6.2–12.5)	51	16.0 (12.4–20.5)
Perceive that it is not easy to obtain lubricants in the correctional center	127	20.1 (17.0–23.4)	57	18.1 (14.2–22.7)	70	22.0 (17.8–26.9)
Peer educators						
Any contact with peer educators in the 3 months preceding the survey	133	21.0 (17.9–24.4)	102	32.3 (27.5–37.7)	31	9.8 (7.0–13.5)
HIV programs						
Receiving HIV testing in correctional centre	446	80.7 (77.1–83.9)	255	89.5 (85.3–92.6)	191	71.3 (65.5–76.4)
Started ART in the centre	64	68.8 (58.4–78.0)	54	79.4 (67.9–88.3)	10	40.0 (21.1–61.3)
Pre-exposure prophylaxis (PrEP)						
Aware of the use of PrEP to prevent HIV transmission	68	10.7 (8.4–13.4)	38	12.1 (8.9 ,16.1)	30	9.4 (6.7–13.1)

CI: Confidence Interval; n=number of individuals who responded yes to the questions posed

6.2.6 HBV and HCV knowledge and awareness

The level of awareness of HBV and HCV was low among study participants, and similar across the two sites (Table 11).

Table 11: Awareness of HBV and HCV infection; Situational analysis of factors associated with HIV and viral hepatitis infection in two South African correctional facilities

	Overall (N=633)		Kgosi Mampuru II (N = 316)		Polokwane (N = 317)	
	n	Point Estimate, (%, 95% CI)	n	Point Estimate, (%, 95% CI)	n	Point Estimate, (%, 95% CI)
Ever heard of HBV infection	83	10.6 (8.3–13.2)	39	12.4 (9.2–16.5)	44	13.8 (10.5–18.1)
Ever heard of HCV infection	47	7.4 (5.5–9.8)	24	7.6 (5.2–11.1)	23	7.2 (4.8–10.6)

CI: Confidence Interval; n=number of individuals in the sample; HBV: hepatitis B virus; HCV: hepatitis C virus

6.3 HBV and HCV infection

Overall, 18 participants had a reactive POC-HBV test, and 28 participants had a reactive POC-HCV test. Of these, one participant had reactive tests for both POC-HBV and POC-HCV. Therefore, 45 specimens were sent to the laboratory for confirmation of HBV and HCV infection. Laboratory tests confirmed all the POC test results that had been documented at the sites (Table 12). The overall prevalence of HBV infection was 2.8% (95% CI: 1.7%-4.5%) and was similar in both sites. The overall prevalence for HCV infection was 4.4.% (95% CI: 3.0%–6.3%) and was higher in Kgosi Mampuru II than Polokwane. HIV/HBV co-infection was high and highest in Polokwane.

Table 12: Prevalence of HBV and HCV infection, HASH Study 2019; Situational analysis of factors associated with HIV and viral hepatitis infection in two South African correctional facilities

	Overall (N=633)		Kgosi Mampuru II (N = 316)		Polokwane (N = 317)	
	n	Point Estimate, %, (95% CI)	n	Point Estimate, %, (95% CI)	n	Point Estimate, %, (95% CI)
Hepatitis B Positive*	18	2.8 (1.7–4.5)	9	3.0 (1.4–5.7)	9	2.9 (1.3–5.4)
Hepatitis C Positive	28	4.4 (3.0–6.3)	20	7.1 (4.4–10.7)	8	2.5 (1.3–4.9)
HIV/HBV co-infection	6	33.3 (13.3-59.0)	2	22.2 (2.8-60.0)	4	44.4 (13.7-78.8)
HIV/HCV co-infection	6	21.5 (8.3-41.0)	5	23.8 (8.2-47.1)	1	12.5 (0.3-52.7)

* Due to insufficient sample and hemolysis, HBV DNA and HCV RNA testing could not be performed for seven samples.
CI: Confidence Interval; n=number of individuals whose results were returned from the laboratory

6.4 Risk factors for HBV infection

There were differences in the prevalence of HIBV infection by sharing piercing tools and history of intravenous drug use (Table 13).

Table 13: Differences in socio-demographics by HBV status; Situational analysis of factors associated with HIV and viral hepatitis infection in two South African correctional facilities

		HBV negative (n=615; 97.2%)			HBV positive (n=18; 2.8%)			Chi²/ Fishers Exact p-value
		n	(%)	95% CI	n	(%)	95% CI	
Sex	Male	510	96.6	94.7–98.0	18	3.4	2.0–5.3	0.09
	Female	82	100.0	-	0	0.0	-	
Age (Years)	18-21	20	100.0	-	0	0.0	-	0.73
	22-34	254	96.9	94.1– 98.7	8	3.1	1.3–5.9	
	≥35	318	97.0	94.5– 98.5	10	3.0	1.5–5.5	
Incarceration status	Sentenced	271	97.1	94.4– 98.8	8	2.9	1.2– 5.6	0.54
	Awaiting trial	146	96.1	91.6– 98.5	6	3.9	1.5–8.4	
Self-reported STI	No	511	96.8	94.9– 98.1	17	3.2	1.9–5.1	0.80
	Yes	12	100.0	-	0	0.0	-	
Marital Status	Never married	451	96.6	94.5–98.0	16	3.4	2.0– 5.5	0.70
	Ever Married	131	98.5	94.7– 99.8	2	1.5	0.2– 5.3	
History of tattoos	No	255	97.7	95.1– 99.2	6	2.3	0.8–4.9	0.65
	Yes	322	96.4	93.8– 98.1	12	3.6	1.9–6.2	

Shared tattooing tools	No	238	96.7	93.7–98.6	8	3.3	1.4–6.3	0.73
	Yes	78	95.1	88.0–98.7	4	4.9	1.3–12.0	
History of piercing	No	278	96.2	93.3–98.1	11	3.8	1.9– 6.7	0.38
	Yes	134	97.8	93.7– 99.5	3	2.2	0.5– 6.3	
Shared piercing tools	No	129	98.5	94.6– 99.8	2	1.5	1.2– 5.4	<0.01
	Yes	3	75.0	19.4– 99.4	1	25.0	0.6– 80.6	
History of IDU	No	549	97.5	95.9– 98.6	14	2.5	1.4– 4.1	<0.01
	Yes	23	85.2	66.3– 95.8	4	14.8	4.2– 833.7	
Shared injection equipment	No	5	100.0	-	0	0.0	-	0.19
	Yes	11	73.3	44.9– 92.2	4	26.7	7.8– 55.1	
Shared razor blade/shaving equipment	No	249	96.5	93.5– 98.4	9	3.5	1.6– 6.5	0.96
	Yes	135	96.4	91.9– 98.8	5	3.6	1.2– 8.1	

HBV – hepatitis B virus; n – Total number of individuals who responded to individual questions representing the selected variables; STI – sexually transmitted infection; IDU – injecting drug use

6.4.1 Risk factors for HCV infection

The prevalence of HCV infection differed by age categories, with the highest proportion of infections among participants 22-34 years (7.7%) compared to those over 35 years (2.8%) and juveniles (0%). A higher proportion of HCV infection was reported in those already serving sentences (7.8%) compared with those awaiting trial (2.1%) (Table 14). The proportion of HCV infection was also associated with having a tattoo, sharing tattooing tools, history of intravenous drugs, and sharing injection tools.

Table 14: Differences in socio-demographics by HCV status; Situational analysis of factors associated with HIV and viral hepatitis infection in two South African correctional facilities

		HCV negative (N=605)			HCV positive (N=28)			Chi²/ Fishers Exact
		n	(%)	95% CI	n	(%)	95% CI	
Sex	Male	477	94.8	92.5– 96.6	26	5.2	3.4– 7.5	0.29
	Female	79	97.5	91.4– 99.7	2	2.5	0.3– 8.6	
Age (Years)	18-21	19	100.0	-	0	0.0	-	0.01
	22-34	229	92.3	88.3– 95.3	19	7.7	4.7– 11.7	
	≥35	308	97.2	94.7– 98.7	9	2.8	1.3– 5.3	
Incarceration status	Sentenced	249	92.2	88.4– 95.1	21	7.8	4.9– 11.6	0.01
	Awaiting trial	143	97.9	94.1– 99.6	3	2.1	0.4– 5.9	
Self-reported STI	No	483	95.4	93.3– 97.1	23	4.6	2.9– 6.7	0.11
	Yes	9	81.8	48.2– 97.7	2	18.2	2.3– 51.8	
Marital Status	Never married	425	94.9	92.4– 96.7	23	5.1	3.3– 7.6	0.89
	Ever married	121	96.0	91.0– 98.7	5	4.0	1–3– 9.0	
Has tattoo	No	245	98.0	95.4– 99.3	5	2.0	0.7– 4.6	0.01

	Yes	296	92.8	89.4– 95.4	23	7.2	4.6– 10.6	
Shared tattooing tools	No	223	94.9	91.3– 97.3	12	5.1	2.7– 8.7	0.02
	Yes	67	86.6	76.2– 92.7	11	14.1	7.3– 23.8	
Has piercings	No	263	95.3	92.1– 97.5	13	4.7	2.5– 79.2	0.16
	Yes	124	91.9	85.9– 95.9	11	8.1	4.1– 14.1	
Shared piercing tools	No	119	92.2	86.2– 96.2	10	7.8	3.8– 13.8	0.44
	Yes	3	75.0	19.4– 99.4	1	25.0	0.6– 80.6	
Ever IDU	No	526	98.0	96.4– 99.0	11	2.0	1.0– 3.6	<0.01
	Yes	11	40.7	22.4– 61.2	16	59.3	38.8– 77.6	
Shared injecting tools	No	4	80.0	28.4– 99.5	1	20.0	0.5– 71.6	0.03
	Yes	4	26.7	7.8– 55.1	11	73.3	44.9– 92.2	
Shared razor blade	No	241	96.0	92.8– 98.1	10	4.0	1.9– 7.2	0.25
	Yes	127	93.4	87.8– 96.9	9	6.6	3.1– 12.2	

HCV: hepatitis C virus; IDU - Injection drug use; STI: sexually transmitted infection; CI – confidence interval; n = total number of individuals responding to the questions representing the selected variables

Results from the univariable for factors associated with HCV infection indicate that age, incarceration status, and sharing tattoo practices tools were associated with increased odds of reporting HCV infection (Table 15). These factors were not significant at the multivariable level.

Table 15: Risk factors for HCV infection in correctional facilities; Situational analysis of factors associated with HIV and viral hepatitis infection in two South African correctional facilities

		Univariable models		Multivariable models	
		Unadjusted OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Age	≥35 years	1		1	
	22-34 years	2.8 (1.3– 6.4)	0.01	2.2 (0.7– 7.2)	0.16
Incarceration status	Sentenced	1		1	
	Awaiting trial	0.3 (0.1– 0.9)	0.02	0.9 (0.2– 3.8)	0.83
Shared tattoo tools	No	1			
	Yes	3.1 (1.3– 7.2)	0.01	-	

OR: Odds Ratio; CI: Confidence Interval

7 QUALITATIVE SUB-STUDY FINDINGS

Qualitative methodology was used to explore the socio-behavioral factors and risk behaviours that drive infections in South African correctional facilities. We conducted 26 in-depth interviews with people who were incarcerated (n=20), peer educators (n=2), correctional officers (n=4) and three focus group discussions with a total of 25 healthcare workers in Kgosi Mampuru II (n=16) and Polokwane (n=9) correctional facilities providing services to people who were incarcerated. For this report, eight transcripts from people who were incarcerated (4 male and 4 female) and two from correctional officers were coded. For diversity, we selected an equal number of inmate interviews across age and location.

7.1 Conceptual framework

The framework described in Figure 4 guided the analysis and interpretation of structural and individual determinants that drive infections within the correctional facilities. The correctional centre structure provides health services to people who are incarcerated. However, the correctional centre system structure seems to mediate some of the high-risk behaviours that people who are incarcerated engage in that increase vulnerability to infections within this setting.

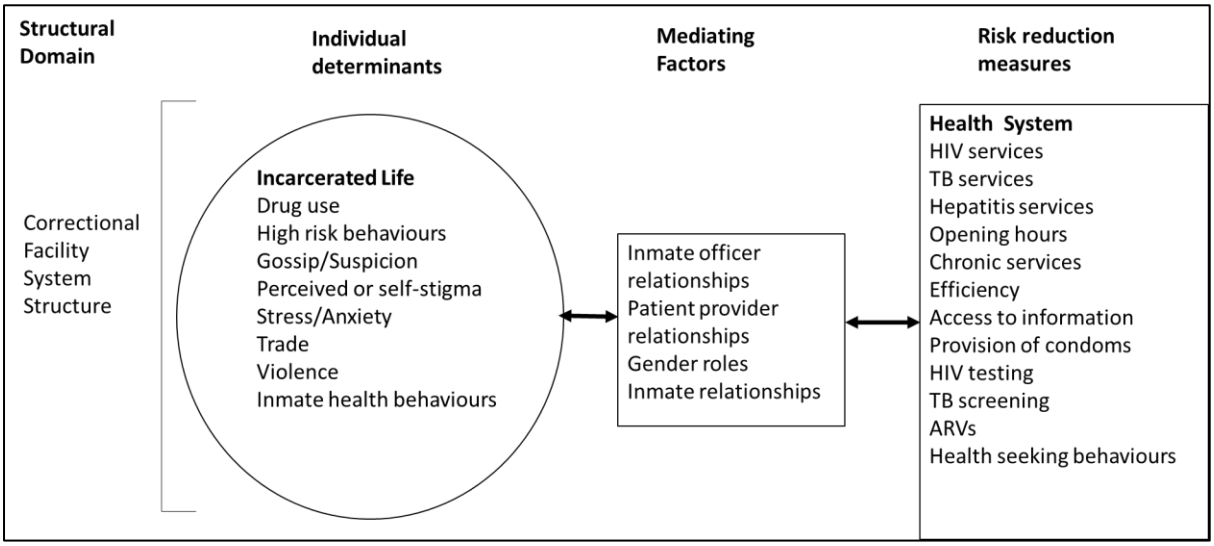

Figure 4: Framework describing the factors that influences HIV infections among people who are incarcerated

7.1.1 Structural Domain

Qualitative findings revealed that people who were incarcerated and correctional officers felt that a lack of privacy and over-crowding contributed to the health risks. To gain some space or privacy, some people who were incarcerated were required to do favors for other people who were incarcerated who oversee the cells.

> *"I think the issue of overcrowding. Some they will be forced to sleep on the floor, and you don't want to sleep on the floor it means you have to do something for the cleaners in the cell (people who are incarcerated who oversee the cell)." Correctional officer.*

Inmates also reported concerns with water, sanitation, and hygiene. Lack of proper disposal of sanitary towels or proper cleaning of toilets during menstruation was mostly reported among female people who were incarcerated. When some femals people who were incarcerated menstruate, they do not properly dispose of their sanitary pads or do not clean any blood left in the toilets. Over-crowding and queuing to use the toilets both contributed to unsanitary conditions that could increase the risk of exposure of people who are incarcerated to blood borne pathogens when using the toilet or showering. Women who were incarcerated were concerned that HIV infections would occur when encountering improperly disposed menstrual hygiene products or blood during showers.

> *"Especially some of the women still see menstruation sometimes when you go to the toilet, and you find there is pads especially now because we have water issues you can find blood on the floor and it's really bad, so the chances are still there of getting HIV." Female inmate.*

Males who were incarcerated also reported that masturbation and sexual intercourse with other men took place in the showers that placed them at risk for infections.

7.1.2 Individual Determinants

Drug use, high-risk behaviours and bloody physical violence were the dominant drivers of infections within the correctional centre from the qualitative interviews.

- **Drug use:** Drugs are smuggled into the centre by fellow people who are incarcerated who attended a court hearing where people who are incarcerated share or buy from each other. Some families also smuggle in drugs when they visit people who are incarcerated and is alleged that some smuggling is facilitated by correctional officers.

  "People who are using substances they have their own way of accessing the drugs to make things happen for them. Most of the time you will find that the people who know where they can access certain things are the officials (security officials) who allow it to get to the prison, although not all of them." Male inmate.

- Inmates have access to dagga, *nyaope* (drug made from ARVs) and practice "bluetooth" (aka "flashblood," referring to a syringe full of blood drawn back immediately after initial injection that is passed to a companion to inject).

  "Other thing is sharing of needles others using nyaope (drug) with same needle or razor blade cutting themselves sharing with others but number 1 it's nyaope. Then two if I inject myself with it the next person because they don't have access to it, he will Bluetooth it. We take that injection that we used to inject me to exchange it because it's in my system put that needle in and they will inject themselves with the nyaope injection." Male who is incarcerated.

- **High-risk behaviours:** Risky sexual behaviours, sharing of razors or cosmetics, exposure to blood, poor hygiene, or violent behaviours such as stabbing were reported in the study.

  "Okay, one of the things is because we are crowded, and we are sharing our things together where outside we are not sharing with other people. For instance, I can make an example maybe you are taking a shower and you are having cosmetics with you, while in the shower you cannot notice what is going on outside the shower with your cosmetics and you find that someone does not have roll on and she just takes your roll on (deodorant) quickly and uses it, and you have a reaction because someone used your roll on. Let's say I was shaving in the shower and obviously when using a razor blade, you going to cut yourself somewhere somehow and the person who was using the roll on outside the shower and I am going to use it directly so is one of the things whereby you may get infected somehow. Somebody uses your roll on or something (went) wrong in the shower." Female who is incarcerated.

- **Sexual abuse:** Sexual assault in correctional facilities may be due to the perception of people who are incarcerated that they are deprived of freedom and consequently, their masculinity resulting in dominating behaviors often manifested in sexual assault and victimization (26). Although some same sex relationships are consensual, many people who are incarcerated and correctional officers reported that people who are incarcerated are forced into sexual relationships in exchange for protection, food, or material items. Due to power dynamics, people who are incarcerated are forced not to use condoms but still engage in sexual activity. To become part of the group and receive essential supplies, an inmate needs to have sexual relations with other people who are incarcerated and "become a wife first"**.**

  "Immediately you join gangsterism you must first be a wife. Then after a wife, sometimes you find out from people the guy doesn't care about you. You have been serving 20 years and he has been serving life sentence in prison and then you could already be serving 10 years or even 5 years. If I join and then you must be first a wife and sleep with you. If you are HIV all those people there must be a chain on you and then after that you can be a gangster, and then that is why you find the

number of people who are infected with HIV is high. People came in prison negative but now within 3 months 2, 3, 4 weeks people came to the hospital its status is already changed. When you ask him how it changed, he will say that he is now a gangster. So now to survive of these things, so other people think that to survive maybe the gangsterism or somebody who is infected will offer powder, roll on every month for sexual favors. After infecting you with the HIV virus, he is no more interested in you. He just wants to give you that virus, after that he is out of you." Male who is incarcerated

- Findings also revealed vengeful acts toward other people who were incarcerated especially among people living with HIV within the correctional centre.

> *"Other unprotected sex because it happens in here it can be man to man…: We are provided with the condoms but now in gangsterism it's like this: if I am infected, you are my brother, it means the requirement said we must be the same, so I cannot be infected, but you are not infected. You must be infected because the requirement said one injury to one its injury to all." Male who is incarcerated*

- **Violence**: is common in the correctional centre. Exposure to blood due to these violent acts place people who are incarcerated at risk for infections. Although people who are incarcerated attend anger management workshops, conflict often arises due to sharing of medication and other personal items. It seems that people who are incarcerated retaliate in anger toward correctional officers when they do not get their requests.

> *"I can say every week is typical because we are always meeting different people who are incarcerated, some are aggressive, full of anger, and you must control them according to our policies. Sometimes they cut themselves with the razor, some have been violent towards women, and they always use other people who are incarcerated as women. They can use one knife to stab… And they use the same knife to hurt maybe three people it can lead to infection. Some use knives they have smuggled from court or through security officials." Correctional officer*

- **Stress or anxiety:** There are several reasons for stress and/or anxiety experienced by people who are incarcerated such as: (i) Sharing small spaces with many other people who are incarcerated; (ii) being ashamed of taking medication; (iii) Prison living conditions are stressful; (iv) Missing their family and concerned about family's well-being; (v) Not receiving visits from family members at centre; (vi) Not getting their medication on time; and (viii) Lack of support and feeling of hopelessness.

7.1.3 Mediating Factors

The study identified gender roles and several different relationships within the correctional setting as mediating factor between individual risk factors and HIV, HBV, and HCV infections.

- **Gender roles:** Although some men who are incarcerated accept same-sex sexual relationships, others are homophobic. Moreover, some men reported forced sexual relationships. These relationship dynamics (with or without consent) make people who are incarcerated more vulnerable to HIV or STIs. Even though people who are incarcerated receive condoms and are educated about safe sex practices, some people who are incarcerated refuse to use condoms.
- **Inmate relationships**: Some people who are incarcerated tend to take care of each other and play a supportive role. Although some people who are incarcerated take physical care of those who are ill, there is limited protective equipment such as gloves that ultimately place people who are incarcerated at risk of infections. In addition, some people who are incarcerated stigmatize those who are taking ARVs, therefore those who are taking ARVs tend to isolate themselves.

> *"They don't want people to know that they got HIV. They take their medication without people seeing. I mean, some of them take at different times. It is not while they take their medication. Everyone's got a different time, morning, or evening whatever the case maybe. But they don't want people to see that they are taking their medication. They shy away, you know they are getting embarrassed." Female who is incarcerated.*

- **Inmate officer relationships:** Inmates work towards avoiding conflict with officials. Officials show special favor to some people who are incarcerated**.**

- **Patient provider relationships**: Some people who are incarcerated have positive relationships with the nurses and value information given by the non-government organization (NGOs). While others describe disrespect and lack of care as common practice. Although people who are incarcerated receive health services, it seems that the services do not always meet their expectations as expressed by a female inmate**.**

> *"I'm going to mention something that was a shock to all of us. When a lady in cell 11 a few months ago passed away. She was complaining with stomach pain and all that. At first, she wasn't taken seriously until the last minute when the woman could hardly walk, only then did they jump and do something about it, and not long after that she passed away in the hospital. I mean it was uncalled for, if they had jump immediately when she complained that woman would still be alive today." Female who is incarcerated.*

7.1.4 Risk reduction measures

The health system within the correctional facilities provides people who are incarcerated with essential services, treatment, and prevention measures for all medical needs. There is regulated access and monitoring of people who are incarcerated on chronic medication (HIV, STI and TB treatment; high blood pressure, and diabetes). Hepatitis management occurs when an inmate has abnormal readings from the liver function tests. Despite delays in some instances, medication was available most of the time and people who are incarcerated received health education. Although nurses and NGOs educated people who were incarcerated about health issues, they lacked knowledge on hepatitis.

8 DISCUSSION

The estimated HIV prevalence in our study was high and similar to other published findings on HIV prevalence in South African correctional facilities (3, 15). Like findings from community-based studies, the estimated HIV prevalence was higher among women compared with men. Most women had received an HIV diagnosis prior to incarceration, pointing to the need for strengthening linkage to care to ensure minimal disruption of ART upon incarceration. Additionally, the multivariate model showed that incarcerated people who are incarcerated are highly likely to be HIV positive. Our findings also highlight those in urban correctional centres may be disproportionately affected with a high HIV burden compared to facilities in rural settings with lower HIV prevalence in the general population. The known risk factors for HIV infection such as being female, using injection drugs and self-reporting of a STI in this setting are like the general population. A constant supply of condoms and lubricants could be made readily available in correctional centers, and PrEP provided to those who test negative.

We observed a high proportion of participants living with HIV who had been diagnosed in a correctional centre. Of those on ART, 80% had a suppressed viral load (<1,000 c/mL). Notably, 21% of those testing positive reported not having a prior HIV diagnosis despite widespread availability and encouragement to test in the correctional facilities. These findings demonstrate general success with HIV care in these facilities as well as an opportunity to further increase HIV testing and diagnosis, and ART adherence to improve viral load suppression. Among those with HIV, 11% were co-infected with HBV and 6% with chronic HCV. The HIV care continuum was comparable to the high rates of viral load suppression by people who are incarcerated in a prospective study in South Africa and Zambia (23) and retrospective reports (24, 25). Elsewhere in SSA, limited data exist on HIV clinical outcomes, a cross-sectional study from Malawi documented 95% self-reported viral suppression among a sample of people who were incarcerated on ART for >6 months (7). Presence of an onsite cited HIV clinic and tracking of people likely to fall out of care was cited which is not observed in the facilities in South Africa (7). Although the DCS has made significant strides towards increasing access to ART with >90% of people aware of their status being linked to ART, there is an opportunity to increase awareness to people who are incarcerated on the importance of knowing their HIV status as only about 60% of people who are incarcerated in the rural centre were aware of their HIV status. Albeit a small sample size, our study findings point to the potential to increase strengthening HIV testing services, particularly in the rural setting. Further, it is necessary to ensure retention of people who are incarcerated on ART within the context of high movement of people who are incarcerated within the correctional centers. Of importance is to note that males who were incarcerated mostly underwent HIV testing in correctional facilities. This implies the demand to scale up regular testing in these settings and ensure verified linkages upon release to sensitized health facilities. Newer interventions such as assisted self-screening and index testing may be accomplished with new admissions to locate sexual or injecting partners in the community. This strategy may assist in finding more males in the community given the general sub-optimal health seeking behavior of males.

We estimated a lower prevalence of HBV infection in the correctional facilities than in the general population (9, 25). This prevalence was lower than some prior studies from South Africa among PLHIV (8) (28-30). Most (72%) of those identified with HCV infection, were co-infected with HIV and sharing of piercing tools and injection for drug use was associated with infection, suggesting adult transmission from shared risk factors (32). Our findings showed that people who were incarcerated with a history of injection drug use were more likely to have HBV infection which is consistent with studies in similar or general settings (9, 10, 33). The sharing needles/equipment used to prepare/inject drugs has been cited as a possible transmission route for HBV infection(31) .

The HCV infection prevalence in our study is higher than reported for the general population in South Africa (13). Studies in South Africa showed varying estimates for HCV infection prevalence for key populations ranging from 0.1% in HIV-infected patients (30), 3.4% in men and 5.6% in MSM (33) to 27% in MSM injecting drugs (13) and 55% in non-MSM injecting drugs (31).The reported prevalence of 4.4% is within the range of other reported studies. Among people with HIV, a recent study reported 12% HCV-HIV co-infection among MSM who inject drugs in three South African cities (31), a slightly higher proportion than we observed (11%). Our finding of an association with younger age (22-34 years), injection drug use, and other potential blood borne transmission is consistent with previous studies in Europe (29). It differs from the trend to higher prevalence in older age groups noted elsewhere (34). The higher prevalence in younger individuals in our study may reflect a new epidemic of injection drug use in South Africa that is starting with younger individuals.

Notably, HCV infection prevalence was higher among people who were incarcerated in the urban, compared with the rural, correctional centre. This may be explained by the readily accessible or availability of drugs in urban over rural settings. Most people who were incarcerated with hepatitis C had a history of a STIs and of injecting drug use. The link between HBV and HCV infection and injection drug use also underscores the opportunity for treating substance use disorders within this setting. This recommendation includes the provision of harm reduction services among people who are incarcerated including long-term medication assisted therapy (MAT) and needle/syringe programs. We observed important risk factors for HBV and HCV infection. Specifically, activities resulting in blood exposure; injection drug use and sharing of piercing or grooming tools were related to HCV infection while blood-borne risk and younger age was associated with chronic HCV infection. Since the risk factors for HIV infection are like those for HBV and HCV, the management of HIV infection should be incorporated in HBV and HCV infection programs as they have similar transmission routes namely, injection drug use and unprotected sex. Our quantitative and qualitative findings reveal low levels of awareness and knowledge of HBV and HCV infections among the people who are incarcerated. This is attributable to the lack of routine programs for HBV and HCV infection.

Qualitative findings revealed presence of physical and sexual violence among people who were incarcerated. Recognizing the fact that sex occurs in prisons and given the risk of disease transmission that it carries, providing condoms and lubricants has been widely recommended (15). Condoms and lubricants are widely provided in South African correctional settings but findings from this study have found sub-optimal use. Condom access represents no threat to security or operations and does not lead to an increase in sexual activity, and is accepted by most people who are incarcerated and correctional officers once introduced (15). However, education and information about the purpose of the condoms, as well as initiatives to counter the stigma that people engaging in same-sex activity face is warranted.

8.1 Strengths and Limitations

To the best of our knowledge, this was the first published study to describe HBV and chronic HCV infection in correctional facilities in South Africa. The main strength of this study was a cross sectional survey that included interviews and laboratory specimen collection. The ability to collect samples for laboratory testing of HIV, HBV and HCV was an important new step in data collection in correctional facilities. The laboratory test results rather than self-report status provided confidence in the estimates for these infections in the correctional facilities. Secondly, the mixed-methods design where the qualitative findings were used to enhance the quantitative findings and provided insights on the risk factors for HIV, HBV, and HCV infection as well as barriers to uptake and delivery of prevention strategies.

There were several limitations, and our findings need to be interpreted with caution. We failed to obtain institutional approval to conduct lab based STI testing and may have underestimated the prevalence of STIs in this setting as many STIs are asymptomatic. We were also unable to conduct HIV recency testing which would have provided further understanding on acquisition of HIV infection among people who are incarcerated. The study was only conducted in two correctional facilities out of the 262 in South Africa. The findings can therefore not be generalized but they provide insight into diverse incarcerated settings including rural versus urban facilities, and populations: adult awaiting trial and sentenced individuals, men, and women, and in settings with high and low HIV burden. While we had the strength of laboratory-based HCV and HBV testing, we did not receive results on all submitted specimens due to challenges with specimen transport and laboratory error. However, the results of POC HBV and HCV were deemed reliable for program considerations.

9 CONCLUSIONS AND OPPORTUNITIES FOR CONSIDERATION

Correctional facilities represent important venues for addressing disease for individual health and prevention of transmission (32, 33, 34). The HIV care findings demonstrate the potential for successful disease management programs. The link between HBV, HCV infection and injection drug use we observed underscores the importance of managing and treating substance use disorders within this setting through harm reduction programs. Ideally, these programs would include medication-assisted treatment and needle/syringe exchange programs . Correctional facilities provide an opportunity to extend care for other conditions, such as HBV infection, chronic HCV infection, and substance use disorders, to a population often coming from and returning to marginalized communities.

This study highlights the presence of blood borne pathogens and an association between HBV and chronic HCV infection and injection drug use and other potential blood exposure prior to and during incarceration. This is an important finding that helps to define infection risks in South Africa and point to the potential value in comprehensive harm reduction programs, including reducing physical and sexual violence in these settings.

The study provides opportunities to consider the following.

1. **Status neutral HIV service delivery:** Through status-neutral approaches to HIV service delivery, HIV programmes in correctional facilities may support achievement of optimal health outcomes for people who are incarcerated, irrespective of their HIV status. In instances where an inmate receives a negative HIV test result, the healthcare provider can engage them in HIV prevention discussions and offer impactful preventive measures such as PrEP, PEP, condoms, and lubricants. The prevention pathway underscores the importance of continuously reassessing the inmate's needs and tailoring prevention and support strategies accordingly. Furthermore, active participation in preventive services ensures expedited access to HIV care in the event of a subsequent positive HIV test result. Additionally, provision of condoms and harm reduction services constitutes an integral component of this prevention pathway, particularly for individuals who may not be prepared or eligible for PrEP.

2. **Strengthening HIV testing services and retention on ART:** Our findings suggest optimizing HIV care continuum outcomes for this population by strengthening HIV case finding activities and exploring innovative ways to track and retain patients on ART both within the correctional system and upon release. There is a demand for more interventions among women who are incarcerated where HIV prevalence was higher, but HIV risky behavior was low. Interventions such as assisted self-testing and index testing included as part of the HIV prevention efforts in correctional facilities are required. Existing interventions such as treatment as prevention require support to continue to avoid gaps in delivery and uptake. Peer-led interventions for tracking of defaulted patients are necessary to sustain viral load suppression. In addition, surveillance of ART resistance in these settings is necessary. Perhaps, improvement of existing protocols specific to these settings is required to increase viral suppression among people who are incarcerated.

3. **Maintain the existing routine HIV surveillance:** Improving the existing routine HIV surveillance is important to identify and address gaps that may impede the monitoring the HIV burden in the correctional facilities.

4. **Strengthening PrEP awareness and uptake in correctional facilities**: Our findings highlight a gap in PrEP awareness and urge correctional facilities to increase PrEP awareness in prevention programming in HIV negative and eligible people who are incarcerated.

5. **Advocating for additional research to explore the high HIV prevalence among women in correctional settings:** Our interpretation of the high HIV prevalence among women is limited by the small sample size. Our findings suggest that women enter the correctional centre already living with HIV and underwent HIV testing in correctional facilities. However further interrogation of these results is required to assess the extent of unmet prevention needs, if any. The use of HIV recency tests to confirm recent infection is encouraged during screening at intake to understand transmission.

6. **Advancing for larger prevalence studies and routine surveillance systems for HBV infection:** Estimates from this study may provide guidance in establishing a systematic national approach to care and management in corrections. Strict and timeous guidelines on transportation of blood samples to the laboratory for testing are required to prevent unusable samples due to hemolysis. It necessary to set up surveillance systems to monitor levels of HBV disease burden, identify HBV/HIV coinfections and efforts to increase awareness among people who are incarcerated in the DCS clinics. The surveillance system must be a platform for increased screening, surveillance, education/prevention, and treatment interventions.

7. **Advancing for larger prevalence studies and routine surveillance systems for HCV infection:** Estimates from this study may provide guidance in establishing a systematic national approach to care and management in corrections. Strict and timeous guidelines on transportation of blood samples to the laboratory for testing are required to prevent unusable samples due to hemolysis Setting up surveillance systems to monitor levels of HCV disease burden, identify HCV/HIV coinfections and efforts to increase awareness among people who are incarcerated is warranted. The surveillance system must be a platform for increased screening, surveillance, education/prevention, and treatment interventions.

8. **Strengthening substance use prevention and treatment programs in correctional facilities:** Intravenous drug use is associated with HBV and HCV infection in correctional environments and the general community (30). The link between HCV infection and injection drug use underscores the sub-optimal treatment of substance use disorders within this setting. This includes medication-assisted treatment (MAT) and needle/syringe exchange programs for the prevention of transmission of blood-borne infections (38). This finding can be used to inform policy change in DCS on prevention of HIV, HBV, and HCV infection in these settings.

9. **Piloting HCV and HBV medical management protocols in correctional settings and following release:** Management of HBV and HCV infection is complex in a correctional setting as there is high turnover through intra-centre transfers and releases. We support the expansion of the existing targeted corrections-community care linkages that would support HBV and HCV infection screening in correctional facilities, offering HBV vaccinations to people who are incarcerated and, when appropriate, be followed by immediate and direct referral to community providers qualified health centers prior to release for those who are found to be positive.

10. **Addressing violence among people who are incarcerated:** The findings from this study highlight violence among people who are incarcerated and this provides an opportunity for the correctional facilities to examine policies and procedures that may increase the risk of sexual violence and HIV transmission in addition to individual-level inmate behavior.

10 References

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11 Appendices

Appendix 1: Summary of ethical approvals over study period

HREC/IRB	Version	Date approved	Reason for amendment
Wits Human Research Ethics Committee	V2.0	16 Jan 2019	No amendment
	V4.0	01 Jul 2019	Change of investigators Additional testing procedures for STIs, HBV and HCV
	V5.0	17 Sep 2019	Removal of STI testing procedures Reduction of sample size and number of participating facilities
DCS Research Ethics Committee	V3.0	15 Mar 2019	No amendment
	V4.0	Not approved	Inclusion of STI was seen as another study and was not supported by DCS REC
CDC Institutional Review Board	V3.0	30 August 2019	No amendment

Appendix 2: Summary of overall partner engagement

Date	Partner	Purpose of meeting	Team
31 Jul 2018	CDC and Aurum	To introduce the idea for a research study to be conducted in the correctional facilities	Ms Helen Savva (CDC) Roger Phili, Joyce Lethoba, Lucy Chimoyi, Geoffrey Setswe (Aurum), Tony Diesel (SA Partners)
February 2019	CDC and Aurum	To discuss progress of development of protocol and ethics submission processes	Ms Helen Savva, Cobus Olivier (CDC) Roger Phili, Joyce Lethoba, Lucy Chimoyi, Geoffrey Setswe (Aurum) and Tony Diesel (SA Partners)
March 2019	DCS CDC, and Aurum	To introduce HASH study to DCS commissioners at a partner meeting	Ms Helen Savva, Cobus Olivier (CDC) Roger Phili, Joyce Lethoba, Lucy Chimoyi, Geoffrey Setswe (Aurum) and DCS representatives
28 May 2019	DCS and Aurum	To introduce the HASH study to Kgosi Mampuru II DCS healthcare staff	Manager, Heads of Centers, Health Manager, Aurum staff
18 June 2019	DCS and Aurum	To introduce the HASH study to Polokwane DCS staff	Operations Manager, Head of Center, Health Manager, Regional coordinator, Aurum staff
28 May 2019	DCS and Aurum	To inform the Area commissioner in Kgosi Mampuru about the HASH study	Manager, Heads of Centers, Health Manager, Aurum staff and Area commissioner,

Appendix 3: Brief CVs for key investigators

BIOGRAPHICAL SKETCH

NAME: MABUTO, TONDERAI

eRA COMMONS USERNAME (credential, e.g., agency login): TONDERAI.MABUTO

POSITION TITLE: Senior Scientist

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE	END DATE	FIELD OF STUDY
University of Zimbabwe, Harare	BS	08/2005	Medical Laboratory Sciences
University of the Witwatersrand, Johannesburg	MPH	06/2010	Epidemiology and Biostatistics
University of the Witwatersrand, Johannesburg	PHD	02/2020	Public Health

A. Personal Statement

I am a trained public health researcher and implementation research scientist, who is passionate about pragmatic research that improves delivery of healthcare services in routine public sector programmes, by placing patients at the centre of healthcare service design and delivery.

1. Rabinovich R, Owczarzak J, Mabuto T, Ntombela N, Woznica D, Hoffmann CJ. Social support needs of HIV-positive individuals reentering community settings from correctional facilities in Johannesburg, South Africa. AIDS Care. 2021 Oct 20; PubMed PMID: 34668791.
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3. Mabuto T, Woznica DM, Lekubu G, Seatlholo N, Mshweshwe-Pakela N, Charalambous S, Hoffmann CJ. Observational study of continuity of HIV care following release from correctional facilities in South Africa. BMC Public Health. 2020 Mar 12;20(1):324. PubMed Central PMCID: PMC7068979.

B. Positions, Scientific Appointments and Honors

Positions and Scientific Appointments

2021 -	Senior Scientist, The Aurum Institute, Johannesburg
2016 - 2021	Director HIV Implementation Research, The Aurum Institute, Johannesburg
2010 - 2016	Senior Programme Manager, HIV Implementation Research, The Aurum Institute, Johannesburg
2007 - 2009	Senior Medical Scientist, Global Fund TB Project, Mbabane
2005 - 2007	Medical Scientist, Ministry of Health, Murewa

Honors

2021	Wits-UNC Fellow in Implementation Science Research, University of North Carolina
2018	Clayton Dedonder Fellowship on Mentorship and Leadership Capacity of HIV/AIDS and TB Researchers in South Africa (Yale Global Health Leadership Initiative), Yale University
2014	Fellowship Recipient: Applied Economic Evaluation. Boston University and Health Economics and Epidemiology Research Office., Boston University
2011	Operational and Epidemiological Research Fellowships in PEPFAR programmes, Forgarty International (SATBAT)
2010	Golden Key Honour Society, University of the Witwatersrand
2010	William Harding Le Riche Medal for outstanding epidemiological research, University of the Witwatersrand

C. Contribution to Science

1. Publications : Complete List of Published Work in My Bibliography: https://www.ncbi.nlm.nih.gov/myncbi/tonderai.mabuto.1/bibliography/public/

BIOGRAPHICAL SKETCH

NAME: Chimoyi, Lucy

POSITION TITLE: Scientist – The Aurum Institute
Honorary appointment- School of Public Health, University of the Witwatersrand, Johannesburg

A. Education/training

INSTITUTION AND LOCATION	DEGREE	END DATE	FIELD OF STUDY
Kenyatta University, Nairobi	B.Sc.	10/2002	Biochemistry
University of the Witwatersrand, Johannesburg	M.Sc.	11/2009	Environmental Science
University of the Witwatersrand, Johannesburg	M.Sc.	10/2013	Epidemiology & Biostatistics
University of the Witwatersrand, Johannesburg	Ph.D.	12/2022	Public Health

B. Employment History, Other memberships, and fellowships

Positions and Employment

2021 – Date Scientist, The Aurum Institute, South Africa
2018-2021 Senior Research Manager, The Aurum Institute, South Africa
2016-2018 Research Manager, The Aurum Institute, South Africa
2013-2016 Researcher (Data management and analysis support), Wits RHI, South Africa
2013-2013 Consultant Researcher, PHRU, South Africa
2009-2011 GIS Consultant, SiVEST PTY Limited, South Africa
2003-2006 Quality Assurance/Regulatory Affairs Executive, Infusion Kenya Limited, Kenya

Other Experiences and Professional Memberships

2013 - 2016 Joint Appointment, Faculty of Clinical Medicine, University of the Witwatersrand
2020-Date Member, people who are incarcerated technical working group, South African National AIDS Council
2019-Date Member, Building networks behind prison walls, UNODC
2022-Date Member, Foundation for Professional Development Research Ethics Committee, FPD, Pretoria
2022-Date Academic Editor for the PLOS Global Public Health Journal
2022-Date Member, International AIDS Society, Africa
2023-Date Founding Member, South African Epidemiology Society

Honors

2009 Golden Key Award, University of the Witwatersrand
2015 Executive Director Award in recognition of outstanding service, Wits RHI
2024 International Visiting Fellow, Center for Interdisciplinary Research on AIDS, Yale University, USA

C. Ongoing and recently completed projects

INV-006096, BMGF Chihota, Violet (PI) 03/2021-date
Optimizing the delivery of tuberculosis preventive treatment among people living with HIV (Opt4TPT): A multi-country program evaluation
Role: Co-investigator and Project Director
This mixed-methods study is generating evidence to optimize the delivery of TPT amongst people living with HIV and attending routine primary health clinics in Ethiopia, South Africa, and Zimbabwe.

215-19, Anglo American Setswe, Geoffrey (PI) 05/05/18-12/31/21
Investigating social risk factors for HIV in mineworkers in three mines in South Africa
Role: Co-Investigator
This mixed-methods cross-sectional study was conducted in three mines and surrounding peri-mining areas to understand the social and structural factors driving HIV infections among mineworkers in South Africa.

BMZ 2010 65954 & BMZ 2012 65 198, GFA Consulting Group, GMBH Setswe, Geoffrey (PI) 03/05/20-09/30/20
Knowledge, attitudes, and practices of young people on HIV testing, prevention, and non-communicable diseases
Role: Co-PI

This mixed methods endline cross-sectional study was conducted in five high HIV/TB burden districts in South Africa to assess impact of a community based HCT intervention among young people (18-24 years) on HIV and TB knowledge, prevention, and treatment practices.

GH001175, CDC-SA Mabuto, Tonderai (PI) 01/30/19-03/31/20

Investigating the socio-behavioural and structural factors driving HIV, STIs and Hepatitis B&C infections in correctional facilities: The HASH study 2019.

Role: Co-PI and project manager

This mixed-methods cross-sectional study was aimed at investigating the burden of HIV, STIs and Hepatitis in two correctional facilities in South Africa.

GGH001981, CDC- SA Carmona, Sergio (PI) 05/01/19-01/31/20

Field evaluation of a plasma separation card for viral load monitoring in Ekurhuleni and Bojanala Districts in South Africa.

Role: Co-Investigator and project manager

This cross-sectional study was a field evaluation of a novel viral load monitoring tool (Plasma Separation Card) conducted among stable ART patients from 2 years old attending routine care in 10 healthcare facilities in South Africa.

MMM/EHPSA/AURUM/05150013, DFID MRC Charalambous, Salome (PI) 07/22/16-03/30/18

To investigate feasibility of implementing universal test and treat (UTT) in correctional facilities in Southern Africa

Role: Co-Investigator and project manager

This mixed methods prospective cohort study investigated the feasibility of implementing universal test and treat in correctional facilities in Johannesburg and Western Cape, South Africa and Lusaka, Zambia.

D. Contribution to Science

TB and HIV prevention research in correctional facilities

I have been involved in research investigating improvement of HIV programmes in correctional facilities in sub-Saharan Africa. I have implemented and managed several studies focusing on linkage and retention in care of HIV patients in key populations (correctional facilities)

a. Hoffmann CJ, Herce ME, **Chimoyi L**, Smith HJ, Tlali M, Olivier CJ, Topp SM, Muyoyeta M, Reid SE, Hausler H, Charalambous S, Fielding K. Reaching for 90:90:90 in Correctional Facilities in South Africa and Zambia: Virtual Cross-Section of Coverage of HIV Testing and Antiretroviral Therapy During Universal Test and Treat Implementation. J Acquir Immune Defic Syndr. 2024 Aug 15;96(5):465-471.
b. **Chimoyi L,** Charalambous S. The case for pre-exposure prophylaxis in prison settings. Lancet HIV. 2023 Jan;10(1): e3-e4. doi: 10.1016/S2352-3018(22)00258-2. Epub 2022 Oct 13. PMID: 36243017.
c. **Chimoyi, L**., Smith, H., Hausler, H., Fielding, K., Hoffmann, C.J., Herce, M.E. and Charalambous, S., 2021. Delivery of TB preventive therapy to incarcerated people living with HIV in southern African correctional facilities. *Public Health Action*, *11*(4), pp.171-173.
d. Topp SM, Chetty-Makkan CM, Smith HJ, **Chimoyi L**, Hoffmann CJ, Fielding K, Reid SE, Olivier AJ, Hausler H, Herce ME, Charalambous S. "It's Not Like Taking Chocolates": Factors Influencing the Feasibility and Sustainability of Universal Test and Treat in Correctional Health Systems in Zambia and South Africa. Glob Health Sci Pract. 2019 Jun;7(2):189-202.
e. **Chimoyi, L**., Smith, H., Hausler, H., Fielding, K., Hoffmann, C.J., Herce, M.E. and Charalambous, S., 2021. Delivery of TB preventive therapy to incarcerated people living with HIV in southern African correctional facilities. *Public Health Action*, *11*(4), pp.171-173.
f. Mukora R, Smith HJ, Herce ME, **Chimoyi L**, Hausler H, Fielding KL, Charalambous S, Hoffmann CJ. Costs of implementing universal test and treat in three correctional facilities in South Africa and Zambia. PLoS One. 2022 Aug 25;17(8): e0272595.
g. **Chimoyi, L**., Hoffmann, C.J., Hausler, H., Ndini, P., Rabothata, I., Daniels-Felix, D., Olivier, A.J., Fielding, K., Charalambous, S. and Chetty-Makkan, C.M., 2021. HIV-related stigma and uptake of antiretroviral treatment among incarcerated individuals living with HIV/AIDS in South African correctional settings: A mixed methods analysis. *PloS one*, *16*(7), p.e0254975
h. Michael E Herce, Christopher J Hoffmann, Katherine Fielding, Stephanie M Topp, Harry Hausler, **Lucy Chimoyi**, Helene J Smith, Candice M Chetty-Makkan, Rachel Mukora, Mpho Tlali, Abraham J Olivier, Monde Muyoyeta, Stewart E Reid, Salome Charalambous **(2020).** Universal test-and-treat in Zambian and South African correctional facilities: a multisite prospective cohort study. The Lancet HIV.

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