



A prospective observational study of heroin users in Johannesburg, South Africa: Assessing psychiatric comorbidities and treatment outcomes[☆]

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ABSTRACT

Background: Despite the rise in heroin use in sub-Saharan Africa opioid agonist maintenance treatment (OAMT) is still not state-funded in South Africa and many other African countries. In South Africa there has been little data published on the profile of heroin users and the outcomes of treatment for those who attend public treatment services.

Methods: 300 heroin users from two state-funded rehabilitation centres in Johannesburg were studied at entry into rehabilitation and 3-months after treatment. Treatment consisted of inpatient detoxification and inpatient psychosocial rehabilitation. Structured interviews measured changes in drug use, psychopathology and criminality post rehabilitation.

Results: Most (65.7%) smoked heroin in combination with cannabis while 29.7% were injecting users. Almost half the sample (49.3%) had at least one mental illness. Of the 252 (84%) participants seen at 3-month follow-up, 6.3% were abstinent of all substances (excluding tobacco), 65.5% had continued heroin use (CHU) and the balance used other substances. At follow-up there were significant decreases in heroin use ($p < 0.0001$) and criminality ($p < 0.0001$). There were however significant increases in alcohol use ($p < 0.0001$), crystalmetamphetamine use ($p = 0.032$) and the prevalence of current episode of major depression ($p < 0.0001$). Just 11.9% received formal psychosocial treatment after leaving rehabilitation. None were on OAMT and only three participants were on psychotropic medication. None were tested for Hepatitis C during the study period and the majority (53%) did not know their HIV status.

Conclusion: There are significant gaps in current treatment services for heroin users in South Africa. Retention in treatment and assessment and management of psychiatric and non-psychiatric comorbidities is low. Services need to be more integrated and should also include the provision of OAMT.

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1. Introduction

Global statistics on alcohol, tobacco and illicit drug use suggested that in 2015 alcohol and tobacco use cost the globe more than a quarter of a billion disability adjusted life years and illicit drug use cost further tens of millions [1]. Opioid dependence is associated with harms such as fatal overdose, HIV, Hepatitis C, psychiatric comorbidities and suicide. Evidently, compared to other

substances of abuse opioids continue to cause the most harm [2]. The mortality rate related to substance use is highest in low and middle income countries with large populations [1].

Sub-Saharan Africa is one of the top three regions most severely affected by opioid-related premature mortality [3]. Factors such as changing routes of drug trafficking, weak border control and reduction in price of opioids has contributed to increasing trends of opioid use in Africa [4,5]. In South Africa heroin is the most commonly abused opioid [6]. Nyaope is the street name for a heroin-based drug that is currently ravaging the township communities of South Africa. A conservative figure shows that from 1994 treatment demand for heroin use has grown from <1% to between 5 and 20% in 2010 [7]. Despite this South Africa and many other countries in the region are still slow to implement adequate treat-

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ment services for those affected by opioid dependence and related mental disorders [8].

International standards for the management of substance use disorders reinforces the need for multidisciplinary treatment that manages psychiatric and non-psychiatric comorbidities and provides long term continuity of care [37]. For opioid dependence World Health Organisation (WHO) guidelines classifies the provision opioid agonist maintenance treatment (OAMT) as a basic or minimal requirement [9]. Research shows that opioid agonist maintenance therapy saves lives and improves treatment outcomes by increasing retention in treatment, decreasing the risk of HIV transmission and decreasing criminality [10,38–41]. Many regard access to OAMT as a human right however in South Africa OAMTs are not state-funded nationally and therefore not easily available for people with heroin dependence [8,10]. Furthermore the assessment and management of cooccurring conditions such as HIV, Hepatitis and mental illness often fall outside the domain of many rehabilitation facilities. Hence treatment providers at rehabilitation centres are required to refer patients to local clinics or hospitals for assessment and treatment of suspected cooccurring conditions. However, this model of service delivery may result in uncoordinated and fragmented care [11].

1.1. Objectives

To describe the clinical characteristics and drug consumption patterns of heroin users seeking inpatient treatment and determine the outcomes of drug use, psychopathology and criminality 3 months post treatment.

2. Methodology

2.1. Study design and setting

This was a prospective observational study of heroin users who were assessed during rehabilitation and then followed-up 3-months after treatment. The study was conducted from two state-funded inpatient drug and alcohol rehabilitation centres in the Gauteng province of South Africa. These centres provided one week of detoxification followed by six to eight weeks of psychosocial rehabilitation. The usual detoxification regimen included Methadone (tapered down over one week), analgesia and vitamin supplements. Psychosocial rehabilitation was provided by social workers and addiction counsellors and consisted primarily of group therapy using the 12-step format. Some patients were also offered individual sessions with their allocated counsellor. Upon completion of rehabilitation patients were encouraged to see their local social workers for follow-up and attend community-based self-help groups such as Narcotics Anonymous.

The study was approved by the University of Witwatersrand Human Research Ethics Committee (M1704100).

2.2. Study procedures

A convenience sample of the new admissions were screened for inclusion and exclusion criteria. In order to be enrolled in the study participants were expected to

- have been using heroin in the months prior to admission
- be older than 18
- be willing to provide locator information for follow-up to occur
- be able to provide informed consent

All baseline and follow-up interviews were conducted in English face-to-face by the principal investigator (PI) who is a psychiatrist.

Participants did not read and answer any of the questionnaires on their own. The PI was not a member of the treating team at the rehabilitation centres. Participants were not compensated for their participation but were given 7 USD for transportation if they returned to the research site for their follow-up interview. In some cases, the PI did home and/or hangout-spot follow-up visits. Participants that were seen at home or hangout-spots were not compensated. No telephonic interviews were done. Baseline and follow-up interviews were conducted between July 2017 and February 2019.

At baseline a detailed socio-demographic and past substance use questionnaire created specifically for the study, was administered. The Opioid Treatment Index (OTI) [12] an open access tool that included sections on past month drug use, past month injecting and sexual practices, social adjustment, past month criminal history and general health, was also administered. Drug use estimates in the OTI are based on a ratio of the average use episodes of a substance. Drug use is expressed as a Q score which describes the frequency of drug use. A Q score of 1.00–1.99 indicates daily use and a score of greater than 2.00 indicates usage of more than once a day.

The Mini International Neuropsychiatric Interview (MINI) [13] version 7.0.2 for DSM-5 was administered to screen and diagnose the following psychiatric conditions: Major Depressive Episode (MDE past and current), Suicidality (current, life-time and future risk), Manic and Hypomanic Episodes, Social Anxiety Disorder (SAD), Obsessive Compulsive Disorder (OCD), Posttraumatic Stress Disorder (PTSD), Psychotic Disorders, Generalised Anxiety Disorder (GAD) and Antisocial Personality Disorder (ASPD). The Stages of Change Readiness and Treatment Eagerness Scale (SOCRATES) 19-item Version 8 was administered at baseline. At 3-month, a Follow-Up interview specifically designed for this study, was administered together with the OTI and MINI. All psychiatric conditions, excluding ASPD were screened for at follow-up. At baseline when psychiatric comorbidities were diagnosed, written referral letters were given to the clinical teams at the rehabilitation centres. At follow-up referral letters addressed to local psychiatric clinics were given to study participants in order for them to access these facilities.

A Multi Drug Urine Test (MDUT) was administered on participants who were able to provide a sample. Urine collection was unsupervised; however, the research assistant was trained to identify any unusual changes in colour, temperature or smell. The MDUT's tested for the presence of Opioids, Cocaine, Amphetamines, Methamphetamine, Cannabis and Benzodiazepines.

2.3. Sample size estimations

Based on worst-case (for sample size) estimates of 50%, 5% precision and the 95% confidence level, a sample size of 385 would be required [14]. A sample size of 300 for this project corresponds to a precision of 5.7% (rather than 5.0%), which was considered adequate.

2.4. Statistical analysis

Descriptive analysis of the data was carried out as follows: Categorical variables were summarised by frequency and percentage tabulation. Continuous variables were summarised by the median and interquartile range. Comparison of follow-up status (those seen and those lost to follow-up) with regard to categorical variables was carried out by the χ^2 test. Fisher's exact test was used for 2×2 tables or where the requirements for the χ^2 test could not be met. Comparison of repeated measures at baseline and follow-up was carried out by the paired-samples *t*-test for OTI scores, and McNemar's test for paired categorical data for number of drugs

used, OTI, criminal behaviours, and MINI diagnoses. Factors associated with continued heroin use versus heroin abstinence, were investigated by univariate binomial regression. Relative Risks (RRs) with their 95% confidence intervals were calculated. Factors significant univariately were considered together in a multiple binomial regression. Data analysis was carried out using SAS version 9.4 for Windows. The 5% significance level was used [15].

3. Results

3.1. Sample characteristics at baseline

Demographic data and drug use characteristics are reported in Table 1. Over the recruitment period 317 patients were screened. Eight did not fit inclusion and exclusion criteria and five refused participation. A total of 304 participants signed written informed consent and were enrolled in the study, however four were withdrawn during baseline (BL) interviews as they were assessed as actively suicidal. The final sample thus consisted of 300 participants, 256 (85.3%) males and 44 (14.7%) females.

The median age at enrolment was 27y (IQR 23–30y; range 18–47y). The majority of participants were Black/African South African (93.0%) and unmarried (99.7%). Fifty-five percent had completed 10 years of schooling (grade 8) and 16.0% had completed their school career (grade 12). Ninety-five percent had no formal employment in the preceding six months, however 49% (n = 147) gained some form of income from informal work such as gardening, recycling and washing cars. With regards to accommodation in the preceding six months, 62.7% lived in formal housing, 19.3% lived in informal housing such as a shack and 17.7% were homeless and living on the streets.

The median age at first substance use was 14y (IQR 13–16y; range 7–25y). The most common substances used once a week or more before onset of heroin use were cigarettes (95.7%), cannabis (94.7%), alcohol (77.3%), methaqualone (46.7%) and inhalants such as glue and benzene (25.3%). The median age at first heroin use was 19y (IQR 17–22y; range 12–42y) and the median duration of heroin use was 7y (IQR 4–9y; range 0–23y).

Two hundred participants (66.7%) predominantly smoked heroin in a joint with cannabis, 29.7% were injecting users and 3.7% used heroin by chasing. None of the sample reported engaging in 'Bluetooth' which is a term used in South Africa to describe heroin users exchanging blood. Typically, a user injects heroin, then withdraws his/her blood and another user injects that blood into their veins.

3.2. Readiness for change and treatment history at baseline

The median scores on The Stages of Change Readiness and Treatment Eagerness (SOCRATES) scale fell within the high category for ambivalence and taking steps the medium category scores for recognition (Table 1). Thirty-nine percent of participants had previously attended an inpatient rehabilitation facility and 37.7% had engaged in some form of outpatient treatment. With regards to the index treatment (rehabilitation received at study baseline), 56.2% completed the entire programme and the median number of days in rehabilitation was 43 (IQR 13–44 days; range 1–57 days).

3.3. Sample characteristics at follow-up

Of the 300 enrolled participants, 252 (84%) were seen at 3-month follow-up, four were incarcerated and two had passed away (according to family reports one was murdered and the other had a severe meningitis). Among those lost to follow-up (LTFU) (n = 41), the chief reason (41%) was that the family reported that the participant was on the streets and could not be found.

Table 1
Baseline sample characteristics.

Variable	Baseline sample (n=300)	%
Median age (years) (IQR)	27 (23–30)	
Gender		
Male	256	83.3
Female	44	14.7
Years of schooling		
Up to 9 years	43	14.3
10 to 11 years	167	55.7
Completed high-school	48	16
Employment Status		
Formal employment	15	5
Informal self-employment	147	49
Unemployed	135	45
Accommodation		
Formal housing	188	62.7
Informal housing/shack	58	19.3
Homeless/on the streets	53	17.7
Past substance use history		
Median age of first substance use (years) (IQR)	14 (13–16)	
Substances used regularly prior to heroin		
Cigarettes	287	95.7
Cannabis	284	94.7
Alcohol	232	77.3
Methaqualone	140	46.7
Inhalants	76	25.3
SOCRATES SCORES (median) (IQR)		
Ambivalence	18.5 (17–20)	
Recognition	34 (32–35)	
Taking steps	39 (37–40)	
Treatment prior to index rehabilitation		
Any treatment prior to rehab	187 (62.3%)	62.3
Inpatient treatment	116 (38.7%)	38.7
Outpatient treatment	113 (37.7%)	37.7
Median no. days completed in index rehabilitation (IQR)	43 (13–44)	
Predominant method of heroin use		
Smoking with cannabis	200	66.7
Injecting	89	29.7
Chasing	11	3.7
Median no. of substances used (excl tobacco) (IQR)	3(2–3)	
Past month substance use		
Heroin use episodes: median Q score (IQR)	7 (4.5–10)	
Cannabis use episodes: median Q score (IQR)	6 (2.5–10)	
Alcohol: number of users in past month	49	16.3
Crack-cocaine: number of users in past month	78	26.0
Crystalmetamphetamine: number of users in past month	58	19.3
Methaqualone: number of users in past month	55	18.3
Tobacco: number of users in past month	297	99.0
Past month crime		
Engaged in any crime	251	83.7
Property Crime	219	73.0
Violent Crime	91	30.3
Dealing	71	23.7
Fraud	52	17.3
Comorbid psychiatric diagnosis		
MDE (current)	17	5.7
MDE (past episode)	98	32.8
Suicidality	206	68.7
Generalised Anxiety Disorder	78	26.0
Post Traumatic Stress Disorder	53	17.7
Antisocial Personality Disorder	157	52.3

The median time to follow-up was 3.2 months (IQR 3.0–3.6 m; range 2.4–7.5 m). A comparison of those interviewed at 3-months and those LTFU indicated that there were no significant differences in median age at enrolment, gender, number of children, employment status, years of schooling, previous rehabilitation, methods of heroin use, HIV status, age at first substance use, duration of

Table 2
Treatment history between discharge from index rehabilitation to 3-month follow-up.

Type of treatment received	3-month follow-up group (n=252)	%
Residential rehabilitation		
Any received	4	1.6
Currently in RR	3	1.2
Outpatient individual sessions		
Any received	17	6.7
Currently attending sessions	7	2.8
Narcotics Anonymous		
Any sessions attended	92	36.5
Currently attending NA	24	9.5
New admissions to inpatient detoxification		
Any new admissions	9	3.6
Completed the programme/ in treatment	7	2.8
Opioid Substitution therapy		
	0	0.0

substance use, and age at first heroin use. There was a significant, weak, association between follow-up status and accommodation at enrolment ($p=0.042$; Cramer's $V=0.15$): Those followed up successfully had a higher proportion of participants living in formal housing at enrolment, compared to those LTFU.

3.4. Treatment history at follow-up

Of the 252 participants followed up, 30 participants (11.9%) received some form of treatment after rehabilitation (Table 2). Of the 30 participants, four were referred to a half-way house, 17 had individual sessions with a social worker and nine were readmitted to inpatient detoxification (three were in inpatient detoxification at 3-month, four had completed another treatment episode and two did not complete). Thirty-seven percent had attended a Narcotics Anonymous (NA) meeting after rehabilitation; however, of those, 48% attended fewer than five sessions (Table 2). None were prescribed OAMT as a maintenance treatment. Three participants received psychotropic medication and one of these two had seen a psychiatrist.

3.5. Substance use at baseline

The majority (71.3%) of the participants were using two or three substances (excluding tobacco) and 21.3% were using four or more substances. The most common substances used, other than heroin and cannabis, were crack-cocaine, crystal methamphetamine and methaqualone. Almost all participants (99.3%, $n=298$) used heroin more than once a day. The median Q score for heroin was 7 (IQR 4–9 uses; range 0–23) (Table 1). This score can be interpreted as a median of seven heroin use episodes a day.

3.6. Heroin use at follow-up

Continued heroin use (CHU) was determined by two factors: self-reported heroin use and/or positive opioids on the multidrug urine test (MDUT). Thus, participants that stated they had not used heroin since leaving rehabilitation but tested positive for opioids were classified as CHU. MDUT's were done on 76.6% of participants.

Of those seen at follow-up, 164 (65.5%) CHU after rehabilitation. Most (53.7%) used heroin within two to four weeks of leaving rehabilitation. There was a significant decrease in the median Q score for heroin from seven to one ($p<0.0001$), however 70.7% of those consuming heroin were still doing so daily.

3.7. Other substance use at follow-up

At 3-month follow-up 65.5% CHU, 28.6% began or continued using other substances and 6.3% were totally abstinent from all substances (excluding tobacco). There was a significant increase in alcohol use at follow-up. At baseline 17.1% (of the 252 participants seen at follow-up) used alcohol in the past month, however at follow-up the number increased significantly to 55.2% ($p<0.0001$) (Table 3). Alcohol use once a day or more, increased significantly from 2.5% at enrolment to 25.8% at follow-up ($p<0.0001$). There was also a significant increase in baseline crystal methamphetamine used in the past month (16.7%) to 23.4% follow-up ($p=0.032$) (Table 2).

There was a significant decrease in cannabis users from 87.3% past month users to 73.0% past month users at follow-up ($p<0.0001$) (Table 3). There was a significant decrease in crack cocaine use from 24.3% past month users at baseline to 17.1% at follow-up ($p=0.016$) (Table 3). There was a significant decrease in the median tobacco use Q score from baseline to follow-up (11 to 8.5, $p<0.0001$), however there was no significant change in the percentage of users versus non-users (98.8% versus 97.5%, $p=0.26$). There was also no significant change in the number of substances used from baseline to follow-up ($p=0.41$).

3.8. Crime at baseline and follow-up

Eighty-three percent ($n=251$) had engaged in crime in the month prior to rehabilitation (Table 1). Most participants (73.0%) engaged in acquisitive crime and 30.3% engaged in violent crime. There was a significant change in whether or not participants had committed crime: 63.2% of those who had committed crime at BL, had not done so at follow-up ($p<0.0001$) (Table 3). The prevalence of all forms of crime decreased significantly from baseline to follow-up.

3.9. Comorbidities at baseline and follow-up

Overall, excluding ASPD, 49.3% of participants had at least one mental illness (MI). The most common psychiatric diagnoses were past MDE (34.0%), generalised anxiety disorder (26.0%) and PTSD (17.7%) (Table 1). The majority (73.3%) had experienced or witnessed some form of trauma. A total of 206 (68.7%) experienced suicidal ideations and 101 (33.7%) had one or more lifetime suicide attempts. Fifty-two percent were diagnosed with ASPD (Table 1).

At follow-up, 40.9% of the participants had at least one mental illness. Current MDE (29.8%) and GAD (38.3%) were the most prevalent. There was a significant increase in current MDE from 6.0% at baseline to 29.2% at follow-up ($p<0.0001$). There was no significant change in the overall prevalence of mental illness from baseline to follow-up ($p=0.081$). At follow-up three participants were on psychotropic medication. Of these two were on medication prior to study enrolment.

At enrolment 53.0% had not had an HIV test in the preceding six months, 26.7% had never done a HIV test in their lifetime and 18.5% of those with known HIV status ($n=233$) stated that they were HIV positive. Between BL and follow-up 45 participants (17.9%) had an HIV test. Of these five (11.1%) tested positive for HIV. None were tested for or reported a diagnosis or Hepatitis C between BL and follow-up.

3.10. Factors associated with continued heroin use (CHU)

3.10.1. Patient related factors

There was no significant association between CHU and age at enrolment, gender, number of children, employment status, and years of schooling.

Table 3
Comparison between baseline and 3-month follow-up.

	Baseline (for those followed-up; n=252) (%)	3-month follow-up (n=252) (%)	p-value
Heroin use in past month	100.0	66.5	<0.0001
Cannabis use in past month	87.3	73.0	<0.0001
Alcohol use in past month	17.1	55.2	<0.0001
Crystallineamphetamine use in past month	16.7	23.4	0.032
Crack-cocaine use in past month	24.3	17.1	0.016
Any crime in preceding month	82.9	32.9	<0.0001
MDE* (current episode)	6.0	29.2	<0.0001

* Major Depressive Episode.

Table 4
Factors associated with continued heroin use (CHU).

Variable	CHU (n=165) n (%)	Non-CHU (n=87) n (%)	Relative Risk for CHU (95% CL)
Median age of first substance use (IQR)	14.2 (12-16)	15 (13-16)	0.956 (0.918-0.996 per year)
HIV positive status	27 (21.3)	6 (9.0)	1.32 (1.08-1.61)
Median no. of days in index rehabilitation (IQR)	32 (11-44)	44 (43-44)	0.988 (0.983-0.993 per day)
Out-patient aftercare treatment	58(35.2)	50 (57.5)	0.72 (0.59-0.88)
Perceived no emotional family support	20 (12.1)	4(4.6)	1.89 (1.43-2.56)

Participants who were HIV positive (RR 1.32; 95% CL 1.08–1.61), those who were of a younger age at first substance use (RR 0.956 for every year of age; 95% CL 0.918-0.996) and those who had little or no family support (RR 1.79; 95% CL 1.41–2.28 and RR 1.89; 95% CL 1.43–2.52 respectively) had a significantly increased risk for CHU (Table 4).

There was no significant association between abstinence status and any of the OTI Drug Q-scores, or the number of substances used. There was also no significant association between abstinence status and suicidality, MDE, GAD, SAD, or any MI (overall).

3.10.2. Treatment related factors

The risk for CHU decreased with increasing number of days in rehabilitation (i.e. fewer days retained in rehabilitation, the more likely participants were to be CHU) (RR 0.988 for every day in rehabilitation; 95% CL 0.983-0.993). Participants who attended an aftercare programme had a lower risk for CHU (RR 0.72; 95% CL 0.59-0.88) (Table 4).

4. Discussion

This is the first prospective cohort study of heroin users entering treatment services in South Africa. Here we provide an in-depth characterisation of heroin users attending state-funded inpatient detoxification and psychosocial rehabilitation services in Johannesburg. The study further offers valuable insights about the outcomes of treatment for patients attending these services. Follow-up interviews were done 3 months following enrolment for 84% of the sample.

The main findings include

- 1 low female enrolment
- 2 substance use beginning at age 14 with heroin use reported at 19 years of age
- 3 cigarettes, cannabis and alcohol consumption precede heroin use
- 4 heroin is mostly smoked together with cannabis
- 5 heroin use decreased significantly at 3-month follow-up, but alcohol consumption increased markedly
- 6 HIV status is mainly unknown
- 7 low rate of any treatment received after leaving inpatient rehabilitation services
- 8 the high rate of criminality decreased significantly over 3 months

9 the high prevalence of psychiatric co-morbidities at baseline remained evident at 3-month follow-up

10 factors related to continued heroin use include a longer history of heroin consumption, a shorter treatment duration, lack of family support, and being HIV positive

Unlike high income countries there are few low and middle income (LMIC) countries that have prospectively assessed heroin treatment outcomes and none can be found for countries in Africa. Favourable response to OAMT was found in a World Health Organisation (WHO) collaborative study which included five low-and-middle income countries [16]. In our study's cohort where participants did not receive OAMT the median heroin use episodes decreased significantly over the 3-month study period however of those using at follow-up, 70.7% used heroin daily. The detoxification sample of heroin users in the Australian Treatment Outcome Study (ATOS) decreased heroin use from a median Q score of two at enrolment to 0.1 (heroin use once a week or less) at 3-month [17]. In a sample that received inpatient detoxification in the UK, of those who used opiates 32% used daily at six months [18] and in the US approximately 26% used heroin daily at 6-month follow-up [19]. Thus, in most other studies a minority of those who continue to use heroin, use daily whereas in South Africa a large majority used heroin on a daily basis.

Additionally, in contrast to most prospective longitudinal studies of heroin users [19–24] rates of other substances, namely alcohol and crystallineamphetamine increased significantly after treatment ($p < 0.0001$ and $p = 0.032$ respectively) and the number of drug classes used remained the same ($p = 0.41$). While some studies report no change in alcohol over time [25,26] even fewer report increases in other substance use. A London based study by Best et al. (2000) found an increase in crack cocaine and cannabis at 6-month follow-up of heroin users in a methadone programme [27]. While this trend was reported as a conundrum in the UK, in this study the marked increase in alcohol and crystallineamphetamine can be explained by the absence of OAMT and the low numbers of participants retained in treatment at follow-up.

The lifetime prevalence of comorbid psychiatric disorders in heroin users is high and reported between 40–85% [28–31]. In keeping with previous studies, rates of psychiatric comorbidities were high and the most common comorbid diagnoses were depression (34.0%), anxiety disorders (26.0%) and antisocial personality disorder (52.3%). However, in this study at BL and follow-up almost none were on treatment for psychiatric comorbidities and rates of current episode of major depression increased from BL to follow-

up. The ATOS report that on average 31.2% of their cohort were on antidepressant treatment and rates current episode of depression improved over time [32]. Even the previously mentioned WHO study which included LMIC reported improvements in mental illness over time [16].

Only 30 participants (11.9%) received any form of treatment after rehabilitation. At six months post opioid detoxification in Geneva 58% were retained in treatment [23], 76% in Australia [17] and 52% had received some form of treatment in the US [19]. Furthermore, with regards to assessment of comorbidities between BL and follow-up interview only 45 (of the 252 followed-up) participants had an HIV test. Most tested for HIV at their local clinics after they had left rehabilitation as HIV testing was not readily offered at the inpatient treatment facilities. None tested for or reported a diagnosis of Hepatitis C at follow-up. In our cohort testing for comorbidities is important as 11.1% of those who tested for HIV after BL interviews tested positive.

The gaps in the system are likely due to logistic and policy related issues regarding the management of substance abuse in South Africa. The major mandate for the prevention and treatment of substance abuse lies with the Department of Social Development. Most state-funded rehabilitation facilities fall outside the domain of the Department of Health and rehabilitation services have limited access to doctors, psychiatrists, laboratory facilities and pharmacies. Most often patients have to be referred to hospitals and clinics run by the Department of Health for assessment and management of psychiatric and non-psychiatric comorbidities. Moreover, most state-funded inpatient rehabilitation facilities do not offer comprehensive aftercare services- presumably due to budget and staff constraints. Therefore, when a patient completes an inpatient programme they are expected to locate outpatient recovery services in their communities and no longer have contact with their previous treating facility. These policy related factors may be contributing to missed opportunities to screen and treat comorbidities and low retention in treatment. A positive finding however was the significant decrease in criminality after treatment. This is in keeping with other studies [33,34].

With regards to the univariate analysis, some treatment related and patient related factors significantly increased risk of CHU. In line with current literature, a longer heroin using career (RR 0.956; 95% CL 0.918-0.996) and shorter retention in treatment, increased risk of CHU (RR 0.988; 95% CL 0.983-0.993 [35]. Those with little or no perceived emotional support from family also had increased risk for CHU (RR 1.89; 95% CL 1.43-2.52). Support from family and friends is said to contribute to better outcomes [36] however, it can be argued that those who remain abstinent tend to receive more positive regard from family than those who relapse shortly after rehabilitation. Importantly those who were HIV positive demonstrated an increased risk for CHU (RR 1.32; 95% CL 1.08-1.61). Physiologically this may be explained by the fact that 53% of those that were HIV positive were injecting users and possibly had greater severity of addiction leading to poorer outcomes. One may also postulate that those who were HIV positive had a greater degree of psychological distress and thus had increased risk for CHU. However, rates of depression and anxiety were not significantly higher in this group.

5. Limitations

This study did not include a control group of heroin users not entering treatment. A control group may allow for a more precise understanding of the impact of treatment in a South African setting. Continued heroin use and abstinence were determined by both self-report and a MDUT. Drug urine tests were done on 76.6% of the group followed-up. Therefore, the CHU and heroin abstinent group

should be interpreted with caution. Additionally, the test used was a six-panel test which did include a test for methaqualone which is fairly commonly used in this population. A final challenge may be with comparing outcomes of 'nyaope' users in Johannesburg with heroin users in other countries. Nyaope is known to contain multiple constituents and is often smoked in combination with cannabis which is not the method of use reported in other studies.

6. Conclusions

Treatment services for heroin users are currently fragmented and uncoordinated. Addiction counselling is offered at inpatient rehabilitation services however assessment and management of comorbidities and long-term treatment are offered at different clinics. It appears that communication and coordination between these departments is poor and therefore there is inadequate assessment and management of psychiatric and non-psychiatric comorbidities and low retention in treatment. Although there were significant decreases in heroin use and criminality post treatment, it must be noted that there were significant increases in alcohol and crystal-metamphetamine use. Furthermore, the majority of those who continued to consume heroin, used the drug daily. These findings indicate that current state-funded treatment facilities for heroin users should adopt a more integrated and coordinated multidisciplinary approach which includes the provision of opioid agonist maintenance treatment.

Author contributions

Nirvana Morgan designed the study, collected the data, analysed and interpreted the results and wrote the manuscript.

Ugasvaree Subramaney (supervisor) and William Daniels (co-supervisor) contributed to the study design, data analysis and the subsequent drafts of the manuscript.

All authors approved the final manuscript.

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Declaration of Competing Interest

There are no conflicts of interest.

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