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# The Epidemiology Of Drug Use And Hiv-Related Risk Behaviors In Mwanza, Tanzania

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# **The Epidemiology of Drug Use and HIV-related Risk Behaviors in Mwanza, Tanzania**

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## ABSTRACT

Heroin trafficking and consumption has increased steadily over the past decade in Tanzania, but limited information regarding HIV and drug abuse exists for the northwestern city of Mwanza. Our study investigates the epidemiology of drug use, and HIV risk behaviors among drug users in Mwanza. Using a combination of targeted sampling and participant referral, we recruited 480 participants between June and August 2014. The sample was 92% male. Seventy-nine (16.4%) of participants reported injecting heroin, while 434 (90.4%) reported smoking heroin. Housing and cohabitation status were the only socioeconomic characteristics significantly associated with heroin injection. More than half of heroin injectors left syringes in common locations, and half reported sharing needles. Other risk behaviors such as lack of condom use during sex, and the use of illicit drugs during sex was widely reported as well. Among the study sample, there was poor awareness of health risks posed by needle sharing and drug abuse. Our results show that heroin abuse and HIV risk related behaviors are pressing problems that have largely been ignored in Mwanza. Harm reduction programs are greatly warranted in Mwanza.

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# INTRODUCTION

The dual epidemic of HIV and drug abuse is an emerging public health problem in Tanzania. It is well established that the injection of drugs is associated with HIV acquisition. Specifically, several studies conducted in Eastern Europe<sup>1</sup>, China<sup>2</sup>, South East Asia<sup>3</sup> and Russia<sup>4</sup> have demonstrated that injection drug use is a key factor in the spread of HIV infections, including Tanzania.<sup>5-7</sup> Some of the people who inject drugs (PWID) engage in HIV risk-related behaviors, such as sharing syringes and other injection equipment and having unprotected sex. These behaviors are potential routes of HIV infection transmission within the injection drug use community, which can then spill over into the general population<sup>8</sup>.

Data on heroin use in Tanzania and the associated HIV risk factors is largely focused on Dar es Salaam and Zanzibar. Rumored reports of heroin use along trucking routes from Dar es Salaam outwards to other towns north and south prompted an examination of heroin use in the far northwestern city of Mwanza. In this study, we detail the epidemiology of drug use, heroin injection and its associated HIV-related risk behaviors in Mwanza, the second largest city in the nation. To our knowledge, this is the first study of its kind to be conducted in Mwanza or elsewhere in Northwest Tanzania.

## Objectives

The main goals of this study are to:

- 1) Describe the socioeconomic characteristics and epidemiology of substance use in a sample of people who use drugs in Mwanza, comparing how PWID differ from non-PWID.
- 2) Highlight HIV-related knowledge and risk behaviors of the subgroup of PWID, in this sample, and determine if the risk behaviors are heterogeneous.

## Injection drug use as a risk factor for HIV

It has been shown repeatedly in studies, primarily outside of sub-Saharan Africa, that drug injection use is a significant risk factor for HIV. HIV risk behaviors include the frequency of needle use, number of partners with whom injection equipment has been shared, and frequency of needle and syringe sharing, as well as sharing non-injection equipment such as cookers, filters and water.<sup>9,10,11</sup> In the past decade, the increase in the number of heroin users has fueled a rise in HIV infections among PWID in Tanzania.<sup>12</sup>

In Tanzania, the prevalence of HIV among PWID is alarming, and can be explained by the risk behaviors practiced by PWID. For instance, PWID in Dar es Salaam reported injecting 3 times a day<sup>5,13</sup> with 41% reported sharing needles in the past 6 days<sup>14</sup>. This has resulted in a rise in HIV infections. While HIV prevalence in the country is estimated at 5.1%<sup>15</sup>, HIV among injectors is fourfold the national rate: 28% among male injectors and 62% among female injectors 28%.<sup>16</sup> The large difference between male and female HIV rates among PWID may be attributed to high risk sexual behaviors among female PWID who are frequently also sex workers. In Dar es Salaam, female heroin injectors are more likely to be living on the streets and have more sex partners.<sup>17</sup> The difference between non-PWID and PWID HIV infections will destabilize the HIV epidemic in Tanzania and is the impetus for the establishment of harm reduction services, such as methadone treatment, to reduce HIV transmissions in Dar es Salaam.

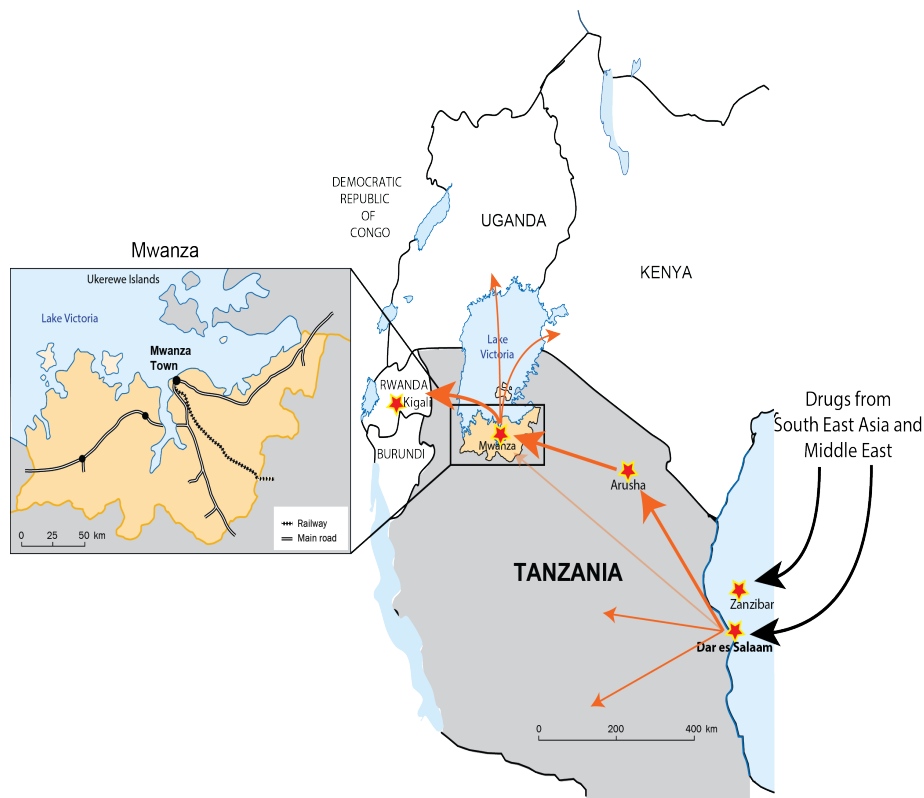
Further worsening the epidemic is a dangerous practice called “flashblood”, where a syringe of blood is drawn from a person who just injected heroin and passed on to another as a proxy for drug injection<sup>6,7</sup>. Dahoma et al.<sup>8</sup> highlight that flashblood sustains a drug habit and concurrently catalyzes a new subset of the HIV epidemic in Tanzania. The practice of flashblood underscores the complexity of drug abuse and the HIV epidemic in Tanzania. It is important that this practice is acknowledged so that the nuances of injection use can be addressed. Understanding the epidemiology of heroin injection and

HIV-related risk behaviors will allow policymakers to implement targeted methadone and needle exchange programs, along with HIV prevention and education programs.

## Heroin abuse has become a major problem in Tanzania

In recent years, East Africa has become an important transit hub point for heroin in the

international drug trade for traffickers from Afghanistan and Pakistan. However, East Africa itself has also become a consumer of heroin in the process.<sup>18</sup> The local market is estimated to consume at least 2.5 tons of pure heroin per year, worth \$160 million.<sup>19</sup> Given the prevalence of HIV and other blood-borne diseases in the region, attention must be paid to heroin abuse.



**Figure 1: Drug circulation within Tanzania and neighboring countries.**

Mwanza lies on the shores of Lake Victoria by Rwanda, Uganda and Kenya (Map modified from Grosskurth et al, 2000). Arrows indicated drug transportation routes.

**Figure 1** describes the flow of drug shipment into and within Tanzania. Heroin is shipped to Dar es Salaam from points in the Middle East and Southeast Asia. Heroin is then trafficked inland from Dar es Salaam along major trucking routes – the northern route is through Arusha towards Mwanza. According to policing reports supplied to the Tanzanian Drug Control Commission<sup>20</sup>, Mwanza is a strategic location for drug traffickers to relay their goods across Lake Victoria to Uganda and via trucking routes to Kigali, Rwanda.



Several studies have shown that drug use in sub-Saharan Africa may be more common than anticipated,<sup>21</sup> and that injection use is on the rise in Nigeria, South Africa and Kenya.<sup>22,23</sup> Just as HIV spread sexually along trading routes in East Africa, HIV is growing in areas where heroin is trafficked and people begin to inject drugs.<sup>24,25</sup>

There are no official figures on the number of PWID or illicit drug users in Tanzania. However, there are an estimated 15,000 PWID living in Dar es Salaam, most of whom inject heroin.<sup>26</sup> Based on the growing prevalence of HIV among heroin injectors in Dar es Salaam, the Tanzanian government and the US CDC requested Dr. Bruce in late 2009 to begin working towards starting methadone treatment in Dar es Salaam as primary and secondary HIV prevention for PWID. In 2011, the first methadone clinic opened at Muhimbili National Hospital in Dar es Salaam. This clinic was a cooperative with Yale University, the Ministry of Health and Social Welfare, CDC/PEPFAR, Pangaea Global AIDS Foundation and the Tanzanian Drug Control Commission. In 2012, the second clinic was established at Mwananyamala with further expansion plans at Temeke and Illala sites.<sup>12</sup>

## Methadone Maintenance Treatment and Needle Exchange Program Efficacy

Evidence has suggested that harm-reduction programs are more effective than drug control policies.<sup>27</sup> In the United States, methadone maintenance treatment (MMT) has been proven to be safe and effective as a treatment for drug addiction weaning drug users off opiates.<sup>28</sup> MMTs have also been shown to avoid HIV related risk behaviors.<sup>29,30</sup> Trials have shown that methadone can reduce the use of heroin among dependent people, and that methadone can be used to retain users in treatment programs.<sup>31</sup> Those who enroll in MMTs are also less likely to engage in HIV risk behaviors.<sup>32</sup>

The other alternative is the needle exchange programs (NEP), which provides clean syringes and needles to PWID. It has been shown that NEPs are not associated with severe negative consequences, which include increased illicit drug use and increased prevalence of other needle HIV risk related behaviors.<sup>33</sup> In fact, NEPs reduce risk of HIV transmission without necessarily increasing drug use, and increased enrollment in drug treatment.<sup>34,35</sup> Even in resource-poor countries, it has been shown that HIV increases by 5.9% in cities without NEPs, and decreases by 5.8% per year in cities with NEPs.<sup>36</sup> Taken together, these results suggest that MMTs and NEPs are effective in HIV risk behavior prevention and increased incidence of HIV infections.

## Mwanza as a Study Site

Although much is known about the epidemiology of HIV among PWIDs in Dar es Salaam, there is a lack of PWID specific data in Mwanza. The seminal “Mwanza and Rakai Trials” conducted from 1991-1994 detailed community based HIV intervention focused on treatment of STIs<sup>37,38</sup>. The trials did not detail HIV and HIV risk factors among PWIDs.

Until now, only a handful of studies have explored the relationship between drug use and HIV in Mwanza. The most recent published works in Mwanza studied the role of biological, behavioral and socio-demographic risk factors for HIV among young people in the Mwanza region<sup>39</sup>, the role of HIV serostatus disclosure in Sekou-Toure hospital in Mwanza<sup>40</sup> and factors associated with HIV status among

some drug users in Mwanza.<sup>41</sup> Although these studies provide the foundations for HIV studies conducted in Mwanza, there is no component in these studies that detail HIV-related risk behaviors and associated sociodemographic factors among PWID. To provide a targeted and effective intervention in Mwanza, determining HIV-related risk factors and its associated sociodemographic factors is an important first step. It is the long-term goal of this study to accelerate the implementation of formal, government-sponsored methadone and needle exchange programs to be set up in Mwanza.

# METHODS

## Field Work

From the June to August 2014, 480 subjects were recruited and interviewed about their drug abuse habits and associated risk behaviors. Drug users were recruited based on a combination of targeted sampling and participant referral<sup>42</sup>

A team of 3 people that comprised of a former drug user, an outreach worker and the primary investigator conducted recruitment and the interviews. The former drug user has been drug-free for 8 years, and has built up an extensive rapport with the community. The outreach worker had been working with the community for 4 years. The outreach workers had established trust with the community prior to the start of the data collection period. Their knowledge and established trust with the drug using community made data collection a relatively smooth process.

A sampling plan was developed using information gleaned from the interviewees who have extensive experience working with illicit drug users in Mwanza. The interviewees for this study were hired as both outreach workers and interviewers. This information was then used to target certain neighborhoods in the city that were known as ‘hotspots’ for drug users. Neighborhood selection was then confirmed by direct observation of drug use by the interviewers. In total, 12 study areas were selected and 50-60 people were interviewed per area. Study areas were determined according to ‘wards’ – local administrative districts – and then further divided according to street names where drug users were reported to congregate. We selected 7 wards, and out of these 7 wards, 12 streets. Data collection began at the street closest to the primary investigator’s office, and ended in the area furthest away.

Study subjects were informed of the study prior to commencing the interview. Verbal informed consent was obtained before conducting the interview. Interviews were conducted on-site, one participant at a time. Interviews were conducted in Swahili.

Eligible participants were those who self-reported to be above the age of 18, had injected drugs in the past 12 months, or used any other kind of drug in the past 12 months. Many of those approached on the streets typically were preparing to use illicit drugs. Screening measures for drug use included self-report and visual inspection for injection marks on the arms, feet or legs. Illicit drug users were typically found in groups in alleyways, in rented rooms, abandoned homes, or common congregation areas such as football fields. Some participants also showed us their injection equipment and drugs as proof that they were abusers. Participants who completed the interview were eligible to be given a small inexpensive meal, drink and/or snack after the interview. On average, each meal cost 958 TSH (USD\$0.50).

Data were collected in Swahili using a self-designed questionnaire based on instruments employed by the World Health Organization (AUDIT survey), Tanzanian AIDS Prevention Program (MAT Pilot Program Client Assessment form) as well as previous instruments based on alcohol abuse that have yielded promising results.<sup>43</sup> Responses that were unclear or inconsistent were verified among members of the data collection team. The primary investigator provided regular feedback to the interviewers daily as part of the data editing and cleaning process. Feedback was based on 3 key points: completeness, accuracy, and consistency between answers. Open-ended questions were also reviewed more closely to ensure that all responses were written legibly. After verification, written responses were then translated back into English.

The study was reviewed and approved by the institutional review boards for the protection of human subjects at Yale University, USA (HSC #1404013808) and at National Institute of Medical Research (NIMR) in Tanzania.

## Instrument

Socioeconomic characteristics were measured by age, gender, education, marital status, living arrangements, source of income and income levels.

Non-injection drug use was measured by asking participants if they had ever used marijuana, pharmaceutical drugs, heroin/cocaine, followed by use in the past 12 months, and then current use. Current use was defined as any use within the past week. Injection drug use was then measured by asking participants if they had ever injected, followed by current injection. Drug use was also measured by asking the participants the number of times drugs of any kind were used per day, followed by the number of days drugs were used. Participants were also asked about the reasons they began using drugs, and when they began using drugs.

Syringe-related risk was assessed by asking participants if they have ever shared syringes or needles, if someone else had taken their needle, if they have shared injection equipment with other users, and what materials were used to clean the needles and other injection equipment with. Two questions about flashback practices were also asked to assess the prevalence of flashback practice among the Mwanza drug user population.

Two open-ended questions that tested participants' knowledge of health risks of using drugs and sharing needles were asked. Open-ended questions were asked instead of offering participants multiple choices, so as to assess the participants' knowledge as accurately as possible.

Sexual risk was measured by asking if participants used any form of drugs and condoms during sex, and the number of partners that they engaged in sexual intercourse with over the past 30 days. The age of sexual debut was also determined.

Alcohol risk was measured by asking if participants had ever consumed alcohol, followed by frequency of alcohol consumption and frequency of binge drinking, defined as having more than 6 drinks on one occasion.

## Statistical Analyses and Data Management

Data was entered into an OpenClinica (Waltham, MA) database and analyzed with the statistical analysis software R (R Core Team, 2014). Data from all 480 participants were available for analysis. A key outcome of interest was heroin injection, defined as either yes or no. We fitted two logistic models to heroin injection use: socioeconomic characteristics, and HIV risk related behaviors.

Predictors measured at continuous integer levels were recoded into discrete categories that reflected the distribution of data. Predictors measured as open-ended questions were recoded into non-ordinal discrete categories. The reference category for each predictor was the one that had lowest perceived HIV risk. Each predictor was individually correlated with likelihood of injection use. Predictors with the highest level of correlation and significance ( $p < 0.2$ ) were included in the multivariate models. Akaike Information Criterion (AIC) and deviance tests were used to compare models to one that included all independent significant variables associated with injection use. The model with the lowest AIC value was used as the final reduced model. Incomplete data were omitted from the model.

Predictors were analyzed for independence, i.e. if there was any interaction between the terms. All predictors were found to be independent. Interaction terms were not included in the final model as none were found to be significant.

Results are presented in the form of odds ratios with 95% confidence intervals. Significance of odds ratios was assessed using 95% confidence intervals and chi-squared tests. We used chi-squared tests to assess differences in socioeconomic characteristics and risk behaviors between PWID and non-PWID.

# RESULTS

## Demographics

In our sample of 480 participants, we interviewed 442 males (92%) and 38 (8%) females. The overall mean age of our study sample was  $28.8 \pm 6.3$  years. The mean age among PWID was  $29.0 \pm 5.8$  years, while the mean age among those who had never injected drugs was  $28.3 \pm 6.4$  years. A majority of the cohort had either completed primary school (30.4%) or had dropped out in lower secondary school (Form 1-4) (35.6%). More than half of the cohort had never been married (61.0%), and a fifth (19.8%) were divorced or separated. More than a tenth of the study population (10.4%) were living on the streets or considered themselves homeless, where 170/480 (42.3%) rented rooms. A significant fraction (69.4%) of the sample reported having a job as a primary source of income where slightly less than a third (27.7%) reported stealing or pickpocketing as a primary source of income.

## Epidemiology of Drug Use and HIV Related Risk Behaviors

Among our study population, 65/480 (13.5%) reported currently injecting drugs, and 79/480 (16.5%) reported a history of injection use. A majority of those who had ever injected drugs remained injectors (82.3%). Almost everyone interviewed (99.4%) reported using drugs 7 days a week. Self-reported daily frequency of any kind of drug use ranged from once a day to a maximum of 25 times a day. The most commonly reported frequencies were: 3 times a day (20.8%), 5 times (20.0%), and 4 times (18.8%).

We found that many current injectors reported engaging in HIV-risk related injecting behaviors. For example, 44/65 (66.7%) reported sharing needles, 31/65 (47.7%) shared injection equipment and 41/65 (63.1%) left syringes in public locations. Only 58/65 (89.2%) of the current injectors reported cleaning injection equipment. Out of these, only 32.7% cleaned their equipment with bleach, while the remainder (43.1%) used potable water, a noneffective method of sterilization.<sup>44</sup>



We were next interested in exploring the relationship between socioeconomic status and type of drug use. To assess socioeconomic status, we used the following measures: age, gender, education level, marital status, living arrangement and income source. However, we found that these factors were not significantly associated with heroin injection (summarized in **Table 1A**).

A majority of PWID were in the 21-25 (31.1%) and 26-30 (28.4%) age groups. Similarly for non-PWID, a majority were in the 21-25 (29.3%) and 26-30 (30.4%) age groups. More females were PWID than not (12.7% vs. 7.0%,  $p>0.05$ ). Fewer males were PWID than non-PWID (87.3% vs. 93.0%,  $p>0.05$ ). More PWID had never gone to school compared to non-PWID (6.3% vs. 3.5%,  $p>0.05$ ). A greater proportion of PWID reported some form of higher secondary education (8.9% vs. 6.7%,  $p>0.05$ ) and post-secondary education compared to non-PWID (10.1% vs. 5.0%,  $p>0.05$ ). In terms of marital status, more PWID were separated or divorced compared to non-PWID (27.7% vs. 18.0%,  $p>0.05$ ). A smaller proportion of PWID were married with one spouse compared to non-PWID (4.6% vs. 16.2%). More PWID lived without a spouse/partner compared to non-PWID (88.6% vs. 81.9%). Those who were separated or divorced were approximately 6 times (OR: 5.92; 95%: 1.91-26.02) more likely to inject heroin compared to those who are married with one spouse.

Room rental was the most common living arrangement among both PWID (45.6% vs. 42.3%,  $p>0.05$ ). Living on the streets was slightly less prevalent among PWID than non-PWID (8.9% vs. 10.7%,  $p>0.05$ ). Income sources differed very little between PWID and non-PWID ( $p>0.05$ ). More than half of PWID and non-PWID have jobs as their main source of income (68.4% vs. 69.6%,  $p>0.05$ ). Those who had jobs mostly reported that they sold household items or were drivers.

**Table 1B** shows a profile of the self-reported drug use among the study population. Among the types of drugs injected, heroin was the most commonly used (16.4%). Other reported injected drugs comprised of methamphetamine, cocaine and pharmaceutical drugs that included Diclopa and Valium. The most common non-injected type of drug used was marijuana (95.0%) and heroin (90.4%). Heroin is commonly smoked with marijuana in joints called *kokteli* (translated to “cocktail”), as a large percentage

of users reported doing so (86.0%). Less commonly reported among the study population is the combination of marijuana, non-injection heroin and pharmaceutical drugs (12.5%).

In addition to injecting heroin, smoking heroin was most commonly reported (83.0%) as a concurrent behavior, followed by smoking marijuana (77.2%). Injectors often engaged in smoking marijuana and heroin (63.3%) in addition to injecting. Injectors also reported engaging in smoking heroin, marijuana and pharmaceutical drugs simultaneously (15.2%). These combinations of risky behaviors are not independent of each other.

## HIV-Related Risk Behaviors

We show in **Table 2** that PWIDs have used drugs for a longer period of time compared to non-PWIDs (8.73 years vs. 7.78 years,  $p>0.05$ ). The range of drug use among PWID extends from 0 – 20 years. Among non-PWID, the range extends from 0 – 33 years. People who are more likely to engage in heroin injection are those who have been using drugs for a period of 11-15 years (29.2% vs. 18.8%) and 16-20 years (12.5% vs. 8.6%) compared to those who have been using for 0-5 years.

Those who have sold items for drugs are more likely to engage in heroin injection than other routes of administration (88.6% vs. 66.3%,  $p<0.05$ ). Similarly, those who have traded sex for drugs are more likely to engage in heroin injection than not (36.9% vs. 14.0%,  $p>0.05$ ). Those who have been arrested by the law also were more likely to engage in heroin injection than not (97.5% vs. 83.4%,  $p<0.05$ ). Compared to non-PWID, PWID also typically reported having spouses/partners who are drug users (13.9% vs. 7.5%,  $p>0.05$ ). The reported use of any type of drugs during sex was comparable among PWID and non-PWID (89.8% vs. 83.3%,  $p>0.05$ ).

Peer pressure, defined as influence from members of his/her social circle, was one of the most commonly cited reasons for starting drug use among PWID and non-PWID (79.7% vs. 80.0%). More PWID cited family problems as the reason for starting drugs than non-PWID (5.1% vs. 2.5%,  $p>0.05$ ).

This further highlights the result in **Table 5A** where we found that housing status and co-habitation are significantly associated with heroin injection.

We next examined whether injection drug users had different sexual practices than the non-injection users. Risky sexual behaviors were found to be different between PWID and non-PWID. More non-PWID experienced sexual debut between the ages of 11-13 than PWID (43.1% vs. 40.3%,  $p>0.05$ ). More PWID than non-PWID reported having more than 5 sex partners in the past 30 days (12.7% vs. 7.9%,  $p>0.05$ ). Overall, there was no significant difference between the number of sex partners among PWID and non-PWID. The use of condoms all of the time was less common among PWID than non-PWID (6.3% vs. 13.0%,  $p>0.05$ ). More PWID did not use condoms at any time than non-PWID (26.6% vs. 22.8%,  $p>0.05$ ).

In our sample, heroin injection and alcohol were not closely associated. Overall, risky alcohol behaviors were not significantly different between PWID and non-PWID. More non-PWID reported drinking 4 or more times a week than PWID (43.4% vs 37.0%). Similarly with binge drinking, more non-PWID reported binge drinking on a daily basis than PWID (20.1% vs. 4.3%).

## HIV-related injection Risk Behaviors among Injectors

In **Table 3**, we highlight HIV-related injection risk behaviors among injectors. We found that many of those with a history of heroin injection are still current PWID (82.2%). Among current PWID, 44/65 (67.7%) have ever shared needles. Approximately half of PWID (47.7%) in our sample reported having shared injection equipment. A majority of the PWID (89.2%) reported cleaning their injection equipment and needles using soap (6.2%), alcohol (9.2%), bleach (29.2%), boiling water (4.6%), and cold water (38.5%).

The practice of flashback was known among the study population, but rarely practiced. There were 6 people in the study who had practiced flashback. The frequency of flashback use could not be

determined for all 6 users, as flashblood was only practiced when the users could not find heroin. The ages of the flashblood users were 19, 30, 32, 34 and 38 years old, and one was unknown. All are current heroin injection users, and all also use non-injection heroin. Only 2/6 users used marijuana. All of the flashblood practitioners shared needles, shared injection equipment, have taken someone else's syringe and leave syringes in common locations. Two-thirds of users knew that one could contract HIV from using needles. However, disturbingly, 5/6 people could not cite any type of health problems associated with drug use. Two-thirds of users reported not using a condom the last time they had sex, and two-thirds reported using heroin during sex frequently.

## Knowledge of risks posed by drug use and using needles

Knowledge and awareness about the risks posed by using and sharing needle is crucial to HIV prevention. We explored this in **Table 4A and 4B** by and showed that approximately one third (32.3%) of the study population did not know about any kind of health risk posed by sharing needles. However, more than half the study population (64.6%) was aware that HIV was a risk posed by sharing needles, where fewer knew that sharing needles could lead to hepatitis C (26.2%), and TB (15.4%). Not knowing about the risks of using and sharing needles was associated with more than 4 times the odds of injecting heroin compared to those who are aware of some risks.

More than half the study population was not aware of the general health problems associated with drug use. One-fifth (20.6%) was aware that drug abuse could cause TB, loss of memory (16.3%), dehydration (8.8%) and loss of appetite (4.2%).

After adjusting for knowledge of other diseases, the adjusted multivariate model demonstrated that “not knowing” and knowledge of TB were the two main knowledge factors associated with heroin injection. The odds of injection drug use among those who were not aware of any problems is 10.4 times (95% CI: 5.88 – 18.97) that of those who do know.

## Factors Associated with Heroin Injection

To find the strongest predictors for heroin injection, we conducted factor analysis. Factor analysis removes redundancy from a set of correlated variables, such that the final model is one that contains the most highly correlated predictors. The reduced multivariate model in **Table 5A** demonstrated that housing and co-habitation status were the strongest socioeconomic predictors of injection drug use out of all the other variables. PWID are also twice as likely to rent a house than own a house (OR: 2.62; 95%CI: 0.72-10.17). Further, those who rent a room in a guesthouse are 2.28 times (95% CI: 0.56 – 9.64) as likely to inject heroin as those who own a house. Those who have a free room at a friend’s or relative’s house are 0.32 times (95% CI: 0.24 – 2.26) less likely to inject heroin than those who own a house. Those who live

on the streets are also 0.26 times (95% CI: 0.21 – 2.81) less likely to inject heroin than those who own a house. The odds of heroin injection among those who do not live with a spouse are 2.25 times (95% CI: 1.05 – 5.44) that of those who do live with a spouse.

Further, as shown in **Table 5B**, multivariate analysis demonstrated that years of drug use, selling items for drugs, trading sex for drugs and being arrested by law enforcers are strongly associated with injection drug use. The odds of injection drug use among those who have used drugs for 11-15 years and 16-20 are 1.09 times (95% CI: 1.00 – 1.18; 0.96-1.22) compared to those who have used drugs for 0-5 years. Those who reported selling items for drugs are 1.12 times as likely to inject heroin compared to those who have not. Similarly, those who have traded sex for drugs are 1.22 times significantly as likely to inject heroin compared to those who have not. The importance of these HIV-related risk behaviors in predicting heroin injection cannot be discounted.

**TABLE 1A:** Socioeconomic Characteristics and Relationship between Current and No History of Injection

	<b>Ever* Heroin Injection (%) n =79</b>	<b>Never Heroin Injection (%) n = 401</b>	<b>Unadjusted Odds ratio of Heroin Injection (95% CI)</b>	<b>P-value for independence*</b>
<b>Age (+s.d.)</b>	29.0 ± 5.8	28.3 ± 6.4	0.98 (0.94 – 1.02)	0.52
<b>Age</b>				0.38
<20	4 (5.4)	19 (4.9)	1.51 (0.41 - 4.62)	
21-25	23 (31.1)	114 (29.3)	1.37 (0.70 – 2.75)	
26-30	21(28.4)	118 (30.4)	1.00	
31-35	18(24.3)	81 (20.9)	1.18 (0.55 – 2.52)	
>36	8 (10.8)	56 (14.4)	0.48 (0.13 – 1.36)	
<b>Gender</b>				0.14
Male	69 (87.3)	373 (93.0)	0.47 (0.22 – 1.09)	
Female	10 (12.7)	28 (7.0)	1.00	
<b>Education Level</b>				0.21
Never went to school	5 (6.3)	14 (3.5)	1.23 (0.27 – 5.38)	
Incomplete primary	9 (11.4)	73 (18.2)	0.50 (0.15 – 1.78)	
Completed primary	22 (27.8)	124 (30.9)	0.65 (0.23 – 2.11)	
Secondary (Form 1-4)	28(35.4)	143 (35.7)	0.71 (0.26 – 2.29)	
Secondary (Form 5-6)	7 (8.9)	27 (6.7)	1.19 (0.34 – 4.50)	
Post Secondary	8 (10.1)	20 (5.0)	1.00	
<b>Marital Status</b>				0.10
Single/never married	47 (64.6)	246 (61.3)	4.23 (1.49 – 17.8)	
Married or living as married (1 spouse)	7 (4.6)	65 (16.2)	1.00	
Married or living as married (>1 spouse)	2 (3.7)	11 (2.7)	4.61 (0.56 – 30.9)	
Separated/divorced	23 (27.7)	72 (18.0)	5.92 (1.91 – 26.02)	
Widowed	0 (0.0)	7 (1.7)	-	

<b>Housing Status</b>				0.22
Own house	5 (6.3)	32 (8.0)	1.00	
Rented house	7 (8.9)	19 (4.7)	3.50 (0.83 – 18.0)	
Renting room in guesthouse	6 (7.6)	12 (3.0)	5.83 (1.33 – 31.2)	
Renting room elsewhere	36 (45.6)	170 (42.3)	1.76 (0.58 – 7.65)	
Free room at friends or relative's house	18 (22.7)	124 (30.9)	1.48 (0.46 – 6.62)	
On the Streets	7 (8.9)	43 (10.7)	1.90 (0.49 – 9.31)	
<b>Living with husband/wife</b>				0.19
Yes	9 (11.4)	72 (18.1)	1.00	
No	70 (88.6)	325 (81.9)	2.72 (1.16 – 7.99)	
<b>Income Source</b>				0.94
Family/friends	2 (2.5)	11 (2.8)	0.78 (0.44 – 1.39)	
Job	54 (68.4)	279 (69.6)	1.00	
Illicit activities	23 (29.1)	110 (27.4)	0.98 (0.14 – 3.99)	

*\* Ever injection was used as the primary variable, but it must be noted that the majority of the ever injectors were also current injectors (82%).*

*\*\* T-test for continuous variables, chi-square test for categorical variables*



**TABLE 1B:** Profile of Self-Reported Drug use among the Study Population

<b>Type of Drug Injected</b>	<b>N (%)</b>
Heroin	79/480 (16.4)
Methamphetamine	2/480 (0.4)
Cocaine	2/480 (0.4)
Pharmaceuticals	3/480 (0.6)
<b>Type of Drugs Not-injected</b>	
Marijuana	456/480 (95.0)
Non-injection heroin	434/480 (90.4)
Pharmaceutical	71/480 (14.8)
Hash	13/480 (2.7)
Solvent	17/480 (3.5)
Marijuana and Non-Injection Heroin	413/480 (86.0)
Marijuana and Non-Injection Heroin and Pharmaceutical	60/480 (12.5)
<b>Combined Heroin Injection + Non-injected Drugs</b>	
Injection Heroin + Marijuana	61/79 (77.2)
Injection Heroin + Non-Injection Heroin	66/79 (83.5)
Injection Heroin + Non-injection Pharmaceuticals	20/79 (25.3)
Injection Heroin + Hashish	2/79 (2.5)
Injection Heroin + Solvent	10/79 (12.7)
Injection Heroin + Marijuana and non-injection heroin	50/79 (63.3)
Injection Heroin + Marijuana and Non-injection Heroin and Pharmaceutical	12/79 (15.2)

**TABLE 2:** Selected Unadjusted Associations between Risk Behaviors and Heroin Injection

	<b>Ever Injection Drug Use (n=79)</b>	<b>Never Injection Drug Use (n = 401)</b>	<b>Unadjusted Odds ratio of injection drug use</b>	<b>p-value of independence</b>
<b>Years since first use (+ s.d.)</b>	8.73 ± 5.1	7.78 ± 5.9	1.03 (0.98 – 1.07)	0.15
<b>Years since first use</b>				0.16
0 – 5 years	26 (36.1)	153 (41.1)	1.00	
6 – 10 years	16 (29.8)	111 (29.8)	0.93 (0.47 – 1.78)	
11 – 15 years	21 (29.2)	70 (18.8)	1.94 (1.02 – 3.63)	
16 – 20 years	9 (12.5)	32 (8.6)	1.81 (0.75 – 4.10)	
<b>Ever sold items for drugs</b>				<0.05
Yes	70 (88.6)	265 (66.3)	3.96 (2.02 – 8.73)	
No	9 (11.3)	135 (33.8)	1.00	
<b>Traded sex for drugs</b>				<0.05
Yes	29 (36.9)	56 (14.0)	3.55 (2.06– 6.07)	
No	50 (63.0)	343 (85.9)	1.00	
<b>Arrested by law enforcers</b>				<0.05
Yes	77 (97.5)	333 (83.4)	7.75 (2.36 – 47.8)	
No	2 (2.5)	67 (16.8)	1.00	
<b>Spouse/partner is a drug user</b>				0.09
Yes	11 (13.9)	30 (7.5)	1.98 (0.92 – 4.06)	
No	66 (83.5)	363 (90.9)	1.00	
Don't know	2 (2.5)	6 (1.5)	-	
<b>Use of drugs during sex</b>				0.18

Yes	71 (89.8)	333 (83.3)	1.78 (0.87 – 4.18)	
No	8 (10.1)	67 (16.8)	1.00	
<b>Main reason for starting drugs</b>				0.10
Peer pressure	63 (79.7)	320 (80.0)	-	
For fun	3 (3.8)	9 (2.3)	-	
Family problems	4 (5.1)	10 (2.5)	-	
Influence from family	3 (3.8)	17 (4.3)	-	
Other	4 (5.1)	11 (2.8)	-	
<b>Age of sexual debut</b>				0.84
11 – 13	27 (40.3)	150 (43.1)	1.19 (0.48 – 3.16)	
14 – 17	32 (47.8)	155 (44.5)	0.99 (0.48 – 2.41)	
18+	8 (11.9)	43 (12.3)	1.00	
<b>Number of sex partners in the past 30 days</b>				0.10
None	16 (20.2)	104 (27.1)	1.00	
1	25 (31.6)	135 (33.6)	1.20 (0.62 – 2.41)	
2-5	21 (26.6)	115 (28.7)	1.19 (0.59 – 2.43)	
>5	10 (12.7)	32 (7.9)	2.03 (0.81 – 4.87)	
<b>Use of condoms during vaginal sex</b>				0.08
None of the time	21 (26.6)	91 (22.8)	1.66 (0.86 – 3.21)	
Some of the time	29 (36.7)	98 (24.5)	2.13 (1.16 – 3.96)	
Most of the time	7 (8.9)	52 (13.0)	0.97 (0.37 – 2.31)	
All the time	5 (6.3)	52 (13.0)	1.00	
<b>Alcohol consumption</b>				0.37
Monthly or less	5 (10.9)	21 (9.5)	1.00	
2-4 times a month	9 (19.6)	53 (24.2)	0.71 (0.23 – 2.55)	
2-3 times a week	15 (32.6)	50 (22.8)	1.26 (0.43 – 4.27)	

4 or more times a week	17 (37.0)	95 (43.4)	0.75 (0.26 – 2.49)	
<b>Binge drinking frequency</b>				<0.05
Never	26 (56.5)	115 (52.5)	1.00	
Less than monthly	7 (15.2)	21 (9.6)	1.32 (0.48 – 3.29)	
Monthly	5 (10.9)	17 (7.8)	1.16 (0.36 – 3.24)	
Weekly	3 (6.5)	22 (10.0)	0.54 (0.12 – 1.70)	
Daily	2 (4.3)	44 (20.1)	0.18 (0.02 – 0.63)	

**TABLE 3:** HIV-related injection Risk Behaviors among Injectors

<b>Current Heroin Injection drug use</b>	<b>65/79 (82.2%)</b>
Ever shared needles	44/65 (67.7%)
Leave syringes in common locations	41/65 (63.1%)
Share injection equipment	31/65 (47.7%)
Clean injection equipment	58/65 (89.2%)
Soap	4/65 (6.2%)
Alcohol	6/65 (9.2%)
Bleach	19/65 (29.2%)
Boiling Water	3/65(4.6%)
Cold Water	25/65 (38.5%)
Flashblood practice	6/79 (7.6%)

**TABLE 4A:** Selected unadjusted and adjusted associations between awareness of risks posed by using and sharing needles and injection drug use

<b>Awareness of risks posed by sharing needles</b>	<b>PWID (Heroin) (n=65)</b>	<b>Unadjusted odds ratio of injection drug use</b>	<b>Adjusted odds ratio of injection drug use</b>
Don't know about risks	21/65 (32.3%)	6.87 (3.94 – 12.32)	4.55 (2.48 – 8.30)
HIV	42/65 (64.6%)	6.41(3.70 – 11.36)	-
Hepatitis C	17/65 (26.2%)	6.24 (3.13 – 12.32)	2.84 (1.32 – 6.18)
TB	10/65 (15.4%)	13.18 (4.39 – 44.21)	3.87 (1.16 – 15.21)
Mental problems	3/65 (4.6%)	9.99 (1.63 – 76.99)	-
Addiction	0/65 (0.0%)	-	-
Tumor	1/65 (1.5%)	-	-
Loss of appetite	0/65 (0.0%)	-	-
Heart disease	1/65 (1.5%)	-	-

**TABLE 4B:** Selected unadjusted and adjusted associations between awareness of risks posed by using any sort of illicit drugs

<b>Health problems caused by any sort of illicit drugs</b>	<b>Total population</b>	<b>Injection Drug Users</b>	<b>Unadjusted odds ratio of heroin injection</b>	<b>Adjusted odds ratio of heroin injection</b>
Don't know	292 (60.8%)	34/65 (52.3%)	1.50 (0.88 – 2.53)	10.43 (5.88 – 18.97)
TB	99 (20.6%)	12/65 (18.5%)	0.85 (0.42 – 1.62)	0.37 (0.19 – 0.72)
Loss of memory	78 (16.3%)	13/65 (20.0%)	1.35 (0.67 – 2.55)	-
Dehydration	42 (8.8%)	12/65 (18.5)	2.91 (1.36 – 5.90)	-
Loss of appetite	20 (4.2%)	3/65 (4.6%)	1.13 (0.26 – 3.50)	-
Addiction	16 (3.3%)	0/65 (0.0%)	-	-
Cancer / tumor	11 (2.3%)	2/65 (3.1%)		-
Neurological damage	7 (1.5%)	4/65 (6.2%)	-	-
“Blood disease”	6 (1.3%)	5/65 (7.8%)	-	-
HIV	2 (0.4%)	1/65 (1.5%)	-	-

**TABLE 5A:** Reduced model of Socioeconomic Characteristics and Injection Drug Use

<b>Socioeconomic Characteristics</b>	<b>Odds ratio of injection drug use</b>	<b>P-value</b>
<b>Housing Status</b>		
Own house	1.00	-
Rented house	2.62 (0.72 – 10.17)	0.15
Renting room in guesthouse	2.28 (0.56 – 9.64)	0.25
Renting room elsewhere	1.12 (0.32 - 3.52)	0.82
Free room at friends or relative’s house	0.68 (0.24 – 2.26)	0.49
On the Streets	0.74 (0.21 – 2.81)	0.65
<b>Living with husband/wife</b>		
Yes	1.00	-
No	2.27 (1.05 – 5.44)	0.04

**TABLE 5B:** Reduced model of HIV related risk behaviors and injection drug use

	<b>Odds ratio of injection drug use</b>	<b>P-value</b>
<b>Years since first use</b>		
0 – 5 years	1.00	-
6 – 10 years	0.96 (0.89 – 1.04)	0.36
11 – 15 years	1.09 (1.00 – 1.18)	0.06
16 – 20 years	1.09 (0.96 – 1.22)	0.17
<b>Ever sold items for drugs</b>		
Yes	1.12 (1.04 – 1.21)	<0.05
No	1.00	-
<b>Traded sex for drugs</b>		
Yes	1.22 (1.12 – 1.33)	<0.05
No	1.00	-
<b>Arrested by law enforcers</b>		
Yes	1.11 (1.00 – 1.22)	<0.05
No	1.00	-



## DISCUSSION

To our knowledge, this is the first study to describe the epidemiology of drug use in general and injection drug use in particular associated HIV related risk behaviors in Mwanza, Tanzania. Using a survey of 480 drug users, we show that a very high percentage of our sample population engaged in heroin use, and that HIV risk behaviors were highly prevalent amongst current drug users in Mwanza. We also show that there is only a marginal difference between PWID and non-PWID in terms of socioeconomic status. These results suggest that the drug user population is heterogeneous and not confined to any one particular socioeconomic stratum.

Prevalence of self-reported heroin use among the study population was extremely high (90.4%) with an even higher prevalence of marijuana use (95.0%). Approximately a fifth of the study population (16.7%) had a history of heroin injection drug use, and 13.5% were current heroin injection drug users. An overwhelming majority of ever injectors are current injectors, which highlights the need for rehabilitation programs as PWID are not receiving the treatment they need. Many users on the streets were eager to be interviewed, as they were told that this research would help to enable a shift in government policy towards drug users.

Very few people reported injection other types of drugs besides heroin. Combinations of smoking heroin and marijuana were also commonly reported. This is not surprising given that both marijuana and heroin are readily accessible. In particular, our study participants reported that approximately 0.5g of heroin costs only 2000TSH (USD\$1.10), and that 600g of marijuana cost 1000TSH (USD\$0.55). Similar figures were reported a decade ago.<sup>5</sup> With such accessible prices, it is not surprising that heroin use has become so rampant. It is also worrying that drug users who smoke heroin with marijuana may increase the probability of transitioning to injection drugs. The median transition time from smoking to injection is 5 years, and for those under 25, it takes 2 years.<sup>45</sup> These statistics, coupled with a high study participation

rate within a short span of time, highlight that heroin abuse in Mwanza is a problem with a potential to worsen, and reveals a hidden problem that is presently being ignored.<sup>6,46,47</sup>

The lack of significant socioeconomic characteristic differences between PWID and non-PWID is not surprising. Previous studies in OECD countries had shown that high risk injection behaviors were not related to socioeconomic markers,<sup>48</sup> even among injectors who had experienced non-fatal overdoses.<sup>49</sup> Our data show that being single, having a primary level or lower secondary level of education, and being male were not significantly associated with heroin injection. This underscores the need for drug prevention efforts that are aimed at users from various socioeconomic backgrounds in Mwanza, moving away from the traditional “target risk group” behavior as Ratliff et al. suggest.<sup>12</sup> These results highlight the importance of home stability and family as a protective factor against heroin injection.

Between genders, because our sample comprised of mostly males, we were unable to determine if risk behaviors between male and female PWID were heterogeneous. However, previous studies have shown that male and female PWID exhibit different HIV-related risk behaviors. For instance, women tend to have more sex partners and men tend to share needles and lend used needles to other injectors.<sup>17</sup>

Housing and cohabitation status were found to be the most significantly associated with injection drug use in our multivariate model. Our data suggests that PWID are more likely to rent houses or rooms than to own homes. We also found that PWID are more likely to not have a spouse or co-habiting partner compared to non-PWID. This result suggests that home and family stability are closely associated with injection drug use. Other heroin injection and HIV risk studies conducted outside of sub-Saharan Africa<sup>50,51</sup> have shown that housing status and residence are key factors in increased HIV risk and injection drug use. Unstable housing was shown to be independently associated with several HIV risk behaviors including borrowed needles, and suggest comprehensive housing policies be implemented.<sup>50</sup> In a similar vein, our results suggest for strengthening family ties through counseling. One of the first signs of recovery is when the patient re-connects with family and is accepted back into the family.<sup>20</sup>

Our results show that participants reported abusing drugs from as far back as 20 years ago. This is not surprising. By the year 2000, there were two reported forms of heroin in circulation—brown and white heroin.<sup>5</sup> However, there has not been widespread reporting of drug abuse in the region until prior to the mid-2000s. Narco-trafficking and substance abuse was more commonly reported in West Africa compared to East Africa.<sup>52</sup>

Deciphering the start of the heroin epidemic is difficult. The type of drug that was first used was not specified. Among our study participants, the mean length of drug abuse is 7.9 years. The most common year that people began to use drugs was in 2006, implying a recent uptick in heroin imports in the region. This is also consistent with UNODC reports that cite an increase in heroin seizures over the past decade, which also imply that there could be many more undetected shipments.<sup>53</sup> Our data shows that heroin abuse is not a recent problem, but one that has remained invisible for many years. Similar to what has been shown in other PWID studies<sup>45</sup>, our data show that the longer the length of drug use, the more likely heroin injection becomes. If action is not taken to curb the critical period between heroin smoking and injection, the drug abuse problem and consequently the HIV epidemic could be exacerbated gravely. In Russia, 75% of all HIV cases occur among PWID, highlighting the urgent need for action to be taken immediately.<sup>54</sup>

Risk behaviors that are significantly associated with heroin injection include: selling items for drugs, trading sex, and being arrested. These are known risk behaviors that are associated with an increased risk of heroin injection and HIV, as shown in previous studies in Dar es Salaam.<sup>5,7</sup> Among our study population, age of sexual debut, use of drugs during sex, condom use and number of sex partners were not found to be significantly associated with heroin injection. However, it must be highlighted that among our study population, some users have been having sex since age 11. Reported frequent condom use during vaginal sex was also very low. A further sobering fact is that an overwhelming majority of PWID and non-PWID alike began using drugs because of peer pressure. In rural Tanzania, it has been shown in recent years that adolescent sexual health intervention programs are effective.<sup>55</sup> Our results

emphasize the need for scaled-up sexual education and HIV prevention among children starting in primary school.

Our data show that alcohol risk behaviors are not significantly associated with heroin injection. While it is known that alcohol consumption is implicated in the spread of HIV/AIDS,<sup>9</sup> our results show that daily binge drinkers are significantly less likely to engage in heroin injection compared to those who do not binge drink at all. Alcohol abuse in Tanzania is a growing problem in itself, which must not go unheeded.<sup>41,43,56</sup>

Needle-related risk behaviors were widely reported among PWID. More than half the PWID leave syringes in common locations and half the PWID shared injection equipment. The general availability of syringes—which consists of a 2ml syringe and 23 gauge needle and is sold in a pack<sup>5</sup>—facilitates needle-related risk behaviors. This increases the probability of HIV transmission among PWID and is a concerning statistic. Taken with the fact that PWID are twice as likely to have sex with more than 5 partners, our data suggest that heroin injection in Mwanza is a serious issue that could result in further HIV spread.

Despite the widespread sharing of injection equipment, cleaning injection equipment was widely reported among PWID. The most commonly used cleaning agent is cold water. Ideally, PWID should clean their needles with bleach adequately to kill viruses, which is currently only being practiced by 29.2% of the PWID in our study population. Community-based outreach organizations should continue to encourage cleaning with bleach in addition to reducing multi-person use of needles.

We investigated the prevalence of flashblood, as it has been widely reported in Dar es Salaam.<sup>7,8,47</sup> We found that although flashblood was not a significant concern among our study population, it is worrisome that the practice was not unheard of and had been practiced. Among the 6 PWID with a history of flashblood, flashblood was only used when circumstances were dire i.e. when both money and heroin was unavailable. This practice is not found anywhere else except for East Africa.

As such, flashblood practice still should not be ignored, as it is a very dangerous and efficient vehicle for the transmission of HIV/AIDS and other blood-borne diseases.

Prior to investigating awareness of needle risks, we asked more broadly if participants were aware of health problems caused by any sort of general drug use. Awareness was poor. More than half the study population could not cite a problem caused by general drug use. Approximately a fifth of the study population cited TB as a risk, followed by memory and appetite loss and dehydration.

In Mwanza, awareness about health risks posed by using and sharing needles is poor. A third of PWID were not able to list any health risks posed by using and sharing needles. Hearteningly, more than half were able to report that contracting HIV/AIDS was a potential risk of needle sharing. Previous prevention efforts conducted in the Mbeya region of Tanzania have shown that information, education and communication about HIV is integral to the reduction of HIV prevalence.<sup>57</sup> However, information dissemination is only one part of the structural approach to HIV prevention; political support, involvement, institutional participation and surveillance are key features of successful programs for behavioral change in East Africa.<sup>57,58</sup> In agreement with these findings, our data suggests that knowledge alone is not enough as a prevention tool. For example, those who are aware about HIV, hepatitis C and TB are actually more likely to engage in heroin injection than those who are not. This suggests that it is not adequate to only raise awareness about diseases as a method of HIV prevention, and, as previously mentioned, other forms of prevention such as methadone treatment and detoxification rehabilitation must also be proactively considered by the government.

## Contribution of Study

The results of this study should be used to catalyze the implementation of methadone clinics in Mwanza and cities beyond Dar es Salaam and Zanzibar. Our results have highlighted that there is a sizable population of heroin drug users in Mwanza, and that many PWID are engaging in high-risk behaviors. However, we must not exclude the non-PWID as well. Given the large number of non-PWID

who use heroin in our study sample, there is a high chance that non-PWID will make the transition to injection later on in life. Research has shown that non-PWID exposed to treatment such as methadone maintenance and rehabilitation are less likely to initiate injection.<sup>59</sup>

## Study Limitations

Our study has several limitations. Firstly, although great care was taken to ensure that we had a sizable and diverse sample of drug users, obtaining a random representative sample of hidden population is extremely difficult. We were also not able to recruit many female drug users, which may have skewed results. The nature of our study is also heavily reliant on self-report, which may have resulted in underreporting of risky behaviors. However, self-report was and is still the main measure of risky behavior.<sup>60</sup> Further, our data are cross-sectional in nature, thus it is not possible to extrapolate the data to make causal inferences. Finally, our data did not plot the chronological transition of users from using non-injection to injection heroin. This would have allowed us to find a suitable intervention point among drug users. Finally, future studies should include exploring the relationship between HIV serostatus, heroin injection and sociodemographic status.

## Conclusion

The results of this study highlight that heroin abuse is a significant problem in a city outside Dar es Salaam and Zanzibar, suggesting that Mwanza has now become a consumer hub of heroin, and may be a transit hub for heroin to other parts of East Africa. We find that housing status and living arrangements are the strongest predictors of heroin injection, and that many users began using drugs due to peer pressure, underscoring the fact that family stability and home life should be taken into consideration in HIV and drug prevention efforts in Tanzania. Many PWID were also reported to engage in needle sharing and reported improper methods of cleaning needles. A significant proportion of the study population exhibited a lack of awareness of the risks involved in needle sharing and drug abuse. However, even among those who are knowledgeable about risks, the odds of heroin injection are high. This suggests that HIV prevention must extend beyond education campaigns, such as ensuring that students stay in schools, engaging in productive after school activities and encouraging family counseling. Failing to recognize heroin injection abuse in Mwanza may derail the work that has been done to stabilize the epidemic in Tanzania.

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