



## Research Article

## EPIDEMIOLOGY OF HEPATITIS B AND C INFECTIONS AMONG INTRAVENOUS DRUG USERS

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## ARTICLE INFO ABSTRACT

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People with Intravenous drugs (PWID) represent a population for which the prevalence of viral hepatitis is not well-documented in Tanzania, unlike the general population, which has seen a statistically significant decrease in prevalence due to various intervention measures. This study aimed to determine the prevalence of and factors associated with Hepatitis B and C among intravenous drug users in the Moshi municipal council. We conducted a cross-sectional quantitative study between September 2022 and May 2023, recruiting 214 PWIDs using the Respondent-Driven Sampling (RDS) technique. A questionnaire was administered to gather socio-demographic information, and blood samples were collected from participants to test for the presence of the Hepatitis C virus (HCV) and hepatitis B surface antigen (HBsAg). Data were cleaned and analyzed using Stata version 14.1 (Stata Corp LP® [StataCorp. 2015]). The majority of the participants (38.8%) were between the ages of 25 and 30, 84.1% were male, and 78.0% were married or cohabiting. The overall prevalence of HBV and HCV among PWID was 17.29% and 10.75%, respectively. Approximately 3% tested positive for co-infection of Hepatitis B and C, while more than 25.23% were seropositive for either viral hepatitis infection. Individuals who were single or divorced were found to be 9 times more likely to have hepatitis C, while those with secondary education or higher were 71% less likely to have HCV. There was no significant association between the sex and age of the participants. In conclusion, 25.2% of PWID were seropositive for either viral hepatitis infection, and 17.3% had HBV infection. These findings underscore the need for targeted interventions among PWID to accelerate progress toward the elimination of hepatitis infections, similar to efforts directed at the general population in Tanzania.

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## INTRODUCTION

Hepatitis B and C are not only serious viral infections but also represent a significant public health challenge, especially among intravenous drug users. The primary mode of transmission for these infections is through the sharing of contaminated needles, placing intravenous drug users at a notably high risk (NIDA, 2020). These blood-borne infections can also spread through the exchange of bodily fluids, unsafe injections, improper medical procedures, unprotected sexual contact, improper blood screening during transfusions, and mother-to-child transmission during childbirth (Demsiss, W. et al., 2018).

Numerous studies have underscored the alarmingly high prevalence of hepatitis B and C among intravenous drug users. For hepatitis C, prevalence rates can range from 0.6% among volunteer blood donors to a staggering 80% among intravenous drug users (Greca et al., 2012). This wide range highlights the vulnerability of this population to hepatitis C. The overall prevalence of hepatitis C among intravenous drug users is estimated to be around 3%. Similarly, hepatitis B

shows a considerable prevalence, with research revealing that 46-95% of intravenous drug users test positive for hepatitis B exposure, even if they report no history of infection (Butler et al., 2022).

The high prevalence of hepatitis B and C among intravenous drug users can be attributed to a complex interplay of factors. These include risky behaviors, limited access to sterile injecting equipment, insufficient knowledge about transmission, poor hygiene practices, compromised immune systems, and socioeconomic disparities. Intravenous drug use is a significant risk factor for hepatitis B and C transmission (March et al., 2007). Notably, the prevalence of these infections among intravenous drug users is significantly higher compared to the general population. Intravenous drug users, also known as intravenous drug abusers or IV drug users, face a substantial risk of both acquiring and transmitting hepatitis B and C infections due to the sharing of contaminated needles and drug paraphernalia (Oa, 2017). Research has revealed that up to 30% of intravenous drug users have hepatitis B, a stark contrast to the 5% prevalence rate in the general population. Furthermore, the prevalence of hepatitis C among intravenous

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drug users is estimated to be between 30% and 60%, significantly higher than in the general population (Altuglu, I. et al., 2019).

Addressing this public health issue requires comprehensive strategies that encompass harm reduction, improved access to healthcare services, and education to raise awareness among intravenous drug users and healthcare providers alike. The high prevalence rates emphasize the urgency of targeted interventions to curb the spread of hepatitis B and C within this vulnerable population, ultimately benefiting both the individuals affected and society as a whole. Therefore, we conducted this study to determine the magnitude of HBV and HCV infection among intravenous drug users in order to have in place effective strategies to control infection among the local population.

## MATERIALS & METHODS

In the picturesque setting of Moshi municipality, nestled within Tanzania's Kilimanjaro region, we embarked on a transformative journey of discovery between September 2022 and May 2023. Our mission: to understand the prevalence of hepatitis among People Who Inject Drugs (PWIDs) using the powerful tool of Respondent-Driven Sampling (RDS). With Moshi's population estimated at 221,733 (NBS, 2022), we strategically selected hotspot locations across all municipal wards to ensure our sample was a true reflection of this unique region. Using a formula inspired by Wejnert C et al. in 2012, we aimed to recruit 214 PWIDs. The estimated hepatitis prevalence was 16%, based on findings by Leyna GH. et al. in 2019.

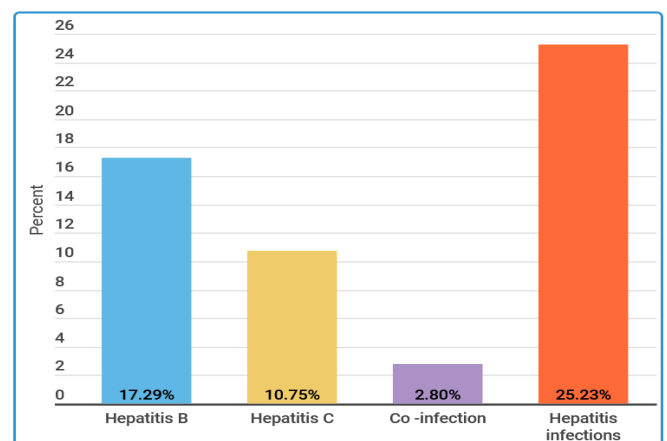
RDS, a method renowned for its effectiveness in reaching challenging populations, guided our efforts. We started with just three seeds, carefully chosen from government-recognized NGOs like THPS, SAUTI Project, and TAWREF, all of which collaborate closely with PWIDs. These seeds were not only trained but armed with coupons, each bearing our study's name, location details, and a brief explanation. Our data collection instrument was a meticulously designed questionnaire, administered at convenient hotspot sites. The questionnaire covered socio-demographics and explored risk factors, including knowledge, attitudes, and practices related to hepatitis B and C.

To ensure the highest data quality, we adhered to National guidelines for hepatitis testing and counseling. Skilled medical personnel collected blood samples (around 5ml) from participants' left arms, following standard procedures near healthcare facilities. Each specimen was diligently labeled with the participant's coupon identification number, establishing a vital link. Our collected samples embarked on a journey of their own, making their way to Pasua Health Centre in a cool box for storage. Laboratory assays were performed, utilizing HBsAg rapid test strips for hepatitis B surface antigen detection and anti-HCV rapid test strips for HCV antibody detection. An external quality assurance (EQA) process was meticulously conducted for HBsAg and HCV testing. Once all samples were collected and locally tested, we retained reactive and 10% of non-reactive samples at Pasua Health Center Laboratory for further verification. Our commitment to data integrity culminated in an external quality assessment.

Data analysis was performed using Stata version 14.1, where the chi-square test unveiled associations between dependent and independent variables. Binary logistic regression emerged as a significant predictor of hepatitis B and C prevalence among our intravenous drug users. We maintained a 5% significance level throughout the study, with variables bearing a p-value less than 0.05 considered significantly associated with our outcome variables.

## RESULTS

In the vibrant city of Moshi, we gathered a total of 214 intravenous drug users to embark on a crucial mission: testing for Hepatitis B and C. These brave individuals came from diverse age groups, with the largest chunk (38.8%) falling between the ages of 25 and 30, while the smallest group (18.2%) consisted of those aged thirty-seven and above. In this group, the majorities (84.1%) were courageous males, and significant portions (78.0%) were currently not in partnerships or married. The results unveiled important insights: the overall prevalence of Hepatitis B among our participants stood at 17.29%, while Hepatitis C was detected in 10.75% of the cases. Intriguingly, about 3% showed the resilience of co-infection, battling both Hepatitis B and C simultaneously. Furthermore, over a quarter of our participants (25.23%) demonstrated seropositivity to either of these viral hepatitis infections, as beautifully illustrated in Figure 1.



**Figure 1** Prevalence of Viral Hepatitis infections

### Knowledge of Hepatitis B and C

In our study, we aimed to gauge the participants' understanding of hepatitis virus infections through a series of five questions related to the disease. The results paint an encouraging picture: An impressive 60.8% of respondents correctly recognized that hepatitis is a preventable disease, emphasizing the importance of prevention, approximately 40.2% acknowledged that vaccination can serve as an effective preventive measure against viral hepatitis infections, highlighting awareness of immunization's role. A substantial 65.4% of participants correctly understood that hepatitis is an incurable disease, demonstrating a realistic grasp of its nature. In terms of transmission, nearly 37% (36.9%) selected the correct mode of transmission, identifying contaminated water and food as potential sources of infection, which is crucial information for prevention. The majority (61.2%) correctly associated jaundice as a characteristic of hepatitis infection, showcasing an awareness of key symptoms. In sum, these findings are reassuring, with more than half (57.0%) of the

participants demonstrating adequate knowledge of hepatitis virus infections.

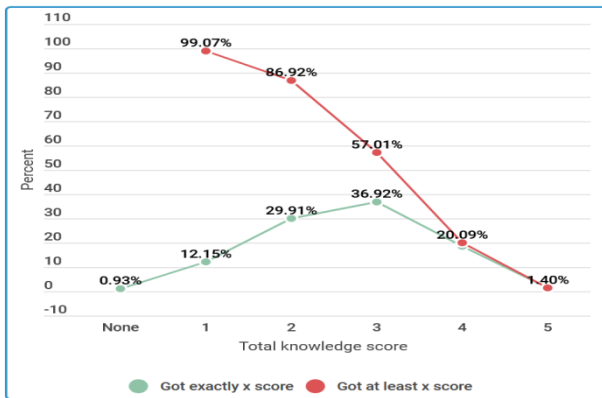


Figure 2 Level of knowledge

### Attitude on Hepatitis B and C

In assessing the attitudes of our participants toward hepatitis virus infection, we uncovered a range of sentiments: Approximately 37.9% displayed a favorable attitude, indicating a positive outlook toward managing and addressing hepatitis. Astonishingly, nearly all participants (97.7%) acknowledged their vulnerability to viral hepatitis, highlighting a keen awareness of the risk. A significant portion (45.8%) expressed concern about the potential consequences, such as death, upon diagnosis with hepatitis infection, revealing the gravity of the issue. Moreover, a substantial majority (73.8%) indicated that they would be deeply concerned if a healthcare professional informed them of a hepatitis infection, underlining the seriousness of the condition. Impressively, virtually all respondents (99.1%) recognized the potential for prevention through lifestyle changes, reflecting a high level of health consciousness and every single participant (100%) expressed a willingness to modify their lifestyle if necessary to prevent hepatitis, demonstrating a strong commitment to their health. These findings indicate a mixed yet largely positive attitude toward hepatitis virus infection among our study participants.

### Practice on Hepatitis B and C

The results of our study shed light on the practices and behaviors of our participants concerning hepatitis B and C: Alarmingly, a significant majority, comprising 73.4%, exhibited unsafe practices related to hepatitis B and C, indicating a need for improved awareness and education on safe behaviors. Approximately two-thirds (67.3%) of the participants reported that they would seek medical attention if they suspected they had a hepatitis infection, demonstrating a proactive approach to their health.

When asked about their preventive measures against hepatitis, nearly half (49.1%) stated that they do not share sharp objects, indicating awareness of the importance of avoiding practices that can transmit the virus. Meanwhile, 28% mentioned practicing safe sex, including the use of condoms, as a preventive measure, and approximately 22.9% indicated monogamy or sticking with one partner as a means of prevention. However, a significant portion (68.2%) revealed that they had never participated in health education programs related to viral hepatitis infection, highlighting a potential gap in public health outreach and education. These findings underscore the need for targeted interventions to promote safe

practices and raise awareness about hepatitis B and C among this population.

### Hepatitis C Virus (HCV) Infection

The results analyzed and presented in Table 1 reveal important associations and insights related to Hepatitis C virus infection among our study participants:

**Attitude on Hepatitis Infection:** Our analysis showed a significant association between Hepatitis C virus infection and participants' attitude towards hepatitis (OR=3.21,  $p=0.0407$ ). This suggests that individuals with an unfavourable attitude towards hepatitis are significantly more likely to be affected by Hepatitis C. Specifically, 14.3% of those with an unfavourable attitude tested positive for hepatitis C, compared to only 4.9% among those with a favourable attitude.

**Practice on Hepatitis Infection:** Hepatitis C infection was also significantly associated with participants' practices regarding hepatitis (OR=9.13,  $p=0.0326$ ). The odds of being affected by Hepatitis C were significantly higher among those with unsafe practices compared to those with safe practices. More precisely, 14% of those with unsafe practices tested positive for hepatitis C, while only 1.8% of those with safe practices were found to be infected.

**Marital Status:** Single or divorced individuals were significantly more likely to be affected by hepatitis infection compared to those who were married or cohabiting (OR=6.98,  $p=0.0308$ ). However, certain factors like age ( $p=0.5125$ ), sex ( $p=0.3280$ ), and knowledge about hepatitis infection ( $p=0.3487$ ) did not show significant associations with hepatitis C infection in this study.

In order to obtain adjusted odds ratios (AOR) for factors associated with hepatitis B infection, we included all variables that showed significance at a 10% level in the unadjusted analysis in our logistic regression model. The results of this adjusted analysis, as presented in Table 2, yielded important insights:

**Attitude on Hepatitis Infection:** After adjusting for other variables, attitude remained significantly associated with hepatitis B infection (AOR=2.66,  $p=0.0309$ ). This suggests that individuals with an unfavorable attitude towards hepatitis are at significantly higher odds of contracting hepatitis B compared to those with a favorable attitude. In other words, the adjusted odds of hepatitis B infection are notably greater among those with an unfavorable attitude.

**Practice on Hepatitis Infection:** Adjusted analysis also confirmed a significant association between practice and hepatitis B infection. Specifically, intravenous drug users with unsafe practices regarding hepatitis were significantly more likely to be affected by hepatitis B virus compared to those with safe practices (AOR=2.95,  $p=0.0344$ ). These findings underscore the importance of addressing both attitudes and practices in interventions aimed at reducing hepatitis B infection among intravenous drug users. They also emphasize the significance of marital status as a potential risk factor.

### Hepatitis C Virus (HCV) Infection

The results presented in Table 2 provide valuable insights into the factors associated with hepatitis C virus infection among our study participants:

**Table 1**Crude Association between Participants’ Characteristics and Viral Hepatitis B and Viral Hepatitis C Infection

Variable	Tested for Hepatitis B				Tested for Hepatitis C			
	Positive N(%)	Negative N(%)	OR(95% CI)	P-Value	Positive N (%)	Negative N (%)	OR(95%CI)	P-Value
<b>Age(Years)</b>				0.3061				0.5125
18-24	9(20.00)	36(80.00)	Reference		4(8.89)	41(91.11)	Reference	
25-30	13(15.66)	70(84.34)	0.74[0.29,1.90]	0.5355	10(12.05)	73(87.95)	1.40[0.41,4.76]	0.5859
31-36	5(10.64)	42(89.36)	0.48[0.15,1.55]	0.2180	7(14.89)	40(85.11)	1.79[0.49,6.60]	0.3796
37+	10(25.64)	29(74.36)	1.38[0.50,3.84]	0.6385	2(5.13)	37(94.87)	0.55[0.10,3.20]	0.5096
<b>Sex</b>								
Male	33(18.33)	147(81.67)	Reference		21(11.67)	159(88.33)	Reference	
Female	4(11.76)	30(88.24)	0.59[0.20,1.80]	0.3574	2(5.88)	32(94.12)	0.47[0.11,2.12]	0.3280
<b>Marital Status</b>								
Married/ Cohabiting	6(12.77)	41(87.23)	1.56[0.61,3.99]	0.3562	1(2.13)	46(97.87)	Reference	
Single/ Divorced	31(18.56)	136(81.44)	Reference		22(13.17)	145(86.83)	6.98[1.92,23.18]	<b>0.0308</b>
<b>Knowledge of hepatitis infection</b>								
In adequate	13(14.13)	79(85.87)	0.67[0.32,1.40]	0.2906	12(13.04)	80(86.96)	1.51[0.64,3.60]	0.3487
Adequate	24(19.67)	98(80.33)	Reference		11(9.02)	111(90.98)	Reference	
<b>Attitude on hepatitis infection</b>								
Favourable	7(8.64)	74(91.36)	Reference		4(4.94)	77(95.06)	Reference	
Unfavourable	30(22.56)	103(77.44)	3.08[1.28,7.39]	<b>0.0118</b>	19(14.29)	114(85.71)	3.21[1.05,9.79]	<b>0.0407</b>
<b>Practice hepatitis infection</b>								
Safe practice	4(7.02)	53(92.98)	Reference		1(1.75)	56(98.25)	Reference	
Unsafe practice	33(21.02)	124(78.98)	3.53[1.19,10.45]	<b>0.0230</b>	22(14.01)	135(85.99)	9.13[1.20,69.35]	<b>0.0326</b>

**Attitude on Hepatitis Infection:** The analysis indicates a significant association between hepatitis C virus infection and attitude toward hepatitis (COR=3.21, p=0.0407). This implies that individuals with unfavourable attitudes are significantly more likely to be affected by hepatitis C compared to those with favourable attitudes.

tested positive for hepatitis C, while only 4.9% of those with favourable attitudes were infected.

**Practice on Hepatitis Infection:** Similarly, there was a significant association between hepatitis C infection and practice regarding hepatitis (COR=9.13, p=0.0326).

**Table 2**Adjusted odds ratios (AOR) for Association between Participants’ Characteristics and Viral Hepatitis B and C Infection

Variable	HEPATITIS C			HEPATITIS B		
	AOR	95% CI	P-Value	AOR	95% CI	P-Value
<b>Current marital status</b>						
Married/ Cohabiting	Reference			–	–	–
Single/ Divorced	9.31	[1.19,72.67]	<b>0.0334</b>	–	–	–
<b>Attitude on hepatitis infection</b>						
Favourable	Reference			Reference		
Unfavourable	2.87	[1.90,9.14]	<b>0.0441</b>	2.66	[1.09,6.47]	<b>0.0309</b>
<b>Practice on hepatitis infection</b>						
Safe practice	Reference			Reference		
Unsafe practice	–	–	–	2.95	[1.28, 8.89]	<b>0.0244</b>

to only 1.8% among those with safe practices. However, in the adjusted analysis, although not significant, subjects with unsafe practices still showed a higher likelihood of being affected by hepatitis C (OR=5.85, p=0.0940).

**Marital Status:** Single or divorced subjects were significantly more likely to be affected by hepatitis C infection compared to those who were married or cohabiting (COR=6.98, p=0.0308). In the adjusted analysis, the odds remained high (OR=9.31, p=0.0334), emphasizing the significance of marital status in relation to hepatitis C infection. While age (p=0.5125), sex (p=0.3280), and knowledge about hepatitis infection (p=0.3487) did not show significant associations with hepatitis C infection in the crude analysis, it's essential to note the role of these factors in understanding the overall risk and prevalence of hepatitis C within this population. These findings underscore the multifaceted nature of factors contributing to hepatitis C infection among intravenous drug users. They highlight the importance of addressing attitudes, practices, and marital status in comprehensive interventions aimed at reducing the prevalence of hepatitis C within this community.

## DISCUSSION

The prevalence of Hepatitis B among intravenous drug users was 17.3%, while the prevalence of Hepatitis C infection was 10.7%. Among PWID, the prevalence of Hepatitis B was higher than that of Hepatitis C. However, it was still higher than the prevalence of Hepatitis B among healthcare workers (HCWs) in a tertiary hospital in the northern part of Tanzania, which was reported as 7.0% (Mueller A., et al., 2015). Among blood donors, the prevalence was found to be 4.1% for Hepatitis B and 1% for Hepatitis C (Mohamed Z, et al., 2019). Therefore, the prevalence among PWID remains notably higher than in other groups. Our findings also indicate an increase in infection rates with these viruses among PWIDs when compared to previous reports from Tanzania (Khatib A., et al., 2017).

The rates of infections with these two viruses have shown a steady rise (Mlunde LB, et al., 2016, Bowring AL, et al., 2013 & Tan AX, et al., 2015). These findings underscore the urgent need to focus on PWID as a key population for strategies aimed at controlling viral hepatitis infections. However, it's worth noting that the prevalence of Hepatitis C in this study is lower when compared to global prevalence, the prevalence in Sub-Saharan Africa (SSA), and Tanzania, which are reported as 52.2%, 21.2%, and 16.2% respectively (Degenhardt L., et al., 2017, Leyna GH., et al., 2019 & Kawambwa RH., et al., 2020). This discrepancy can be attributed to interventions that have been implemented among the general population to educate and assist PWID in preventing the spread of infections. For instance, participants aged 37 years and above showed a higher prevalence of hepatitis B infection compared to other age groups in the study.

Several challenges were encountered during the whole process of this study, including recall bias among respondents, difficulties in the blood sample collection process, and unfriendly hotspots. There were also instances of excessive demands for money from hotspot owners. To address these challenges, the use of counselors when requesting participants to undergo HBV and HCV status checks, as well as involving

key gatekeepers who facilitated introductions to PWID and data collection, proved to be more precise ways to manage time constraints. Clear explanations were also provided to clarify that the study was research-based and not a donor-funded activity, as some participants believed.

The findings from this study may reflect similar trends in other communities and can be valuable for informing future studies and the development of management and prevention programs. They provide essential information for resource allocation in hepatitis prevention interventions and the planning of programs for intravenous drug users (IDUs).

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