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Prevalence of *Hepatitis C Virus* Infection among People Living with HIV/AIDS Attending Specialist Hospital Sokoto, Nigeria

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Abstract

The Hepatitis C virus (HCV) remains a large healthcare burden. Human Immunodeficiency Virus (HIV) and HCV coinfection are major global health concerns worldwide. This study aimed to assess the HIV/HCV coinfection and the potential risk factors among people attending Specialist Hospital, Sokoto. A cross-sectional seroprevalence survey of HCV infection was carried out on 77 HIV/AIDS reactive subjects attending Specialist Hospital, Sokoto, from 30th March 2021 to 4th May 2021. Serum samples were tested for anti-HCV antibodies using immunochromatographic test. Of the 77 study participants, the overall anti-HCV antibody prevalence was 5.2%. The 36-40 age group revealed the highest seropositivity of 18.18%, followed by 51-55 years (14.29%) and the least (11.11%) among 26-30 years. Females had the highest seropositivity of 6.25% and males least (3.45%). The highest seropositivity was seen among the Hausa tribe (7.14%), while the least in Fulani (5.56%). The highest seropositivity was recorded among people with no formal education (6.82%), while people with formal education had the least (5.88%). The highest seropositivity was seen in self-employed individuals (6.52%) regarding occupational status, while employed individuals had the least (4.17%). Married individuals had the highest seropositivity of 7.69%, while the divorced and widow/widower had 5.26% and 4.76% respectively. People who injected drugs recorded the highest seropositivity of 33.33%, with multiple sex partners at 6.90%, while people who shared sharp objects had the least (6.67%). There were no significant differences statistically in HCV seroprevalence among the different age categories, gender, tribe, education, occupation, marital and risk factors ($p>0.05$). The HCV prevalence rate (5.8%) observed in this study underscored the need to intensify HCV screening among people living with HIV/AIDS for early diagnosis and management of cases.

Keywords: *Hepatitis C, HIV, AIDS, Seroprevalence, Risk factors, Sokoto,*

INTRODUCTION

The *Hepatitis C virus*(HCV) is a major cause of chronic liver disease worldwide (Williams, 2006). According to the World Health Organization (WHO), approximately 170 million individuals are HCV-positive globally, with 3-4 million new cases annually. Africa bears the highest burden, with an estimated 32 million infections and a prevalence of 5.3% in Sub-Saharan Africa. The Eastern Mediterranean (4.6%) and Western Pacific (3.9%) regions also report significant prevalence rates (Okonkwo *et al.*, (2017); WHO, (2012).HCV infection is a significant global health concern, particularly among populations with compromised immune systems (Okonko *et al.*,2020). One such

vulnerable group includes People Living With HIV/AIDS (PLWHA).

Human immunodeficiency virus (HIV) prevalence, on the other hand, also remains a significant global health concern, with Africa bearing a disproportionate burden. Sub-Saharan Africa accounts for the highest number of HIV cases worldwide, with Nigeria having one of the largest populations living with HIV/AIDS. Despite global efforts, HIV continues to pose a major public health challenge in Africa, specifically in Nigeria (Nwalozie *et al.*, 2024). Approximately 2.3 million people globally are simultaneously infected with both HIV and *Hepatitis C virus* (HCV). Individuals with HIV are

six times more likely to contract HCV than those without HIV (Gobran *et al.*, 2021). Coinfection with HCV and HIV is a critical public health issue due to the complex interplay between the two viruses, which can exacerbate disease progression and complicate treatment regimens (Sulkowski, 2016; Aliyu *et al.*, 2021; Eleje *et al.*, 2022). In PLWHA, the presence of HIV can facilitate a more rapid progression of HCV-related liver disease, leading to higher morbidity and mortality rates (Thomadakis *et al.*, 2024). Furthermore, managing co-infected patients presents additional challenges, including drug interactions and the increased risk of antiretroviral therapy (ART) resistance (Grzeszczuk *et al.*, 2015; Hajizadeh *et al.*, 2024).

HIV and HCV coinfection is common due to shared transmission routes (Gedefie *et al.*, 2023; Ali *et al.*, 2024; Li *et al.*, 2024). HCV is primarily transmitted through blood-to-blood contact, which can occur through practices such as intravenous drug use, unsafe medical procedures, and blood transfusions (Xia *et al.*, 2008; Jafari *et al.*, 2010; Yousefpouran *et al.*, 2020; Ali *et al.*, 2024). People living with HIV are at higher risk of HCV infection, which can accelerate liver disease progression and complicate treatment (Grzeszczuk *et al.*, 2015; Yusuf-Ajibade *et al.*, 2023; Famoni *et al.*, 2024). HIV impairs the immune system, making it harder for the body to control HCV, and coinfection can lead to more severe liver damage and an increased risk of liver-related mortality. HIV and HCV coinfection is a significant concern, as it complicates managing and treating both infections (Chen *et al.*, 2014; Balmasova *et al.*, 2019; Thomadakis *et al.*, 2024). Coinfected individuals often experience faster progression of liver disease and may have a reduced response to HCV treatment (Ellwanger *et al.*, 2018). This underscores the importance of integrated care approaches for HIV/HCV coinfection to optimize treatment outcomes and control both infections effectively (Elrashdyet *et al.*, 2022; Li *et al.*, 2024; Thomadakis *et al.*, 2024).

Understanding the prevalence of HCV among people living with HIV/AIDS is crucial for public health planning and management (Ryscavage *et al.*, 2024). Coinfection presents unique challenges, necessitating integrated care approaches to improve health outcomes for affected individuals (Piekarska *et al.*, 2024). Sokoto, located in the northwestern region of Nigeria, is home to a significant number of

PLWHA. The Specialist Hospital Sokoto, a leading healthcare institution in the region, provides critical care and support to this population. Understanding the prevalence of HCV infection among PLWHA in this setting is crucial for developing targeted interventions, optimizing clinical outcomes, and reducing the burden of these coinfections. This study aims to assess the prevalence of HCV infection among PLWHA attending Specialist Hospital Sokoto. The findings will inform local healthcare policies and strategies and contribute to the global understanding of HCV/HIV coinfection dynamics.

MATERIALS AND METHODS

Study Area and Study Design

Sokoto State, located in the extreme northwest of Nigeria, shares a border with the Republic of Niger. It covers an area of 25,973 km² and has a population of 3,702,676, according to the 2006 census (National Population Commission NPC, 2017). The state's coordinates are 13°05'N 05°15'E. Sokoto, the capital and largest city, lies near the confluence of the Sokoto River and the Rima River. The state is predominantly populated by Fulani and Hausa people, with over 80% of the population engaged in agriculture. Sokoto State is in the dry Sahel region, characterized by sandy savannah and isolated hills. The area experiences an annual average temperature of 28.3°C (82.9°F). The hottest months are February to April, with daytime temperatures exceeding 45°C (113°F). The rainy season occurs from June to October, featuring brief daily showers. From late October to February, the Harmattan wind from the Sahara brings dust, lowering temperatures and causing dusty conditions.

The cross-sectional study was designed to evaluate the prevalence of HCV among people living with HIV/AIDS attending Specialist Hospital, Sokoto.

Study Population, Inclusion Criteria and Exclusion Criteria

HIV clients attending the ART clinic, newly diagnosed with HIV at the Voluntary Counseling and Testing (VCT) Center Clinic of Specialist Hospital, Sokoto, were recruited for the study.

Individuals who tested reactive to HIV antibodies and gave their consent were included in the study.

Clients who appeared non-reactive to HIV antibodies or who declined to give their consent were excluded from the study.

Sample Size Determination

The required sample size was determined using the formula Thrustfield (1997) described.

$$n = \frac{Z^2pq}{d^2}$$

Where,

n = Minimum required sample size

z = Standard Normal deviation (1.96)

p = Prevalence rate from the previous study (5.3%) (Okonkwo *et al.*, 2017)

q = 1 - p

d = Precision tolerance margin of error (0.05)

Therefore:

$$N = \frac{(1.96)^2 \times 0.053 \times (1-0.053)}{(0.05)^2} = 77$$

A total of 77 patients were randomly recruited and screened for HCV.

Ethical Consideration

Ethical permission was sought from the Ethical Review Committee of the Sokoto Specialist Hospital and patient consents were also sought before enrolment.

Data Collection

In this study, questionnaires were employed to gather data from every patient. All patients meeting the inclusion criteria underwent detailed interviews, and the information was documented using a designated questionnaire. The inquiries covered various aspects such as gender, marital status, occupation, history of blood transfusions, tattoos, intravenous drug usage, gestational age, and level of education.

Specimen Collection and Sample Analysis

Aseptic blood samples were obtained from each participant via the median cubital, basilic, or cephalic vein after disinfection with 70% alcohol. A tourniquet was applied above the forearm, and three milliliters (3ml) of venous blood were drawn from each patient using a sterile syringe and needle into a plain sample tube. The samples were left at room temperature for clotting and retraction, then centrifuged at 3000 rpm for 3 minutes, and the serum was transferred into sterile cryovials.

HCV screening test was done using a Narrow-Care Rapid Test Strip (serum) Package insert with LOT NO:20200630.

Procedure

Before testing, the test specimen and controls were brought to room temperature (15-30°C). The test strip was taken out of the sealed pouch and used immediately. The strip was dipped vertically into the specimen for at least 15 seconds, ensuring it was completely wet but not letting the specimen rise above the arrows marked on the strip. During this time, a timer was started. After removal from the specimen, the strip was placed on a clean, flat, non-absorbent surface and left to stand for 15 minutes before reading the result. The result was not read after 30 minutes.

Result Interpretation

Positive: Two distinct red lines will appear, one in the control region (C) and another in the test region (T).

Negative: One red line will appear in the control region (C), and no red line will appear in the test region (T).

Invalid: If the control line does not appear, it is likely due to insufficient specimen volume or incorrect procedural techniques. Review the procedure and repeat the test with a new strip.

Statistical Analysis

The age, gender, and other sociodemographic information of the study participants were collected through a questionnaire. Frequency tables were created for the variables, and the significance between categorical variables was tested using the Statistical Package for the Social Sciences (SPSS) (Version 20.0). A P value of less than 0.05, determined by the chi-square test, was considered significant.

RESULTS

A total of seventy-seven (77) venous whole blood samples were collected from people living with HIV/AIDS between ages five and seventy years at Specialist Hospital, Sokoto, Sokoto State, for the detection of the possible presence of *Hepatitis C* virus based on serological method. Of the 77 blood samples analyzed from the people living with HIV/AIDS for HCV, 4/77(5.2%) were reactive to *Hepatitis C* Surface Antigen (HCsAg) (Table 1).

Table 1: Overall prevalence of *Hepatitis C* virus among the study participants

HCV Result	N (%)
Positive	4 (5.20)
Negative	73 (94.80)
Total	77 (100)

Key: HCV=*Hepatitis C* Virus, N= Number of, % = Percentage

The age group of 36-40 years had the highest participation rate, with 11 out of 77 participants (14.29%). The age ranges with the lowest participation were 61-65 and 66-70 years, each with a frequency of 3 out of 77 (3.90%). The highest seropositivity was observed in the 36-40 age group, with 2 out of 11 participants (18.18%), followed by the 51-55 age group with 1 out of 7 participants (14.29%). The lowest seropositivity was in the 26-30 age group, with 1 out of 9 participants (11.11%) (Table 2).

Among the 77 HIV/AIDS participants, 29 (37.66%) were male, and 48 (62.34%) were female. The highest seropositivity was found among females, with 3 out of 48 (6.25%), while males had the lowest, with 1 out of 29 (3.45%) (Table 3).

Regarding ethnic groups, the highest participation was among Hausa individuals, with 42 out of 77 (54.54%), followed by Fulani, with 18 out of 77 (23.38%). The highest seropositivity was recorded among the Hausa, with 3 out of 42 (7.14%), and the lowest among the Fulani, with 1 out of 18 (5.56%) (Table 4).

Most participants had no formal education, with 41 out of 77 (53.25%), while 36 out of 77 (46.75%) had formal education. The highest seropositivity

was seen among those without formal education, with 3 out of 44 (6.82%), and the lowest among those with formal education, with 1 out of 17 (5.88%) (Table 5).

Among the 77 HIV/AIDS participants in the study, the highest frequency was among self-employed individuals, with 46 out of 77 (59.74%), followed by employed individuals, with 24 out of 77 (31.17%). The highest seropositivity was observed in the self-employed group, with 3 out of 46 (6.52%), while the lowest seropositivity was in the employed group, with 1 out of 24 (4.17%).

Regarding marital status, married individuals had the highest participation rate, with 26 out of 77 (33.77%), followed by widows/widowers, with 21 out of 77 (27.27%). The highest seropositivity was among married individuals, with 2 out of 26 (7.69%). The lowest seropositivity was observed among divorced individuals, with 1 out of 19 (5.26%), and widows/widowers, with 1 out of 21 (4.76%) (Table 7).

Regarding risk factors, the highest frequency was observed in individuals with multiple sex partners, with 29 out of 77 (37.66%), followed by those with a history of blood transfusion, with 17 out of 77 (22.08%). The last reported risk factor was a history of organ transplant (0%). The highest seropositivity was among people who inject drugs, with 1 out of 3 (33.33%), followed by individuals with multiple sex partners, with 2 out of 29 (6.90%). The lowest seropositivity was seen among those who share sharp objects, with 1 out of 15 (6.67%) (Table 8).

Table 2: Age-based distribution of *Hepatitis C* Virus infection among the study participants

Age group (years)	No. Examined	No. positive N (%)	No. negative N (%)	Chi-square(X ²)	P-value
0-5	4	0 (0)	4 (100)		
6-10	6	0 (0)	6 (100)		
11-15	8	0 (0)	8 (100)		
16-20	3	0 (0)	3 (100)		
21-25	4	0 (0)	4 (100)		
26-30	9	1 (11.11)	8 (88.89)		
31-35	6	0 (0)	6 (100)	8.321	0.822
36-40	11	2 (18.18)	9 (81.81)		
41-45	5	0 (0)	5 (100)		
46-50	4	0 (0)	4 (100)		
51-55	6	1 (16.67)	5 (83.33)		
56-60	4	0 (0)	4 (100)		
61-65	3	0 (0)	3 (100)		
66-70	3	0 (0)	3 (100)		
Total	77	4	73		

Key: N= Number of, %= Percentage

Table 3: Gender-based distribution of *Hepatitis C Virus* infection among the study participants

Gender	No. Examined	No. positive		No. negative		Chi-square(X ²)	P-value
		N (%)	N (%)	N (%)	N (%)		
Male	29	1 (3.45)	28 (96.55)			0.288	0.591
Female	48	3 (6.25)	45 (93.75)				
Total	77	4	73				

Key: N= Number of, %= Percentage

Table 4: Tribe-based distribution of *Hepatitis C Virus* infection among the study participants

Tribe	No. Examined	No. positive		No. negative		Chi-square(X ²)	P-value
		N (%)	N (%)	N (%)	N (%)		
Hausa	42	3 (7.14)	39 (92.86)			1.26	0.868
Fulani	18	1 (5.56)	17 (94.44)				
Igbo	6	0 (0)	6 (100)				
Yoruba	8	0 (0)	8 (100)				
Others	3	0 (0)	3 (100)				
Total	77	4	73				

Key: N= Number of, %= Percentage

Table 5: Education-based distribution of *Hepatitis C Virus* infection among the study participants

Educational status	No. Examined	No. positive		No. negative		Chi-square(X ²)	P-value
		N (%)	N (%)	N (%)	N (%)		
Primary	17	1 (5.88)	16 (94.12)			1.161	0.762
Secondary	13	0 (0)	13 (100)				
Tertiary	3	0 (0)	3 (100)				
No formal education	44	3 (6.82)	41 (93.18)				
Total	77	4	73				

Key: N= Number of, %= Percentage

Table 6: Occupation-based distribution of *Hepatitis C Virus* infection among the study participants

Occupation	No. Examined	No. positive		No. negative		Chi-square(X ²)	P-value
		N (%)	N (%)	N (%)	N (%)		
Student	7	0 (0)	7 (100)			0.6	0.741
Employed	14	1 (7.14)	13 (92.86)				
Self-employed	56	3 (5.36)	53 (94.64)				
Total	77	4	73				

Key: N= Number of, %= Percentage

Table 7: Marital-based distribution of *Hepatitis C Virus* infection among the study participants

Marital status	No. Examined	No. positive		No. negative		Chi-square(X ²)	P-value
		N (%)	N (%)	N (%)	N (%)		
Single	17	0 (0)	17 (100)			0.94	0.816
Married	31	2 (6.45)	29 (93.55)				
Divorced	7	1 (14.29)	6 (85.71)				
Widow/widower	22	1 (4.54)	21 (95.45)				
Total	77	4	73				

Key: N= Number of, %= Percentage

Table 8: Risk factors associated with occurrence of Hepatitis C Virus among the study participants

Risk factor	No. Examined	No. positive N (%)	No. negative N (%)	Chi-square(X ²)	P-value
History of blood transfusion	17	1 (5.88)	16 (94.12)	6.703	0.244
History of tattoos	7	0 (0)	7 (100)		
People who inject drugs	3	0 (0)	3 (100)		
People who share sharp objects	15	1 (6.67)	14 (93.33)		
History of organ transplant	0	0 (0)	0 (0)		
History of accidental pricking	6	0 (0)	6 (100)		
Multiple sex partner	29	2 (6.9)	27 (93.1)		
Total	77	4	73		

Key: N= Number of, %= Percentage

DISCUSSION

The prevalence of *Hepatitis C* virus (HCV) infection among people living with HIV/AIDS in Nigeria is a significant health concern. This dual burden exacerbates health complications, necessitating comprehensive screening and integrated treatment strategies to improve patient outcomes and manage the spread of these infections (Piekarska et al., 2024; Ryscavage et al., 2024). This study aimed to determine the prevalence of *Hepatitis C* virus (HCV) infection and identify associated sociodemographic risk factors among individuals living with HIV/AIDS attending the Specialist Hospital in Sokoto. The outcome of this study reveals a notable coinfection rate of 5.2%, underscoring the importance of screening for HCV among HIV-positive individuals in this setting. This aligns closely with the findings from related studies. For instance, studies conducted by Rusine et al. (2013) in Rwanda, Gebre et al. (2005) in Ethiopia, Zenebe et al. (2015) in Bahir Dar, Khamis et al. (2016) in Egypt, and Dimitrakopoulos et al. (2000) in Greece reported similar prevalence rates. Notably, variations in prevalence across different regions, including Nigeria, may be attributed to socio-cultural practices, environmental factors, and modes of transmission.

In contrast, lower prevalence rates were observed in studies conducted by Mbotto et al. (2009) in Gambia, Amin et al. (2004) in South Africa, Walusansa et al. (2009) in Uganda, and Tripathi et al. (2007) in India. Similarly, studies within Nigeria reported lower prevalence rates, such as those conducted by Adekunle et al. (2011) in Ado Ekiti, Nneoma et al. (2019) in Abuja, Anigilage et al. (2013) in Makurdi Benue State, and Ya'aba et al. (2015) in Abuja.

Regarding coinfection rates, this study reported a lower prevalence compared to similar studies conducted elsewhere, including those by Forbi et al. (2007) in Keffi Nasarawa State, Nigeria; Verucchi et al. (2004) in North America and Europe, Alavi et al. (2007) in Iran, and Balogun et al. (2012) in Lagos, Nigeria. Platt et al. (2016) reported a prevalence of 2.4% in a global systematic review and meta-analysis, but on the other hand, a higher rate (60.94%) was reported by Hajizadeh et al. (2024) in a very recent systematic review and meta-analysis by Hajizadeh et al. (2024). Differences in findings may be attributed to various factors, such as the sensitivity of test reagents, socio-cultural differences, and regional variations in virus prevalence.

Analysis of age groups revealed the highest seropositivity among individuals aged 36-40 years, suggesting a potential age-related vulnerability to HCV infection within this population, consistent with findings by Okechukwu et al. (2014) and Ojide et al. (2015). Further research is warranted to explore the underlying factors driving this association.

Furthermore, Gender disparities in seropositivity were evident, with females exhibiting a higher seropositivity rate compared to males, possibly due to increased rates of unprotected sexual practices, as observed in other studies highlighting the vulnerability of females to blood-borne infections due to biological and socio-cultural factors (Balmasova et al., 2019; Ali et al., 2024). Addressing gender-specific risk factors and ensuring equitable access to prevention and treatment services are crucial for mitigating this disparity.

Ethnicity and educational attainment also emerged as notable determinants of HCV seropositivity. The higher participation among

Hausa individuals could be attributed to demographic factors, cultural practices, or healthcare-seeking behavior within this population. However, further investigation is needed to elucidate the specific cultural or socio-economic factors contributing to the observed disparities in seropositivity among different ethnic groups. Additionally, individuals with no formal education demonstrated a higher prevalence, underscoring the importance of education in raising awareness and reducing the risk of infection, as noted by [Nwankiti et al. \(2012\)](#). Moreover, self-employed individuals and married couples exhibited elevated seropositivity rates, indicating potential socioeconomic factors and intimate partner transmission as significant contributors to HCV infection within these groups.

Regarding risk factors, our study corroborates existing evidence linking high-risk behaviors such as multiple sex partners and history of blood transfusion to increased HCV seropositivity among HIV/AIDS patients ([Famoni et al., 2024](#); [Hajizadeh et al., 2024](#); [Thomadakis et al., 2024](#)). The absence of reported cases of organ transplant history among seropositive individuals underscores the effectiveness of preventive measures in transplant settings. Furthermore, people who inject drugs displayed the highest seropositivity rate, highlighting the critical role of needle-sharing behaviors in HCV transmission, consistent with previous research by [Carmen et al. \(2014\)](#), [Adepoju et al. \(2018\)](#), and [Nneoma et al. \(2019\)](#).

Interventions for reducing the spread of HCV among HIV patients are critical and should be comprehensive and tailored to address specific risk factors associated with coinfection ([Piekarska et al., 2024](#)). Some key strategies include: 1) Implementing educational programs to increase awareness about the modes of transmission and risk factors for HCV among HIV patients. This includes information about safer sex practices, harm reduction strategies for injecting drug use, and the importance of regular screening for both viruses; 2) Ensuring widespread access to HCV testing and treatment services for HIV patients, including those in resource-limited settings. Early detection of HCV allows for timely intervention and reduces the risk of transmission to others; 3) Providing access to clean needles and syringes through needle exchange programs and harm reduction initiatives for individuals who inject drugs. This helps to reduce the risk of HCV transmission through contaminated needles; 4) Encouraging

consistent and correct use of condoms among HIV patients to prevent sexual transmission of HCV, particularly among those engaging in high-risk sexual behaviors; 5) Integrating HCV screening, prevention, and treatment services into existing HIV care and treatment programs to ensure comprehensive care for co-infected individuals; 6) Scaling up HCV treatment among HIV patients to achieve sustained virologic response, which not only improves individual health outcomes but also reduces the risk of HCV transmission to others and 7) Engaging peer educators and support groups composed of HIV-positive individuals who have successfully navigated coinfection to provide peer support, education, and linkage to care for others facing similar challenges. By implementing these interventions in a coordinated and holistic manner, it is possible to reduce the spread of HCV among HIV patients, improve health outcomes, and contribute to the overall control of both infections ([Famoni et al., 2024](#); [Hajizadeh et al., 2024](#); [Thomadakis et al., 2024](#)).

CONCLUSION

In conclusion, this study reveals a 5.2% prevalence of HCV infection among HIV/AIDS patients at Specialist Hospital, Sokoto. This rate aligns with some regional and international studies, highlighting consistent patterns of HCV coinfection. Variations in prevalence underscore the influence of sociocultural practices, environmental factors, and transmission modes. Key findings indicate the need for targeted public health interventions. Higher seropositivity among individuals aged 36-40 and females suggest age- and gender-specific preventive measures. Ethnic and educational disparities, particularly among Hausas and those without formal education, call for culturally tailored health education programs. Elevated seropositivity among self-employed individuals and married couples points to socioeconomic factors and intimate partner transmission. The high rate among people who inject drugs emphasizes the need for harm reduction strategies, including needle exchange programs and substance abuse treatment. Overall, a multifaceted approach integrating demographic-specific strategies, education, socioeconomic support, and harm reduction is essential to reduce HCV transmission among HIV/AIDS patients in Nigeria and similar settings.

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