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Prevalence and Risk Factors of Hepatitis C Virus Antibodies among Inmates in North Central Nigeria: A Cross-Sectional Study

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Abstract
Hepatitis C is a serious global health concern, with an estimated 189 million cases and 71 million chronic carriers. The lack of data among certain populations in low- and middle-income nations like Nigeria exacerbates the dilemma. The purpose of this research is to ascertain the prevalence of anti-hepatitis C virus antibodies in adult inmates in north-central Nigeria. In this cross-sectional survey, 385 adult inmates (age 18 years and above) were enrolled from three selected correctional facilities in North Central Nigeria. Each volunteer gave their informed consent before blood sample collection. An interviewer-administered questionnaire was administered to the consented 385 inmates. A venous blood sample (5mL) was collected from each inmate and tested for the presence of HCV antibody. Aria HCV Ab PLUS COMBO Rapid Test cassette, which is a lateral flow chromatographic immunoassay, was used to screen the samples for anti-HCV antibodies. The sensitivity and specificity of the test are 98.7% and 99.6%, respectively, while the overall Agreement is 99.3%. The screening is performed according to the manufacturer's instructions. The mean age of the participants was 33.92 years. The prevalence of anti-HCV antibodies was 7.27%, indicating a significant health concern among inmates. These findings suggest the need for enhanced screening and preventive measures in correctional facilities. The bivariate analyses of risk factors associated with the transmission of hepatitis c virus infection showed no statistical significance. The high prevalence (7.27%) of anti-HCV antibodies among the inmates calls for serious and urgent public health intervention through enhanced screening and public education. The documented risk factors associated with transmission of hepatitis c virus need to be reviewed, particularly in low- and middle-income countries, as there may be other possible routes of hepatitis c virus transmission other than parenteral.
Key Words: Anti-HCV-Ab, Hepatitis C virus, Prevalence, Risk Factors, incarceration.

INTRODUCTION

Hepatitis C is a serious global health concern, with an estimated 189 million cases (Spearman *et al.*, 2019) and 71 million chronic carriers (Spearman *et al.*, 2019) and is the foremost cause of mortality and morbidity due to liver-related problems such as liver cirrhosis, hepatocellular cancer, liver failure, and death (Stanaway *et al.*, 2016). According to Huang and colleagues (Huang *et al.*, 2022), HCV accounts for 29% of deaths attributed to liver cancer.

The global spread of HCV is uneven, with varying prevalence in different nations and the most afflicted regions being Europe and the Eastern Mediterranean, with a prevalence of >3.5% in the general population(Gower *et al.*, 2014) whereas low-prevalence of <1.5% regions include Asia-Pacific, Latin America, and North America. According to updated estimates, the prevalence of HCV is 2.98% throughout Africa, with Southeast Africa having a lower incidence than West Africa (Rao *et al.*, 2015). The seroprevalence of HCV in Nigeria varies depending on the study population and the geographical setting(Onyekwere *et al.*, 2016).

According to previous studies, a significant number of HCV cases are observed in certain groups, such as incarcerated and people who inject drugs (PWID) (Falla *et al.*, 2018). HCV prevalence in prison is higher than in the general population due to high-risk behaviors such as injecting drug use, tattooing, or sharing drug injection equipment(Behzadifar *et al.*, 2018).

Furthermore, incarcerating PWID and criminalizing drug use increase their vulnerability. The global prevalence of HCV among the incarcerated population is 15.4% (Moazen *et al.*, 2020). Prisons offer a population with a high prevalence of diseases and risk factors, as well as affordable treatment options, making them a prime location for interventions aimed at combating the HCV epidemic. The general population's risk of contracting the disease may decline as a result of HCV therapy in certain areas(Daniels & Studdert, 2020). Among prison inmates, (Dan-Nwafor *et al.*, 2018) and (Okafor *et al.*, 2020), have reported HCV prevalence of 5.9% and 29.65% respectively.

The WHO target of eradicate viral hepatitis by diagnosing 90% of eligible individuals and treating 80% of them will be a mirage (World Health Organization & Global Hepatitis Programme, WHO, 2017) if high-risk groups(Midgard *et al.*, 2016) such as those incarcerated are not given the needed attention. On the other hand, not much is known about how HCV testing and treatment are going for the most impacted groups, which are PWID and inmates(Oru & Verster, 2019). Information regarding the frequency of the hepatitis C virus among prisoners in Nigeria's correctional facilities is scarce. This study aims to determine the prevalence of anti-HCV antibodies among inmates in North Central Nigeria, a population often overlooked in health surveys.

MATERIALS ANS METHODS

A cross-sectional survey was conducted among 385 inmates selected randomly from correctional facilities. Blood samples were tested for anti-HCV antibodies using the Aria HCV Ab PLUS COMBO Rapid Test, with sensitivity and specificity of 98.7% and 99.6%, respectively. Statistical significance was determined using Epi Info version 7, with a p-value threshold of ≤0.05.

This survey was conducted at the correctional facilities of Kuje, Keffi New, and Jos, respectively. Samples were collected between May and August 2022. Information on sociodemographic characteristics and risk factors, such as history of injection drug use and history of hepatitis C infection, were gathered using a structured interviewer-administered questionnaire. Using an aseptic approach, each respondent had 5ml of blood drawn into an EDTA vacutainer tube using a vacutainer blood collection device from a big, firm vein in the antecubital fossa. The skin was cleaned with a swab of 70% alcohol, and the area was left to air dry after a tourniquet was applied to highlight the vein. As soon as possible, the samples were sent to the appropriate designated laboratories—the Plateau State Human Virology Research Centre, Jos, which covers the Jos Correctional Center, and the Medical Microbiology Laboratory of the National Hospital, Abuja, which covered the Kuje and Keffi New Correctional Centers. The test was carried out in accordance with the manufacturer's instructions.

Principle of the serological test kit: The Aria HCV Ab Plus Rapid Test is a double antigen lateral flow chromatographic immunoassay for the qualitative detection of anti-hepatitis C virus antibodies (IgG, IgM, IgA) in human plasma. The test device is pre-coated with recombinant HCV fusion antigen covering the core, NS3, NS4, and NS5 of the hepatitis C virus open reading frame (ORF). The test cassette has an internal quality control - C line, which is pre-coated with a control line antibody

Ethical Consideration: Prior to the blood collection and interview, each subject gave their informed consent. The National Health Research Ethics Committee of Nigeria (NHREC/01/01/2007-29/06/2022) and the Nigeria Correction Service Headquarters in Abuja (NCS.65/VOL.T/215) provided the administrative and ethical permissions, respectively.

RESULTS

A total of 385 Inmates participated in this study. Age ranged from 18-80 years (mean age 33.92); 368 were males (95.6%), while 17 were females (4.4%). The prevalence of serological evidence of hepatitis C virus infection among the inmates is 7.27% (Table 1). Occupation has no significant role in exposing people to getting infected with the hepatitis c virus. This table further shows that unemployment is not a risk factor for getting infected with the hepatitis c virus. The bivariate analysis reveals no statistical significance between serological evidence of hepatitis c virus infection and the associated risk factors (Table 2).

Table 1: Sociodemographic characteristics of the study population in relationship with Anti-HCV Ab Status

Characteristics	Anti-HCV Antibody No. of Positive (%)	No. of Negative (%)	95% CI
Sex			
Male	**27(7.34)**	**341(92.66)**	**0.16 – 9.92**
Female	**1(5.88)**	**16(94.12)**	
Total	**28(7.27)**	**357(92.73)**	
Age (years)			
<25	**1(1.67)**	**59(98.33)**	
25-34	**10(5.81)**	**162(94.19)**	
35-44	**10(10.10)**	**89(89.90)**	
45+yrs	**7(12.96)**	**47(87.04)**	
Marital Status			
Single	**16(7.84)**	**188(92.16)**	**0.5512 – 2.6063**
Married	**12(6.63)**	**169(93.37)**	
Occupation			
Employed	**19(7.54)**	**233(92.46)**	**0.4936 – 2.5573**
Unemployed	**9(6.77)**	**124(93.23)**	

The prevalence of anti-HCV antibodies is 7.27% (Table 1). Detailed analysis revealed that the highest prevalence was among inmates aged 45 and above (12.96%).

Table 2: Risk factors associated with Anti-hepatitis C virus (HCV)-Ab positivity among the study population

Risk Factors	Anti-HCV Antibody Positive (%)	Negative (%)	95% CI	*P*-Value
Length of Incarceration (Months)	43.21	44.25		0.9185
Injection drug use	2(4.44)	43(93.56)	0.1287 – 2.4507	0.4374
Sex with condom	10(7.09)	131(92.91)	0.4296 – 2.1383	0.9175
Surgery	2(4.08)	47(95.92)	0.1166 – 2.2080	0.5556
Blood transfusion	5(11.36)	39(88.64)	0.6375 – 4.9290	0.2674
Sharing of Tooth Brush	1(5.88)	16(94.12)	0.1008 – 6.1807	1.0000
Tattoo	2(2.56)	76(97.44)	0.0660 – 1.2252	0.0874
Tribal Marks	7(7.78)	83(92.22)	0.4519 – 2.6795	0.8332
Piercing	4(3.39)	114(96.61)	0.1204 – 1.0479	0.0562

Among the risk factors analysed, no statistically significant associations were found (Table 2).

DISCUSSION

The prevalence of 7.27% among incarcerated adults in North Central Nigeria is higher than that reported by Dan-Nwafor (Dan-Nwafor *et al.*, 2018) and colleagues (5.9%) but lower than that reported by Okafor and colleagues (Okafor *et al.*, 2020) (29.6%) among the incarcerated population in Enugu. This suggests regional variations and highlights the need for targeted interventions. The results of this study seem to contradict, however, the assumption that people who inject drugs are more concentrated in prisons. Across the globe, there is a concentration of HCV cases in criminal justice systems, primarily due to the fact that drug use is now considered a crime (Kamarulzaman *et al.*, 2019). The prisons remain the best option for public health efforts toward eliminating hepatitis c virus infection as a public health problem (Jack *et al.*, 2020).

With a worldwide prevalence of 15.4%, hepatitis C virus (HCV) has been estimated to be the most prevalent major infectious disease in prisons. The exceptionally high prevalence of HCV in prisons is attributable to common risk behaviors, including sharing contaminated tattooing equipment and drug paraphernalia, as well as a lack of HCV control interventions, including needle and syringe programs(Moazen *et al.*, 2020). The study investigated the demographic data of prisoners, including age, marital status, drug injection

history, tattoos, piercings, having previously had blood transfusions, high-risk sexual behavior, occupation, and length of incarceration. The results indicated that none of these variables was significantly linked to HCV infection, agreeing with a study conducted by SeyedAlinaghi and colleagues (SeyedAlinaghi *et al.*, 2023), with the exception of the history of drug injection and tattooing that were found to be significantly associated with HCV infection (SeyedAlinaghi *et al.*, 2023).

Despite the importance of attention to prisoners as a highly at-risk population to acquire and transmit HCV, the number of HCV research and policy documents ignoring prisoners is increasing (Moazen *et al.*, 2020). Since more than 90% (Moazen *et al.*, 2020) of convicts are eventually released back into society, they could serve as a means of disseminating HCV throughout the general public. Prisoners must be considered an important group in order to effectively reduce the worldwide burden of HCV and achieve the goals put forth by the international community, such as the WHO's HCV elimination targets. Without aggressive case detection, prevention methods, and treatment for positive cases and patients in correctional facilities, HCV prevention is insufficient. These initiatives will have positive effects on the wider public in addition to those inside jail walls. We fear that the exclusion of inmates from HCV-related research and policies may cause a delay in the attainment of the global elimination of HCV.

Recommendation

With regional variation in HCV prevalence, we recommend that a nationwide screening for the incarcerated population be carried out in order to generate comprehensive data that will be better used to inform policy direction for the provision of better health care services for inmates in the country.

CONCLUSION

This study investigated the prevalence of HCV infection and its risk factors among incarcerated adults in North-Central Nigeria correctional facilities of Kuje, Keffi New, and Jos. The prevalence of HCV (7.27%) is high. Reviewing the established risk factors linked to hepatitis C virus transmission is necessary, especially in low- and middle-income nations where parenteral transmission may not be the only Route.

Conflict of interest

There is no conflict of interest by the authors of this publication.

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