Review

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Social Determinants of Health (SDoH) and Hepatitis B and C Health Inequalities Among Male Prisoners in Nigeria: A Narrative Literature Review

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Posted Date: 23 September 2024

doi: 10.20944/preprints202408.0910.v2

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Review

Social Determinants of Health (SDoH) and Hepatitis B and C Health Inequalities Among Male Prisoners in Nigeria: A Narrative Literature Review

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Abstract: Viral hepatitis caused by hepatitis B virus (HBV) and hepatitis C virus (HCV) pose a significant global health challenge, with an increasing number of deaths and a substantial burden on healthcare systems, among prisoners in particular. Nigeria ranks fifth in Africa for prison population, with 98.2% being males and are more likely than females to have higher rates of viral hepatitis and other risky behaviours. This literature review explores the impact of social determinants of health (SDoH) on the prevalence and outcomes of HBV and HCV infections among male prison inmates in Nigeria, by examining factors such as overcrowding, inadequate healthcare access, and food insecurity. This review reports the updated data on HBV and HCV infection rates among inmates in different regions in Nigeria, with a special focus on related risk factors, highlighting how these determinants contribute to the high rates of hepatitis infections in this category. The review underscores the urgent need for a multifaceted approach involving policy changes, improved healthcare access, and enhanced preventive measures to address these health disparities. The findings aim to inform public health strategies and interventions to reduce the transmission and impact of viral hepatitis in prison settings, aligning with global health goals and promoting health equity among this population group.

Keywords: viral hepatitis; hepatitis B virus (HBV); hepatitis C virus (HCV); social determinants of health (SDoH); inadequate healthcare access; prevalence; food insecurity; marginalised population group and Nigerian prisons

1. Introduction

The World Health Organization (WHO) has identified viral hepatitis, caused by hepatitis B (HBV) and hepatitis C viruses (HCV), as one of the most significant threats to global public health (WHO, 2017). Viral hepatitis is an inflammation of the liver, predominantly triggered by viral infections, and is a leading cause of morbidity and mortality worldwide (Jefferies et al., 2018; Wang et al., 2016). The burden of HBV and HCV is substantial, with the number of deaths rising from 0.89 million in 1990 to 1.45 million in 2013 (Stanaway et al., 2016; WHO, 2017). These blood-borne infections are transmitted through contact with infected blood or body fluids and are major contributors to global mortality, causing 1.4 million deaths annually (WHO, 2017; Torre et al., 2021). Both HBV and HCV can lead to acute and chronic infections, resulting in progressive liver damage, cirrhosis, hepatocellular carcinoma (HCC), and death (Berumen et al., 2021; Bashir et al., 2017). In 2016, the World Health Organization (WHO) launched a strategy to eradicate viral hepatitis by 2030, emphasising prevention, testing, and treatment (WHO, 2021).

In Nigeria, HBV and HCV prevalence rates are 8.1 and 1.1% respectively, among adults aged 15-64 years. The World Health Organization (WHO) supported the country in developing policy and guidance documents to prevent and treat viral hepatitis across the 5 core intervention areas, including vaccination, prevention of mother-to-child transmission, blood and injection safety, harm reduction and hepatitis B and C testing and treatment. Interestingly, the country was reported to have

 doi:10.20944/preprints202408.0910.v

established capacity for viral hepatitis response at all levels. In contrast, awareness and the cost of treatment are the major obstacles (WHO, 2023).

Globally, over 10.74 million people are incarcerated, with Africa having some of the highest prison populations (World Prison Brief, 2024). Nigeria ranks fifth in Africa in terms of prison population, with 78,621 inmates as of March 2024 (World Prison Brief, 2024). The Nigerian Correctional Service reported 80,507 inmates, 98.2% males (Nigerian Correctional Service, 2024). Males are more likely than females to have higher rates of viral hepatitis and other risky behaviours such as drug injection (Navadeh et al., 2013). Studies in various Nigerian prisons have shown high seroprevalence rates for HBV and HCV, with significant variation across different regions (Adoga et al., 2009; Uchechukwu et al., 2018; Okafor et al., 2020; Dan-Nwafor, 2021; Gimba et al., 2021; Dolan et al., 2016).

This literature review aims to critically examine the impact of social determinants of health (SDoH) on the prevalence and outcomes of HBV and HCV infections among male prison inmates in Nigeria. By exploring the intersectionality of overcrowding, inadequate healthcare access, and food insecurity, this review seeks to highlight key factors influencing viral hepatitis transmission and propose public health policies and strategies for mitigating health disparities within Nigerian prisons.

2. Social Determinants of Health (SDoH)

Social Determinants of Health (SDoH) refers to "the conditions in which people are born, grow, work, live, and age, as well as the wider set of forces and systems shaping the conditions of daily life," which includes "political systems, social norms, development agendas, economic policies, and systems" (World Health Organization, 2021). According to the rainbow model by Dahlgren and Whitehead (2021), these conditions could be categorized into individual lifestyle factors, social and community networks, living and working conditions, and eventually into general socioeconomic, cultural, and environmental conditions. The further conditions extend towards the final and outer layer, the more distal and so less proximal, i.e., individual, determinants become (Dahlgren & Whitehead 2021). Health inequalities, or the unfair and preventable differences in health status that are seen both within and between countries are mainly caused by the socioeconomic determinants of health (WHO, 2020). Prisons have been characterized as a "concentration mechanism" that contributes to the amplification and spread of infectious illnesses because they generate a complex intersection of personal, societal, and environmental issues (Kamarulzaman et al., 2016). These infections are linked to high rates of morbidity and death, especially if they are not tested for or treated (World Health Organisation, 2019b; World Health Organisation, 2019c; World Health Organisation, 2018). In Nigerian prisons, male inmates are disproportionately affected, and the prevalence of HBV and HCV is notably high. Social determinants of health SDoH such as overcrowding, inadequate healthcare access, and food insecurity play critical roles in exacerbating these infections. Understanding how these determinants intersect and affect health outcomes in this context is essential for developing targeted interventions and improving public health strategies.

2.1. Overcrowding and Unsanitary Conditions

Overcrowding and unsanitary conditions are major social determinants of health SDoH that impact the health of Nigerian prison inmates. These conditions facilitate the spread of infectious diseases, including HBV and HCV (World Health Organization, 2017). Overcrowded prisons increase the risk of transmission through contaminated razors, shared needles, and unprotected sexual activity (Khan et al., 2019; Morag MacDonald, 2018; Aldridge et al., 2018). The African judicial system's inadequacies contribute to prison congestion, further exacerbating the spread of infections (WHO, 2007; Terwase & Emeka, 2015; Omorotionwman, 2015). Due to overcrowding and inadequate cleanliness within the Nigerian prison system, bloodborne illnesses like hepatitis B virus and hepatitis C virus are more easily spread in prisons (World Health Organization, 2017). Lack of proper hygiene (unsanitary conditions) is not maintained within the prison facility which later affects the health of the inmates (Morag MacDonald, 2018). In comparison to the general population, the

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frequency of infectious illnesses, such as hepatitis B and C, is much greater among those who are jailed (Aldridge et al., 2018). Topp et al., (2016) found that the filthy and overcrowded conditions in jails exacerbate health disparities among inmates by increasing the spread of infectious illnesses. Nigerian jails frequently experience overcrowding due to the admission of prisoners over the statutory capacity and unsanitary conditions. Inmates at more than 240 prison institutions in Nigeria, according to a 2012 Amnesty International assessment, make up nearly 80% of the total number of prisoners under trial. Due to the resulting overpopulation, infectious illnesses like HBV can spread more easily (Terwase and Emeka, 2015). Additionally, overcrowding, inadequate infrastructure, insufficient infection control procedures, and restricted or non-existent access to appropriate diagnosis, care, and treatment all contribute to the worsening of health conditions in jails (Stöver et al., 2021).

2.2. Inadequate Healthcare Access

Inadequate access to quality healthcare significantly affects the ability to diagnose, treat, and monitor HBV and HCV infections in Nigerian prisons (Ahmed et al., 2019). Health facilities in prisons often suffer from inadequate staffing, poor equipment, and a lack of essential supplies (Durojaiye et al., 2019). This results in many prisoners receiving subpar care or going undiagnosed, which worsens health disparities and disease progression (Christopher et al., 2017). Despite international declarations advocating for prisoners' right to healthcare, access remains limited (United Nations, 2024; Bretschneider & Elger, 2014; NHS England, 2019, 2021). These issues have an impact on public health in addition to the health of individual inmates (Van Hout et al., 2019). Furthermore, health disparities or health inequalities associated with HBV/HCV infections among prisoners are made worse by the lack of access to antiviral drugs, diagnostic equipment, and deployment of trained healthcare professionals to prison facilities and this leads to a rise in the infection's dissemination and transmission (Ojieabu et al., 2020). Studies reveal that prison medical facilities frequently have inadequate staffing, inadequate equipment, and a deficiency of critical supplies needed to diagnose and treat infectious illnesses such as HBV and HCV. As a result, many prisoners go undetected or receive subpar care, which exacerbates health disparities among the population and causes liver disease to worsen (Durojaiye et al., 2019). Despite these numerous health-related challenges, prisoners frequently complain about inadequate care (Christopher et al., 2017). "Prisoners shall have access to health services available in the country without discrimination on the grounds of their legal situation," states the Universal Declaration of Principles adopted by the United Nations for treating prisoners (United Nations, 2024). However, this fundamental idea is rarely implemented, and inmates often have poorer access to healthcare than those not confined in most nations (Bretschneider & Elger, 2014).

2.3. Food and Nutrition Insecurity

Food and nutrition insecurity are critical social determinants of health SDoH contributing to health inequalities among Nigerian prisoners. Inadequate access to nutritionally sufficient and safe foods can lead to chronic diseases and exacerbate infectious diseases like HBV and HCV (Harding et al., 2014; Testa & Jackson, 2018, 2019; LaBriola, 2020; Apel & Powell, 2019; Harris & Harding, 2019). Dietary imbalances are common in prisons, especially in developing countries like Nigeria, and significantly impact inmates' health (Mattei et al., 2015; Singh et al., 2014; Meyer et al., 2015; United Nations, 1948, 2015; Sawyer, 2017; Kavithe et al., 2018). Food insecurity as a social determinant can increase the risk of severe health outcomes among prison inmates, including chronic diseases, like diabetes, cardiovascular disease, hypertension, asthma, and kidney disease (Testa & Jackson 2018; Testa & Jackson 2019); infectious diseases like HIV and HIV-HCV co-infection (LaBriola, 2020; Apel R, Powell, 2019; Harris & Harding, 2019) and mental health conditions, such as anxiety and depression (Jackson & Vaughn, 2017; Cox & Wallace, 2016). Dietary imbalances are associated with the development of chronic and deficiency diseases (Mattei et al., 2015; Singh et al., 2014). Also, adequate dietary intake can be a significant factor in rehabilitation programs, given the potential influence of specific nutrients on prosocial behaviours (Meyer et al., 2015). It is a fundamental human

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right for inmates to have access to sufficient nourishment, and in a bid to promote good health, they should be given a variety of dietary options (United Nations General Assembly, 1948; United Nations General Assembly, 2015). In low and middle-income countries like Nigeria, problems relating to nutrition are frequently disregarded, especially among marginalized population groups, such as those incarcerated (World Health Organization, 2014). There is insufficient variety and quality of food offered to inmates in many jails (Sawyer, 2017). In addition, dietary deficits are particularly common in jails in developing nations, with the largest prevalence occurring in low-income countries (Kavithe et al., 2018). Food insecurity among correctional populations seems to be among the highest of any population, at an estimated 70–91% with limited data (Dong et al., 2018; Wang et al., 2013). According to the United Nations Sustainable Development Goal 2 (SDG 2), achieving food security and improved nutrition is crucial for sustainable development worldwide (United Nations, 2015). By referring to Sustainable Development Goal 2, this review emphasizes the significance of addressing food insecurity among prisoners not only as a matter of public health but also as a part of broader global efforts to ensure access to safe and nutritious food for all individuals, regardless of their circumstances (United Nations, 2015). This aligns with the overarching goal of promoting sustainable agriculture and ending hunger as outlined in Sustainable Development Goal, 2 (SDG 2). Addressing food insecurity is crucial for promoting health and rehabilitation among prisoners (United Nations, 2015).

2.4. Addressing Health Disparities

A settings approach is advocated to address the health challenges faced by the prison population, promoting inclusion, and tackling inequities (Dooris, 2009; Department of Health, 2002; Baybutt et al., 2014; Ross, 2010). The ecological model, derived from Whitehead and Dahlgren's social model of health, emphasizes the importance of the environment in determining health outcomes (Barton & Grant, 2006). Implementing health promotion programs and enhancing access to high-quality healthcare in correctional settings is essential for improving the health and well-being of inmates (Baybutt & Chemlal, 2016; Travis et al., 2014).

3. HBV and HCV Prevalence among prison inmates in Nigeria

Perception of infection risk was low among inmates, with only 30% considering themselves at high risk for hepatitis ("In Nigeria, Boosting Viral Hepatitis Awareness and Treatment" 2023). Numerous studies have documented the prevalence of HBV and HCV among prisoners in Nigeria, linking these infections to various socioeconomic, cultural, and environmental risk factors. In this review, we provide updated data on HBV and HCV infection rates among inmates across different regions in Nigeria, with a particular focus on the associated risk factors.

3.1. HBV Prevalence

The prevalence of HBV infection among inmates in Calabar, Cross River State, Southern Nigeria, was found to be 10%, with male inmates showing the highest prevalence at 9.20%. The highest infection rate, 14.28%, was observed among inmates aged 40 years and above, while the lowest prevalence of 4.54% was recorded in those under 20 years old. There was a statistically significant association ($p<0.05$) between HBV infection and factors such as duration of stay in prison, equipment sharing, sexual exposure, multiple partners, and alcohol use. Alcoholism was also significantly linked to an increased risk of HBV infection (Okafor et al., 2023).

Ojodu and Galadima (2023) reported an HBV infection prevalence of 25.3% among male inmates and 25% among female inmates. The slightly higher rate in males reflects the larger male population within Nigerian prisons. The highest prevalence, 28.4%, was found in Minna Old Prison, while the lowest was in the Nigeria Prison Service, Bida, at 17.8%. HBV infection was most common among inmates aged 21-30 years, with a prevalence of 29.7%, and absent in those aged 61-70 years (0%). A statistically significant association was found between the sharing of objects and the high prevalence of HBV.

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The HBV seroprevalence among inmates at the Port Harcourt Maximum Security Custodial Centre was 4%, with significant associations found with blood oaths and a history of surgery ($p<0.05$). Inmates aged 21-30 years (4.6%) and 31-40 years (5.5%) showed higher prevalence compared to other age groups. Males had a higher prevalence (5.8%) than females, and single individuals (4.8%) were more affected than married ones. Interestingly, inmates in monogamous marriages (2%) had a higher prevalence than those in polygamous marriages. Those with at least a primary education showed the highest HBV prevalence (9.3%), while unemployed inmates (7.1%) and those in private employment (6.3%) were more affected than others. Christians had a higher HBV prevalence (4.3%), and previously incarcerated inmates had a slightly lower rate of infection (3.8%) compared to those without prior incarceration (4%). However, factors such as age, gender, marital status, type of marriage, education level, occupation, religion, previous incarceration, and length of current incarceration were not significantly associated with HBV seropositivity ($p>0.05$) (Vito-Peter et al., 2023).

In Maiduguri, Biu, and Bama prisons (Borno State, Nigeria), 16.3% of inmates had detectable HBsAg. A significant difference ($p<0.001$) in seroprevalence was observed based on educational qualifications, with inmates holding higher education levels having the highest prevalence (20.9%). The age group 60-69 years had the highest infection rate at 33.3%, although there was no significant difference across age groups. Maiduguri prison had the highest HBsAg prevalence at 20.5%, followed by Biu (12.7%) and Bama (6.7%). No significant association ($P>0.05$) was found between HBsAg prevalence and inmates' marital status or occupation. Homosexuality and duration of incarceration were identified as key risk factors for infection (Lawan et al., 2021).

The HBV seroprevalence among inmates at Kuje Prison in the Federal Capital Territory was 13.7%. Of the inmates, 55.4% were susceptible to HBV infection, 20.7% had a past or resolved infection, and 10.3% had acquired immunity, either naturally or through vaccination. Factors significantly associated with HBV infection included being 25 years old or younger (aOR 8.0), being ever married (aOR 4.2), and having a history of alcohol consumption (aOR 3.4) (Dan-Nwafor et al., 2018).

In Nasarawa State, 23% of male inmates tested positive for HBV. Wamba Prison had the highest prevalence at 35.7%, followed by Lafia Prison (24.0%) and Keffi Prison (19.4%), while Nasarawa Prison had the lowest rate (11.1%). Inmates with a longer prison stay, previous incarceration, those engaging in anal sex within prison, and those with multiple sexual partners before incarceration were more likely to contract HBV. Histories of alcohol consumption and blood transfusion were also significantly associated with HBV infection. Additionally, inmates lacking knowledge of HBV transmission modes had a higher likelihood of infection ($p<0.05$). Risk factors for HBV included duration of incarceration, prior imprisonment, intra-prison anal sex, multiple sex partners, lack of knowledge about transmission, blood transfusion, and alcohol consumption (Adoga et al., 2009).

Table 1 provides an overview of key findings from studies reporting the prevalence of HBV among prisoners in Nigeria, including infection rates, and geographical distribution.

Table 1. Prevalence of HBV infection among inmates in Nigeria.

Year	Prevalence (%)	Gender	Location	References
2023	10	Males: 9.20%	Calabar, Cross Rivers State (Southern Nigeria).	(Okafor et al., 2023).
2023	25.3	Males: 25.3% Females: 25%	Niger State	Ojodu and Galadima, 2023).
2023	4	-	Port Harcourt Maximum Security Custodial Centre, Rivers State, Nigeria.	(Vito-Peter et al., 2023).
2021	16.3	Males: 16.1% Females: 20%	Maiduguri, Biu and Bama prisons, Borno State, Nigeria.	(Lawan et al., 2021).
2021	13.7	-	Kuje prison inmates, Abuja, Nigeria	(Dan-Nwafor et al., 2018).

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2009	23	Males: 23%	Nasarawa State	(Adoga et al., 2009).

3.2. HCV Prevalence

The HCV seroprevalence among inmates at the Port Harcourt Maximum Security Custodial Centre was 3.5%. Significant associations were found between HCV infection and a history of blood oaths, sexual activity with non-marital partners, and illicit drug use ($p<0.05$) (Vito-Peter et al., 2023). At Kuje Prison in the Federal Capital Territory, Nigeria, HCV seroprevalence among inmates was found to be 5.9%. The study revealed both a high rate of infection and a lack of awareness regarding HCV transmission and prevention among prison inmates (Dan-Nwafor et al., 2018).

A study assessing HCV prevalence among prison inmates in Calabar, Cross River State, Nigeria, found that 29.6% of participants were seropositive for HCV. Among those, 31% were male and 15.4% were female, with no significant difference between genders ($p>0.05$). HCV seropositivity was observed in 23.5% of inmates with tattoos or scarification, 29.6% of injection drug users, 33.3% with a history of blood transfusion, 29.8% with sexual experience, 21.2% who shared shaving equipment, and 28.3% who had multiple sexual partners. Education levels showed seropositivity rates of 50.0% for primary education, 25.0% for secondary, 27.8% for tertiary, and 33.3% for those without formal education. No significant associations were found between socio-demographic variables—such as marital status, occupation, or education level—and HCV seroprevalence ($p>0.05$) (Ifeyinwa M. Okafor, Ugwu, and Okoroiwu 2020).

In Nasarawa State, 12.3% of male inmates tested positive for HCV. Lafia Prison had the highest prevalence at 16%, followed by Keffi (12.9%) and Wamba (10%). The highest infection rate was observed in inmates aged 33-38 years. Those who had longer stays in prison or had been previously incarcerated were more likely to be infected with HCV. Histories of alcohol consumption and blood transfusion were also significantly associated with HCV infection. Additionally, inmates with limited knowledge of HCV transmission modes were more prone to infection ($p<0.05$). Key risk factors included the duration of incarceration, previous imprisonment, and alcohol consumption (Adoga et al., 2009).

Table 2 presents data from studies reporting HCV prevalence among prisoners in Nigeria, such as infection rates, demographic characteristics, and geographic locations.

Table 2. Prevalence of HCV infection among inmates in Nigeria.

Year	Prevalence (%)	Gender	Location	References
2023	3.5%	Males: 5.8%	Port Harcourt Maximum Security Custodial Centre	(Vito-Peter et al., 2023).
2020	29.6	Males: 31% Females: 15.4%	Calabar, Cross River State, Nigeria	(Ifeyinwa M. Okafor, Ugwu, and Okoroiwu 2020).
2018	5.9%	-	Kuje Prison Inmates, Federal Capital Territory	(Dan-Nwafor et al., 2018).
2009	12.3%	Males 12.3%	Nasarawa State	(Adoga et al., 2009).

4. Discussion

The prison population in Africa continues to rise, exacerbating already severe overcrowding. In several African capital cities, prison occupancy rates exceed 300%, significantly impacting the physical and mental health of inmates. This overcrowding has powered the spread of infectious diseases, increased the prevalence of skin conditions, and contributed to widespread depression. ("Africa: Informal Governance and Healthcare Access in Prison" 2021). In Nigeria, viral hepatitis is particularly rampant, ranking among the most prevalent infectious diseases within the prison system.

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In this review, we examined the prevalence of HBV and HCV among inmates in various Nigerian prisons, highlighting significant variability in seroprevalence rates and associated risk factors. Overall, HBV affects prisoners at a much higher rate than the general population (Smith et al., 2017). When compared with other African countries, the HBV seroprevalence among prisoners is relatively similar, estimated at 12.5% in West Africa (Jaquet et al., 2016), 12.9% in Douala New Bell Prison, Cameroon (Kowo et al., 2021), and 14.8% in Garoua Central Prison, Cameroon (Galdima *et al*., 2024), In Ethiopia, the rates are 6.5% in Northeast Ethiopia (Kassa et al., 2021), 7% in Gondar city, Northwest Ethiopia (Tadesse et al., 2024), and 7.9% in Tigray, Northern Ethiopia, with the highest prevalence observed among young adults, those housed in overcrowded cells, and individuals with a history of alcohol consumption (Tsegay et al., 2023).

For HCV, seroprevalence rates are 0.5% in West Africa (Jaquet et al. 2016), 4% in Gondar city, Northwest Ethiopia (Tadesse et al. 2024), 0.3% in Tigray, Northern Ethiopia (Tsegay et al., 2023), and 1.2% in Northeast Ethiopia (Kassa *et al*., 2021). These findings reflect the regional similarities and variations in viral hepatitis prevalence among prisoners across different African countries.

Individuals at higher risk for HBV infection are often also at greater risk for incarceration, and prisons experience elevated rates of HBV transmission. To address this, all incarcerated individuals who are not already immune should be immunized against HBV. Additionally, improving access to safe injecting and tattooing equipment, condoms, and personal hygiene supplies can help reduce the spread of HBV and other blood-borne or sexually transmitted infections within prison populations (Smith et al., 2017).

The findings from this review highlight the urgent need for targeted HBV education, enhanced prison healthcare, and comprehensive vaccination programs to reduce infection rates. Additionally, a lack of awareness about HCV transmission was consistently associated with higher infection rates among inmates. Beyond infectious diseases, inadequate mental health and social care significantly impacts inmates' well-being and may also contribute to higher recidivism and poor health outcomes after release. Routine screening for depression and other, often overlooked, mental health conditions should be a priority in prison healthcare systems (Nwefoh et al. 2020).

In terms of healthcare availability and quality in Nigerian prisons, only 37% of respondents expressed satisfaction with the services provided, which include HIV testing, hepatitis prevention and treatment, sexual and reproductive health services, and harm reduction programs. Satisfaction was highest in the northeast zone (50%) and lowest in the south-south zone (23%). ("In Nigeria, Boosting Viral Hepatitis Awareness and Treatment" 2023). This underscores the urgent need for preventative and control measures in prisons to reduce infection and transmission rates. Risky behaviours among inmates, such as tattooing, scarification, injection drug use, sharing shaving equipment, having multiple sexual partners, and alcohol consumption, should be actively discouraged (Okafor et al., 2023; Tadesse et al., 2024). Moreover, prison-specific health interventions are essential to improve healthcare access and outcomes in Nigeria's correctional facilities (Dan-Nwafor et al., 2018).

5. Conclusion

Prisoners are key populations not only for HBV and HCV but also for HIV, tuberculosis, and other infectious diseases. This review highlights the significant impact of social determinants of health SDoH on the health outcomes of male prison inmates in Nigeria, particularly concerning the prevalence of HBV and HCV infections. Addressing these issues requires a multifaceted approach involving policy formulation, research, surveillance, and collaboration among stakeholders. Implementing WHO recommendations and the Centers for Disease Control and Prevention (CDC) strategies can significantly reduce the transmission and spread of viral hepatitis within Nigerian prisons. Ensuring health equity, preventing disease transmission, and improving the overall health and well-being of prison populations are critical steps toward achieving sustainable public health goals.

References

1. Adoga, M. P., Banwat, E. B., Forbi, J. C., Nimzing, L., Pam, C. R., Gyar, S. D., Agabi, Y. A., & Agwale, S. M. (2009). Human Immunodeficiency Virus, Hepatitis B Virus, and Hepatitis C Virus: Sero-Prevalence, Co-Infection and Risk Factors among Prison Inmates in Nasarawa State, Nigeria. *The Journal of Infection in Developing Countries*, 3, 539-547.
2. Barton, H., & Grant, M. (2006). A health map for the local human habitat. *Journal of the Royal Society for the Promotion of Health, 126(6),* 252-261.
3. Bashir, T., Asim, M., Ahsan, M., Zafar, M., & Hussain, K. (2017). A case report: Patient with the history of Hepatitis C virus. *Journal of Antivirals & Antiretrovirals*, 9(2), 55–57.
4. Baybutt, M., Acin, E., Hayton, P., & Dooris, M. (2014). Promoting health in prisons: A settings approach. In World Health Organization (Ed.), Prisons and Health (pp. 180–184). Copenhagen: WHO Regional Office for Europe.
5. Baybutt, M., & Chemlal, K. (2016). Health-promoting prisons: Theory to practice. Global Health Promotion, 23(1_suppl), 66-74. https://doi.org/10.1177/1757975915614182.
6. Berumen, J., Baglieri, J., Kisseleva, T., & Mekeel, K. (2021). Liver fibrosis: Pathophysiology and clinical implications. WIREs Mechanisms of Disease, 13(1), 1499.
7. Bretschneider, W., & Elger, B.S. (2014). Expert Perspectives on Western European Prison Health Services: Do Ageing Prisoners Receive Equivalent Care? *Journal of Bioethical Inquiry, 11*, 319-332.
8. Centers for Disease Control and Prevention. (2020). Division of Viral Hepatitis Strategic Plan 2020-2025. Retrieved from https://www.cdc.gov/hepatitis/pdfs/DVH-StrategicPlan2020-2025.pdf
9. Christopher, P. P., Garcia-Sampson, L. G., Stein, M., Johnson, J., Rich, J., & Lidz, C. (2017). Enrolling in clinical research while incarcerated: What influences Participants' decisions? *The Hastings Center Report,* 47(2), 21–29.
10. Cox, R., & Wallace, S. (2016). Identifying the link between food security and incarceration. *Southern Economic Journal*, 82(4), 1062–1077.
11. Dan-Nwafor, C., Adeoye, I., Aderemi, K., Adebobola, B., Nguku, P., Ade-Yusuf, I., & Udom, E. (2018). Knowledge, serological markers and risk factors associated with hepatitis B and C virus infection among Kuje prison inmates, Federal Capital Territory, Nigeria. *International Journal of Infectious Diseases, 73*, 374. https://doi.org/10.1016/j.ijid.2018.04.4260.
12. Dahlgren, G., & Whitehead, M. (2021). The Dahlgren-Whitehead model of health determinants: 30 years on and still chasing rainbows. *Public Health,* 199, 20-24.
13. Degenhardt, L., Webb, P., Colledge-Frisby, S., et al. (2023). Epidemiology of injecting drug use, prevalence of injecting-related harm, and exposure to behavioural and environmental risks among people who inject drugs: A systematic review. *The Lancet Global Health,* 11(5), e659-e672.
14. Department of Health. (2002). *Health Promoting Prisons*: A Shared Approach. London:
15. Dolan, K., Wirtz, A. L., Moazen, B., Ndeffo-mbah, M., Galvani, A., Kinner, S. A., et al. (2016). Global burden of HIV, viral hepatitis, and tuberculosis in prisoners and detainees. *The Lancet*, 388(10049), 1089–1102. doi: 10.1016/S0140-6736(16)30466-4.
16. Dong, K. R., Tang, A. M., Stopka, T. J., Beckwith, C. G., & Must, A. (2018). *Food acquisition methods and correlates of food insecurity in adults on probation in Rhode Island*. PLoS ONE, 13(6), e0198598. doi: 10.1371/journal.pone.0198598.
17. Dooris, M. (2009). Holistic and sustainable health improvement: The contribution of the settings-based approach to health promotion. *Perspectives in Public Health*, 129, 29–36.
18. Durojaiye, O. C., Amoo, P. O., & Ayoola, O. O. (2019). Healthcare delivery system in Nigerian prisons: A review. *Medical Practice and Reviews*, 10(2), 9-15.
19. Galadima, M. A., Balkissou, A. D., Djapa, G. R. N., Nga, W. T. B., Aghoagni, G., Ndam, A. W. N., Abas, A., et al. (2024). Prevalence of hepatitis B and associated factors in the Garoua Central Prison, Cameroon: A cross-sectional study. *Open Journal of Gastroenterology, 14*(5), 174–183. https://doi.org/10.4236/ojgas.2024.145020.
20. Gimba, S. N., Lawan, S., Elyuguda, A. D., Sabo, H., & Dadile, H. M. (2021). Hepatitis B Virus Infection among Prison Inmates in Borno State: Determination of Prevalence of Surface Antigen (HBsAg) and Possible Risk Factors of Disease. *Journal of Hepatitis Research,* 6(1), 1041.
21. Harding, D. J., Wyse, J. J. B., Dobson, C., & Morenoff, J. D. (2014). Making ends meet after prison. *Journal of Policy Analysis and Management*, 33(2), 440–470.
22. Harris, H. M., & Harding, D. J. (2019). Racial inequality in the transition to adulthood after prison. RSF: The Russell Sage Foundation. *Journal of the Social Sciences*, 5(1), 223.
23. Health and Social Care Committee House of Commons Education and Skills. (2018). Prison Health. *Twelfth report of session* 2017-2019. London.
24. House of Commons Health and Social Care Committee. (2018). Prison Health: Twelfth report of session 2017–19. London.
25. Institute for Criminal Policy Research. (2018). World Prison Population List (p. 2). World Prison Brief.

26. Jackson, D.B., & Vaughn, M. G. (2017). Parental history of disruptive life events and household food insecurity. *Journal of Nutrition Education and Behaviour*. 49(7), 554-560.e551.
27. Jaquet, A., Wandeler, G., Tine, J., Dagnra, C. A., Attia, A., Patassi, A., Ndiaye, A., et al. (2016). HIV infection, viral hepatitis and liver fibrosis among prison inmates in West Africa. *BMC Infectious Diseases, 16*(1), 249. https://doi.org/10.1186/s12879-016-1601-4
28. Jefferies, M., Rauff, B., Rashid, H., Lam, T., & Rafiq, S. (2018). Update on global epidemiology of viral hepatitis and preventive strategies. *World Journal of Clinical Cases,* 6(13), 589-599. https://doi.org/10.12998/wjcc.v6. i13.589.
29. Kamarulzaman, A., Reid, S. E., Schwitters, A., Wiessing, L., El-Bassel, N., Dolan, K., ... & Altice, F. L. (2016). Prevention of transmission of HIV, hepatitis B virus, hepatitis C virus, and tuberculosis in prisoners. The Lancet, 388, 1115–1126. https://doi.org/10.1016/S0140-6736(16)30769-3
30. Kassa, Y., Million, Y., Biset, S., & Moges, F. (2021). Hepatitis B and hepatitis C viral infections and associated factors among prisoners in Northeast Ethiopia. *Journal of Blood Medicine, 12*, 561–570. https://doi.org/10.2147/JBM.S314556
31. Kavithe, K. R., Dorcus, M. D., & Maoga, W. N. (2018). Dietary intake and factors affecting food service of male prisoners living with human immunodeficiency virus at selected prisons in Kenya. *International Journal of Nutrition and Metabolism*, 10, 6–15. doi: 10.5897/ijnam2017.0229.
32. Khan, A. J., Simard, E. P., Bower, W. A., Wurtzel, H. L., Khristova, M., Wagner, K. D., ... & Bell, B. P. (2019). Ongoing transmission of hepatitis B virus infection among inmates at a state correctional facility. *American Journal of Public Health*, 109(2), 289–295.
33. Khan, N. R., Riya, S., Islam, S., & Majeed, H. A. (2017). Knowledge and preventive practice regarding hepatitis B among the nurses in Dhaka medical college hospital. *Journal of Dhaka Medical College,* 26(1), 36-42.
34. Kowo, M. P., Andoulo, F. A., Sizimboue, D. T., Ndjitoyap Ndam, A. W., Ngek, L. T., Kouanfack, C., Leundji, H., et al. (2021). Seroprevalence of hepatitis B and associated factors among inmates: A cross-sectional study in the Douala New Bell Prison, Cameroon. *The Pan African Medical Journal, 38*, 355. https://doi.org/10.11604/pamj.2021.38.355.20386
35. LaBriola, J. (2020). Post-prison employment quality and future criminal justice contact. RSF: The Russell Sage Foundation. *Journal of the Social Sciences*, 6(1), 154.
36. Lawan, S., Gimba, S. N., Elyuguda, A. D., Sabo, H., & Dadile, H. M. (2021). Hepatitis B virus infection among prison inmates in Borno State: Determination of prevalence of surface antigen (HBsAg) and possible risk factors of disease. *Austin Journal of Hepatitis*, 6, Article 1041. https://austinpublishinggroup.com/hepatitis/fulltext/hepatitis-v6-id1041.php
37. MacDonald, M. (2018). Overcrowding and its impact on prison conditions and health. *International Journal of Prisoner Health*,14(2), 65–68.
38. Mattei, J., Malik, V., Wedick, N. M., Hu, F. B., Spiegelman, D., Willett, W. C., ... et al. (2015). Reducing the global burden of type 2 diabetes by improving the quality of staple foods: The Global Nutrition and Epidemiologic Transition Initiative. Globalization and Health, 11(1), 23.
39. Meyer, B. J., Byrne, M. K., Collier, C., Parletta, N., Crawford, D., Winberg, P. C., ... et al. (2015). Baseline omega-3 index correlates with aggressive and attention deficit disorder behaviours in adult prisoners. PLOS ONE, 10(3), e0120220.
40. Moazzami, S. H., Shiroodi, M., & Salehi, M. (2015). The impact of prison on the repetition of women's crime. Encyclopedia Law Polit., 23, 39–58.
41. Navadeh, S., Mirzazadeh, A., Gouya, M. M., Farnia, M., Alasvand, R., & Haghdoost, A.-A. (2013). HIV prevalence and related risk behaviours among prisoners in Iran: Results of the national biobehavioural survey, 2009. Sexually Transmitted Infections, 89(Suppl 3), iii33–iii36. doi: 10.1136/sextrans-2013-051295.
42. NHS England. (2021). NHS commissioning: health and justice.
43. NHS England. (2019). The NHS Long Term Plan. NHS England.
44. Nigeria Correctional Service. (2024). Statistics summary. Retrieved from https://www.corrections.gov.ng/statistics_summary on May 5, 2024.
45. Nwefoh, E., Aguocha, C. M., Ryan, G., Ode, P., Ighagbon, F. O., Akinjola, O., Omoi, S., et al. (2020). Depression and experience of incarceration in North Central Nigeria: A situation analysis at Makurdi Medium Security Prison. *International Journal of Mental Health Systems, 14*(1), 76. https://doi.org/10.1186/s13033-020-00408-0.
46. Ojieabu, W. A., Uwakwe, K. A., Odu, O. O., & Egbewale, B. E. (2020). Risk factors, clinical presentation, and virological profile of chronic hepatitis B virus infection in Nigerian prison inmates. *The Pan African Medical Journal*, 36, 158.
47. Okafor, I. M., Ugwu, S. O., & Okoroiwu, H. U. (2020). Hepatitis C Virus Infection and Its Associated Factors among Prisoners in a Nigerian Prison. BMC Gastroenterology, 20, Article No. 360. https://doi.org/10.1186/s12876-020-01504-8.

48. Okafor, I. M., Ugwu, S. O., & Okoroiwu, H. U. (2020). Hepatitis C virus infection and its associated factors among prisoners in a Nigerian prison. *BMC Gastroenterology, 20*(1), 360. https://doi.org/10.1186/s12876-020-01504-8
49. Okafor, I. M., Okoroiwu, H. U., Ogar, C. O., & Esong, A. A. (2023). Spread of hepatitis A and B among inmates of correctional centers: A cause for concern. *African Journal of Laboratory Haematology and Transfusion Science, 2*(4), 294–306.
50. Okeke, C. I., Ozioma, E., Nwokeukwu, H. I., et al. (2018). Prevalence of hepatitis B virus infection among inmates in a Nigerian prison. Journal of Epidemiology and Global Health, 8(3-4), 177-181.
51. Omorotionmwan, J. (2015). Prison Riots and Insecurity. The Nigerian Observer, October 12, p.13.
52. Penal Reform International. (2022). *Global Prison Trends 2022*. Penal Reform International.
53. Penal Reform International. (2019). Global prison trends 2019.
54. Prison Insider. (2021, June 22). *Africa: Informal governance and healthcare access in prison*. https://www.prison-insider.com/en/articles/afrique-gouvernance-informelle-et-acces-a-la-sante-en-prison.
55. Ross, M. W. (2010). Prison staff occupational health and safety and its relationship with inmate health: A review. Prison Service Journal, 192, 55–59.
56. Sander, G., Shirley-Beavan, S., & Stone, K. (2019). The global state of harm reduction in prisons. Journal of Correctional Health Care, 25(2), 105-120.
57. Sawyer, W. (2017). *Food for thought: Prison food is a public health problem*. Prison Policy Initiative. The Ladies of Hope Ministries, USA.
58. Singh, P. N., Arthur, K. N., Orlich, M. J., James, W., Purty, A., Job, J. S., et al. (2014). Global epidemiology of obesity, vegetarian dietary patterns, and noncommunicable disease in Asian Indians. *The American Journal of Clinical Nutrition*, 100(Supplement1), 359S-64S.
59. Smith, J. M., Uvin, A. Z., Macmadu, A., & Rich, J. D. (2017). Epidemiology and treatment of hepatitis B in prisoners. *Current Hepatology Reports, 16*(3), 178–183. https://doi.org/10.1007/s11901-017-0364-8
60. Stanaway, J. D., Flaxman, A. D., Naghavi, M., et al. (2016). The global burden of viral hepatitis from 1990 to 2013: *Findings from the Global Burden of Disease Study* 2013. Lancet, 388(10049), 1081–1088.
61. Stöver, H., Tarján, A., Horváth, G., & Montanari, L. (2021). The state of harm reduction in prisons in 30 European countries with a focus on people who inject drugs and infectious diseases. *Harm Reduction Journal*, 18(1), 1–7.
62. Tadesse, K., Ayalew, G., Million, Y., & Gelaw, A. (2024). Hepatitis B and hepatitis C virus infections and associated factors among prisoners in Gondar City, Northwest Ethiopia. *PLOS ONE, 19*(4), e0301973. https://doi.org/10.1371/journal.pone.0301973
63. Terwase, J. M., & Emeka, C. K. (2015). Prevalence of hepatitis B surface antigen among Julius Berger Staff Quarters residents, Kubwa, Abuja. *International Journal of Preventive and Treatment*, 4(2), 29–33. http://article.sapub.org/10.5923.j.ijpt.20150402.02.html
64. Testa, A., & Jackson, D. B. (2019). Food Insecurity Among Formerly Incarcerated Adults. *Criminal Justice and Behavior*. 46(10), 1493-1511.
65. Testa, A., & Jackson, D.B. (2018). Food Insecurity, Food Deserts, and Waist-to-Height Ratio: Variation by Sex and Race/Ethnicity. *Journal of Community Health, 44*, 444-450.
66. Testa, A. M. (2019). Access to healthy food retailers among formerly incarcerated individuals. *Public Health Nutrition*, 22(4), 672–680.
67. Topp, S. M., Moonga, C. N., Luo, N., Kaingu, M., Chileshe, C., Magwende, G., … & Henostroza, G. (2016). Exploring the drivers of health and healthcare access in Zambian prisons: A health systems approach. *Health Policy and Planning*, 31(9), 1250-1261. https://doi.org/10.1093/heapol/czw059
68. Torre, P., Aglitti, A., Masarone, M., & Persico, M. (2021). Viral hepatitis: Milestones, unresolved issues, and future goals. *World Journal of Gastroenterology*, 27(28), 4603–38. https://doi.org/10.3748/wjg.v27.i28.4603
69. Torkaman, M., Farokhzadian, J., Miri, S., & Pouraboli, B. (2020). The effect of transactional analysis on the self-esteem of imprisoned women: *A clinical trial. BMC Psychology*, 8, 3. https://doi.org/10.1186/s40359-019-0369-x.
70. Torkaman, M., Miri, S., & Farokhzadian, J. (2020). Relationship between adaptation and self-esteem in addicted female prisoners in the southeast of Iran. *International Journal of Adolescent Medicine and Health*, 32, 1–7. https://doi.org/10.1515/ijamh-2017-0168.
71. Travis, J., Western, B., & Redburn, F. S. (2014). The growth of incarceration in the United States: Exploring causes and consequences. *The National Academies Press*.
72. Tsegay, B., Gebrecherkos, T., Kahsay, A. G., & Abdulkader, M. (2023). Seroprevalence and associated factors of hepatitis B and hepatitis C viral infections among prisoners in Tigrai, Northern Ethiopia. *Infection and Drug Resistance, 16*, 3743–3750. https://doi.org/10.2147/IDR.S410017
73. Uchechukwu, O. F., Abdulrahman, Y., Aliyu, A. U., Mustaphar, U., Zama, I., Charles, A. T., Kwaifa, I., Ali, B. H., Augustine, O., Marafa, A., & Osaro, E. (2018). Seroprevalence of HIV, HBV and HCV among Prisoners in Sokoto, Nigeria. *Asian Journal of Medicine and Health*, 13, 1-8.

74. United Nations. (2015). Sustainable Development Goals: Goal 2 - Zero Hunger. Retrieved from https://sdgs.un.org/goals/goal2 on May 5, 2024.
75. United Nations General Assembly. (1948). Universal declaration of human rights. Department of State, United States of America. United Nations, USA.
76. United Nations General Assembly. (2015). United Nations standard minimum rules for the treatment of prisoners (the Nelson Mandela rules). Resolution adopted by the General Assembly on 17 December 2015. UN Doc. A/RES/70/175.
77. Van Hout, M. C., & Mhlanga-Gunda, R. (2019). Prison health situation and health rights of young people incarcerated in sub-Saharan African prisons and detention centres: A scoping review of extant literature. *BMC International Health and Human Rights*, 19(1), 17.
78. Vito-Peter, B., Hart, G. M., Dio, A., Nwogu, V. C., Ideozu, N. O., Okoro, O. C., Albert, O. C., et al. (2023). Seroprevalence and associated risk factors of hepatitis B and C among inmates of Port Harcourt maximum security custodial centre. *Advances in Infectious Diseases, 13*(2), 159–182. https://doi.org/10.4236/aid.2023.132016
79. Wang, H., Naghavi, M., Allen, C., Barber, R. M., Bhutta, Z. A., Carter, A., et al. (2016). Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980–2015: *A systematic analysis for the Global Burden of Disease Study 2015*. The Lancet, 388(10053), 1459–1544.
80. Woodall, J. (2016). *A critical examination of the health promoting prison two decades on*. Critical Public Health, 26(5), 615–621.
81. World Health Organization, Regional Office for Africa. (2023, February 8). In Nigeria, boosting viral hepatitis awareness and treatment. *WHO | Regional Office for Africa*. https://www.afro.who.int/countries/nigeria/news/nigeria-boosting-viral-hepatitis-awareness-and-treatment-0
82. World Health Organization. (2021). Global Progress Report on HIV, Viral Hepatitis and Sexually Transmitted Infections, 2021: Accountability for the Global Health Sector Strategies 2016–2021: Actions for Impact. World Health Organization.
83. World Health Organization. (2020). About social determinants of health. Retrieved from https://www.who.int/social_determinants/sdh_definition/en/
84. World Health Organization. (2019b). Hepatitis C. Retrieved from www.who.int/en/news-room/fact-sheets/detail/hepatitis-c (accessed 6 June 2019).
85. World Health Organization. (2019c). HIV/AIDS. Retrieved from www.who.int/en/news-room/fact-sheets/detail/hiv-aids (accessed 6 June 2019).
86. World Health Organization. (2017). Global hepatitis report. Geneva: World Health Organization. Retrieved from http://apps.who.int/iris/bitstream/10665/255016/1/9789241565455-eng.pdf
87. World Health Organization. (2017). Global hepatitis report. Geneva: World Health Organization.
88. World Health Organization. (2018). Tuberculosis. Retrieved from www.who.int/en/news-room/fact-sheets/detail/tuberculosis (accessed 5 June 2019).
89. World Health Organization. (2014). Prisons and health. Copenhagen: World Health Organization. Retrieved from http://www.euro.who.int/data/assets/pdffile/0005/249188/Prisons-and-Health.pdf (Accessed May 5, 2024).
90. WHO (World Health Organization). (2014). *Prisons and health.* Copenhagen, Denmark: WHO Regional Office for Europe.
91. World Health Organization. (2007). *Health in Prisons*. A WHO Guide to the Essentials in Prison Health. World Health Organization.