

RESEARCH

Open Access



Seroprevalence of hepatitis B, hepatitis C, and HIV in pregnant women attending a tertiary care hospital in Mogadishu, Somalia, 2017–2021

Mohamed Abdulkadir Hassan-Kadle¹ , Esra Keles² , Mosab Ahmed Nor³ , Mohamed Abdulahi Hassan⁴ , Seyma Karaketir⁵ , Ahmed Isak Hussein⁶ , Hasan Huseyin Eker^{7,8} and Shafie Abdulkadir Hassan^{9*}

Abstract

Background Hepatitis B, C, and HIV infections are serious global health concerns that affect both developed and developing nations. This study aimed to determine the prevalence of hepatitis B, hepatitis C, and HIV among pregnant women attending a tertiary hospital in Mogadishu, Somalia.

Methods This retrospective study, conducted from January 2017 to December 2021 at the Somalia-Mogadishu Recep Tayyip Erdoğan Training and Research Hospital, assessed HBV, HCV, and HIV prevalence among pregnant women. Screening was performed using the VITROS® 3600 Immunodiagnostic System. Data analysis was performed using IBM SPSS, with descriptive data presented as frequencies and percentages, and quantitative data as means and standard deviations. The χ^2 test or Fisher's exact test was used for categorical data analysis.

Result A total of 7,874 pregnant women were screened. After applying the exclusion criteria, 7,836 were tested for HBV, of whom 220 (2.8%) were positive for HBsAg. A total of 7,791 women were tested for HCV, and 33 (0.4%) were seropositive for anti-HCV antibodies. For HIV, 7,854 women were screened, and 16 (0.2%) tested positive for anti-HIV antibodies. These results indicate a moderate prevalence of HBV, a low prevalence of HCV, and a relatively low, but still concerning prevalence of HIV among pregnant women in this setting. HBsAg positivity showed statistical significance across all age groups ($p \leq 0.001$), while anti-HCV positivity was significant for patients aged < 20 and $26-30$ years ($p = 0.011$).

Conclusion This study found lower HBV, HCV, and HIV prevalence among pregnant women in Mogadishu compared to previous studies, suggesting improvements in healthcare. However, these infections remain a public health concern. Strengthening antenatal screening, expanding hepatitis B vaccination, and ensuring universal access to treatment are crucial to reducing their impact on maternal and neonatal health in Somalia.

Keywords Hepatitis B, Hepatitis C, HIV, Pregnancy, Seroprevalence, Somalia

*Correspondence:
Shafie Abdulkadir Hassan
Shafici@just.edu.so

Full list of author information is available at the end of the article



© The Author(s) 2025. **Open Access** This article is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License, which permits any non-commercial use, sharing, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if you modified the licensed material. You do not have permission under this licence to share adapted material derived from this article or parts of it. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by-nc-nd/4.0/>.

Introduction

Hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV) are bloodborne pathogens that constitute major public health threats worldwide [1].

HBV infection causes various liver diseases, including acute and chronic hepatitis, cirrhosis, and hepatocellular carcinoma [2]. The World Health Organization (WHO) estimates that approximately 296 million people are living with chronic hepatitis B infection globally, of whom at least 65 million are in Africa [3]. Globally, HBV infection is the tenth leading cause of death and the second most frequent cause of cancer death after tobacco use, accounting for nearly 1.2 million deaths annually [4]. Mother-to-child transmission (MTCT) is responsible for more than half of chronic HBV infections worldwide, despite an available immunoprophylaxis regimen [5]. Exposure to contaminated blood or body fluids, sexual contact, tattooing, body piercing, and injection drug use may also be important in the transmission of HBV [6]. HBV infection acquired in adult life usually results in a self-limiting acute infection and resolves spontaneously, whereas chronic infection develops when the infection is acquired in the perinatal/neonatal period [7].

The WHO estimates that approximately sixty million people in the WHO Eastern Mediterranean Region are infected with HBV [8]. The WHO categorized the prevalence of HBV as low (<2%), medium (2–8%), or high (>8%) [9]. Previous studies in Somalia have indicated an HBV prevalence of 20.5% among pregnant women, classifying the country as having high endemicity for hepatitis B virus infection [10].

HCV is a hepatotropic virus that is known to cause chronic liver diseases, such as chronic hepatitis, liver cirrhosis, and hepatocellular carcinoma [11]. Globally, an estimated 58 million people have chronic HCV infection, with more than 1.5 million new cases occurring per year [12]. In 2018, the prevalence of HCV infection among Somali people was estimated to be 4.84% [10]. Hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV) are primarily transmitted through parenteral exposure, such as unsafe injections or blood transfusions [13, 14]. Additionally, sexual contact, intrafamilial transmission, occupational exposure, and vertical (mother-to-child) transmission are common routes for spreading these infections [15]. While the placental barrier typically prevents direct transplacental passage of HBV and HCV, particularly in low-viremic mothers, vertical transmission can occur in certain cases, especially when viral load is high or other risk factors are present [16]. Nonetheless, maternal inflammation plays a significant role in adverse pregnancy outcomes such as preterm birth, low birth weight, intrauterine growth restriction, and stillbirth [17]. Additionally, HBV and

HCV are often associated with HCC during pregnancy due to estrogen and decreased immunity, which results in increased maternal mortality [18].

HIV infection remains a global health challenge [19]. It has been estimated that almost 650,000 people died of HIV-related diseases, and 1.5 million people were newly infected in 2021 [20]. Globally, an estimated 38.4 million people are living with HIV, two-thirds of whom are in the WHO African Region [21]. Somalia was classified as having a low-level HIV epidemic in 2014, but for 10 years before that, antenatal HIV rates had been marginally above 1% in Somaliland, with this area classified as having had a generalized HIV epidemic [22]. The antenatal survey data in the country revealed a 0.1% prevalence of HIV [10]. HIV can be transmitted from a mother to her child during pregnancy, labor, delivery, or breastfeeding. Sexual contact, the use of contaminated needles, receiving unsafe injections, and needlestick injuries may also be important [14, 23].

There is a lack of sufficient studies in Somalia regarding the seroprevalence of HBV, HCV, and HIV among antenatal women, and further research is needed to understand the potential transmission routes and associated pregnancy outcomes in this setting. To fill that gap, the present study aimed to determine the seroprevalence of HBV, HCV, and HIV infections among pregnant women attending the largest tertiary hospital in Somalia.

Methods

This retrospective study was conducted between January 2017 and December 2021 on pregnant women who attended the Somalia-Mogadishu Recep Tayyip Erdoğan Training and Research Hospital, the largest tertiary hospital that provides referral-level care to Mogadishu and its catchment areas.

The data were collected from the hospital's electronic medical records. General variables such as age, year of blood sampling, and the results of viral markers for hepatitis B, C, and HIV were included in the study. All the health records of pregnant women registered in the hospital's electronic database system were eligible for inclusion in the study. Participants with missing or incomplete records, or with a history of liver disease, diabetes, or HELLP syndrome, were excluded to ensure data completeness and reduce bias in interpreting serological status. Screening for HBV (HBsAg), HCV (anti-HCV), and HIV (anti-HIV 1/2) infections was performed using the VITROS® 3600 Immunodiagnostic System, which utilizes chemiluminescent immunoassay (CLIA) technology [24]. The HBV assay detects hepatitis B surface antigen, while the HCV assay targets antibodies against HCV, both with reported high sensitivity and specificity according to manufacturer data. The HIV infection was detected using the Anti-HIV 1 + 2 assay, which identifies antibodies to

HIV-1 and HIV-2. This fully automated system provides reliable, rapid, and high-throughput testing suitable for clinical screening.

All the statistical analyses were performed using IBM SPSS for Windows, version 25.0. (IBM Corp., Armonk, NY, USA). Qualitative variables are presented as frequencies (n) and percentages (%). Quantitative variables are presented as the mean and standard deviation (mean \pm SD). The χ test or Fisher's exact test was used for the analysis of categorical data. A value of *p* less than 0.05 was considered to indicate statistical significance.

Results

Over the study period, 7874 pregnant women were subjected to ELISA. Of those, 7836 pregnant women were tested for HBV infection, 220 (2.8%) were diagnosed with hepatitis B infection, 7791 pregnant women were tested for HCV infection, 33 (0.4%) were diagnosed with hepatitis C infection, 7854 pregnant women were tested for HIV infection, and 14 (0.2%) were diagnosed with HIV infection. According to 2017, 2018, 2019, 2020, and 2021, HBsAg positivity was 2.5%, 3.1%, 2.4%, 2.8%, and 3.2%, respectively. Anti-HCV positivity according to 2017, 2018, 2019, 2020, and 2021 was 0.2%, 0.4%, 0.5%, and 0.4%, respectively. There were 2 (0.2%) anti-HIV-positive patients in 2017 and 14 (0.7%) in 2021, and the difference in the number of patients stratified by year was statistically significant ($p < 0.001$) as shown in Table 1.

The seroprevalence of HBsAg showed a significant correlation with age ($p \leq 0.001$), with higher rates observed among older age groups, ranging from 1.3% in individuals ≤ 20 years to 4.4% in those ≥ 31 years. A significant difference was also observed across the study period ($p \leq 0.001$). HCV seropositivity was significantly correlated with age ($p = 0.011$), with rates ranging from 0.1% in those ≤ 20 years to 1.2% in those ≥ 36 years; however, no significant variation was noted across the period ($p = 0.103$). HIV seroprevalence did not show a significant correlation with age ($p = 0.137$) or with the study period ($p = 0.825$). The distributions of hepatitis B, hepatitis C, and HIV markers by year and age group are presented in Table 1.

HIV case detection rates were 12.5% and 87.5% for 2017 and 2021, respectively. HBV diagnoses ranged from 11.8% in 2017 to 30.1% in 2021, with a steady increase observed over the five years. For the HCV group, pregnant women had the highest case detection rates, ranging from 9.1% in 2018 to 27.3% in 2021 (Table 2).

Discussion

HIV, HBV, and HCV are highly contagious infections that can be transmitted vertically from mother to child, posing a significant public health concern due to their potential for chronic illness, complications, and impact

Table 1 Positivity for HBsAg, anti-HCV, and anti-HIV in pregnant women by year and age group

		HbsAg			p	Anti HCV			P	Anti HIV			p	Total			p				
		Positive		Negative		Positive		Negative		Positive		Negative		Positive		Negative					
		n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%				
Date	2017	26	2.5	1002	97.5	0.535	5	0.5	1021	99.5	0.825	2	0.2	1046	99.8	33	1.1	3069	98.9	0.103	
	2018	39	3.1	1239	96.9		3	0.2	1280	99.8		0	0	1283	100.0	42	1.1	3802	98.9		
	2019	44	2.4	1825	97.6		8	0.4	1856	99.6		0	0	1866	100.0	52	0.9	5547	99.1		
	2020	43	2.8	1489	97.2		8	0.5	1547	99.5		0	0	1554	100.0	51	1.1	4590	98.9		
	2021	68	3.2	2061	96.8		9	0.4	2054	99.6		14	0.7	2089	99.3	91	1.4	6204	98.6		
Age groups	≤ 20	17	1.3	1308	98.7	≤0.001	1	0.1	1313	99.9	0.011	2	0.2	1321	99.8	0.137	20	0.5	3942	99.5	≤0.001
	21-25	56	2.2	2530	97.8		7	0.3	2567	99.7		7	0.3	2578	99.7		70	0.9	7675	99.1	
	26-30	79	3.3	2292	96.7		13	0.6	2340	99.4		2	0.1	2360	99.9		94	1.3	6992	98.7	
	31-35	45	4.4	988	95.6		6	0.6	1027	99.4		5	0.5	1027	99.5		56	1.8	3042	98.2	
	≥ 36	23	4.4	498	95.6		6	1.2	511	98.8		0	0.0	552	100.0		29	1.8	1561	98.2	
Age (yrs). mean±SD (median)		28±5.3 (28)		26±5.6 (25)	≤0.001	30±6.4 (28)		26±5.6 (25)	0.001	26±4.6 (24)		26±6 (26)		28±5.3 (28)		26±6.6 (25)		26±6.6 (25)		≤0.001	

Table 2 Results of serologic marker detection according to year and age group

		HbsAg (+)		Anti HCV (+)		Anti HIV (+)		Total	
		n	%	n	%	n	%	n	%
Date	2017	26	11.8	5	15.2	2	12.5	33	12.3
	2018	39	17.7	3	9.1	0	0.0	42	15.6
	2019	44	20.0	8	24.2	0	0.0	52	19.3
	2020	43	19.5	8	24.2	0	0.0	51	19.0
	2021	68	30.9	9	27.3	14	87.5	91	33.8
	Total	220	100.0	33	100.0	16	100.0	269	100.0
Age groups	≤ 20	17	7.7	1	3.0	2	12.5	20	7.4
	21–25	56	25.5	7	21.2	7	43.8	70	26.0
	26–30	79	35.9	13	39.4	2	12.5	94	34.9
	31–35	45	20.5	6	18.2	5	31.3	56	20.8
	≥ 36	23	10.5	6	18.2	0	0	29	10.8

in resource-limited settings [25–27]. This study aimed to determine the seroprevalence of hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV) among pregnant women attending a tertiary care hospital in Mogadishu, Somalia, between 2017 and 2021 which provides critical insights into the burden of these infections in a high-risk population. The findings of this study demonstrate a moderate prevalence of HBV (2.8%), a low prevalence of HCV (0.4%), and a low prevalence of HIV (0.2%) among pregnant women attending antenatal care at Somalia-Mogadishu Recep Tayyip Erdoğan Training and Research Hospital between 2017 and 2021. The prevalence of hepatitis B virus (HBV) infection among pregnant women in our study was found to be 2.8%, aligning with the World Health Organization's (WHO) definition of intermediate endemicity (2–7%) [28]. This rate is notably lower than previous estimates, including studies that reported HBV prevalence rates as high as 20.5% among pregnant women [9, 14]. Similarly, it is lower than the prevalence reported in an earlier study conducted in the same region [29–31]. This decline may reflect growing public awareness, enhanced diagnostic capacity, and the integration of the pentavalent vaccine into Somalia's Expanded Programme on Immunization (EPI) in 2013 [35]. Nonetheless, Somalia continues to lack a universal birth-dose HBV vaccination strategy, which is a critical intervention to prevent mother-to-child transmission (MTCT) of the virus.

When compared to other African and regional settings with moderate endemicity, the prevalence observed in our study aligns with the range reported in several other countries across Africa and parts of Asia with moderate endemicity, where rates typically range from approximately 2.4–4.6% [32–34]. Despite Somalia being categorized overall as a high-endemicity country, our findings suggest a shift toward intermediate levels in specific populations, such as pregnant women. Moreover, the age-specific increase in HBsAg positivity, particularly among women aged 26–35 years, is similar to the previous

studies [35, 36]. The exposure risk over time underscores the critical need for routine antenatal HBV screening and timely interventions to curb vertical transmission.

When comparing international data, the HBV prevalence observed in this study remains higher than that of several countries with low endemicity, such as Qatar (2%), Libya (2.2%), and the United Arab Emirates (>2%), Afghanistan (1.53%), and Saudi Arabia (1.9%) [37–39]. On the other hand, it is lower than prevalence rates reported in other high-endemic countries, including Nigeria, Sudan (8%), Kenya (9.4%), and South Sudan (11%) [6, 33, 40]. These disparities are likely due to variations in demographic profiles, cultural and behavioral risk factors, differences in diagnostic methods (e.g., rapid tests, ELISA, or DNA detection), laboratory testing algorithms, and the broader public health context, including post-conflict conditions that may influence disease transmission and healthcare access.

This study provides the first comprehensive assessment of hepatitis C virus (HCV) prevalence among pregnant women in Somalia, addressing a significant gap in national epidemiological data. The HCV seroprevalence observed in this study was 0.4%, which is substantially lower than the previously reported national pooled estimate of 4.8% derived from older meta-analyses, as well as more recent hospital-based findings that range between 1.4% and 1.9% [10, 15, 41]. These findings place Somalia within the World Health Organization's classification of low-endemic countries for HCV, defined as having a prevalence of less than 1.5% [42]. Globally, the estimated HCV prevalence among pregnant women varies widely, ranging between 1% and 8% [43], suggesting that Somalia's burden is comparatively low.

The observed HCV prevalence of 0.4% in this study is consistent with similar low rates reported in neighboring and regional countries [44]. However, it is significantly lower than rates documented in other African and Middle Eastern nations [45, 46]. Importantly, no cases of HBV and HCV coinfection were identified in this study.

Remarkably, the highest HCV positivity rates were observed in women aged 26–35 years, potentially linked to prior medical procedures though these associations could not be confirmed due to the retrospective nature of the study [47]. The findings highlight a critical need for increased awareness and targeted screening strategies for HCV in Somalia, particularly among pregnant women, a population that has historically received limited attention in HCV-related public health efforts, which have primarily focused on HBV and HIV. The HIV prevalence of 0.2% among pregnant women aligns with Somalia's status as a low-level HIV epidemic country. It also mirrors the recent reported national prevalence of 0.1%, yet remains higher than the UNAIDS elimination target of less than 0.1% among pregnant women [48]. However, the geopolitical areas of Somali states differed, with 0.15% in Somaliland, 0.17% in Puntland, and 0.04% in the rest of the country's federal member states [49]. A similar study conducted in Mogadishu showed that the rate of HIV in pregnant women was 0.2%, while another recent study conducted in Oman reported a rate of 0.1% [50]. However, our rate is lower than that reported in other East African countries, where the prevalence of HIV among pregnant women ranges from 2.25% in South Sudan to 6.9% in Kenya [51]. The above differences may be a result of variations in sexual habits and behavior, awareness of HIV infection and testing, sociocultural practices such as religion, and access to healthcare.

Globally, pooled prevalence rates among pregnant women are estimated at 4.8% for HBV, 1.0% for HCV, and 2.9% for HIV [52], placing Somalia's rates below global averages but still above thresholds required for elimination of vertical transmission. As Somalia works toward the WHO's 2030 targets for eliminating vertical transmission of HIV, HBV, and syphilis, the absence of routine HCV screening, birth-dose HBV vaccination, and universal access to antiretroviral therapy (ART) presents barriers. Our findings will contribute to the understanding of viral hepatitis and HIV infections among pregnant women in Somalia in several ways and provide a basis for future studies. Furthermore, the present findings might help policymakers and healthcare providers formulate courses of action for the prevention and treatment of HBV and HIV infections, where clear guidance on pharmacological prophylaxis exists. For HCV, these findings can inform strategies focused on prevention and monitoring to avoid unfavorable maternal-fetal outcomes and reduce healthcare costs.

Conclusion

The prevalence rates of HBV, HCV, and HIV observed in this study among pregnant women in Mogadishu are lower than those reported in previous studies, indicating possible improvements in healthcare access and

preventive measures. Nevertheless, these infections remain a significant public health concern. Strengthening antenatal screening protocols, expanding hepatitis B vaccination coverage, and ensuring universal access to treatment are crucial steps to further reduce the impact of these infections on maternal and neonatal health in Somalia.

Abbreviations

HBV	Hepatitis B Virus
HCV	Hepatitis C Virus
HIV	Human Immunodeficiency Virus
MTCT	Mother-to-Child Transmission
HBsAg	Hepatitis B Surface Antigen
Anti-HCV	Antibodies against Hepatitis C Virus
Anti-HIV	Antibodies against Human Immunodeficiency Virus
CLIA	Chemiluminescent Immunoassay
ELISA	Enzyme-Linked Immunosorbent Assay
EPI	Expanded Programme on Immunization
ART	Antiretroviral Therapy

Authors' contributions

M.A.H.-K., E.K., M.A.N., H.H.E., M.A.H., A.I.H., and Ş.K conceptualized the study, designed the research methodology. M.A.H.-K., E.K., M.A.N., H.H.E., M.A.H., A.I.H., Ş.K., and S.A.H were responsible for data collection, data analysis, interpretation, and drafted the manuscript. All authors contributed to manuscript revision, read, and approved the final submitted version.

Funding

The authors declare that no funding was received for the conduct of this study.

Data availability

The data and materials used during the current study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Ethical approval for the use of secondary data was obtained from the Ethics Committee of Somalia Mogadishu–Turkey Recep Tayyip Erdogan Training and Research Hospital (Approval number: 21.09.2021- MSTH/7434). Informed consent was waived by the ethical commission due to the retrospective nature of the study.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

¹Liver Center Somalia, College of Medicine and Health Science, Waabari Hospital, Abarar University, Mogadishu, Somalia

²Department of Gynecologic Oncology, University of Health Sciences Turkey, Kartal Lütfi Kırdar City Hospital, Istanbul, Turkey

³Department of Internal Medicine, University of Health Sciences Turkey, Mogadishu Somalia-Turkey Recep Tayyip Erdoğan Training and Research Hospital, Mogadishu, Somalia

⁴Department of Internal Medicine, Dr. Sumait Hospital, Faculty of Medicine and Health Sciences, SIMAD University, Mogadishu 2526, Somalia

⁵Department of Public Health, Occupational Health Training Programme, Istanbul School of Medicine, Istanbul University, Istanbul, Turkey

⁶Department of Gynecologic Oncology, University of Health Sciences Turkey, Mogadishu Somalia-Turkey Recep Tayyip Erdoğan Training and Research Hospital, Mogadishu, Somalia

⁷Department of Public Health, Hamidiye Faculty of Medicine, University of Health Sciences Turkey, Istanbul, Turkey

⁸Department of Public Health, University of Health Sciences Turkey, Mogadishu Somalia-Turkey Recep Tayyip Erdoğan Training and Research Hospital, Mogadishu, Somalia

⁹Department of Medical Laboratory Sciences, Faculty of Medicine and Health Sciences, Jamhuriya University of Science and Technology, Wadajir District, Benadir Region, Mogadishu, Somalia

Received: 11 June 2024 / Accepted: 17 June 2025

Published online: 01 July 2025

References

- Victor BO, Isa HM, Yahaya I, Chindo I, Iboru O, Yakubu YS, et al. Epidemiologic survey of HBV, HCV and HIV infections in a pregnant women population in central Nigeria: a cross-sectional study. *J Infect Dis Epidemiol*. 2021;7(2):1–9.
- Ali A, Hussein N, Omar E, Elmi H. Hepatitis B vaccination coverage and associated factors among medical students: a cross-sectional study in Bosaso, Somalia 2021. *BMC Public Health*. 2022;21–8. <https://doi.org/10.21203/rs.3.rs-2381378/v1>.
- Mamuye B, Gobena T, Oljira L. Hepatitis B virus infection and associated factors among pregnant women attending antenatal clinics in West Hararge public hospitals, oromia region, Ethiopia. *Pan Afr Med J*. 2020;35:1–9.
- Hassan YSA, Hassan SA, Ahmed NR. Uptake of hepatitis B vaccination and associated factors among health sciences students, Mogadishu, Somalia. *Front Public Heal*. 2023;11(September):1–6.
- Tadesse M, Tafesse G, Hajare ST, Chauhan NM. Assessment of prevalence of hepatitis B virus and its associated factors among pregnant women from Wolaïta Sodo, Ethiopia. *J Clin Virol Plus*. 2022;2(2):100069. <https://doi.org/10.1016/j.jcvp.2022.100069>.
- Magaji FA, Okolo MO, Yiltok ES, Golit W, Anzaku SA, Ogwuche J, et al. Prevalence of hepatitis B virus infection in pregnant women with and without HIV in Jos, Nigeria. *Int J Infect Dis*. 2021;104:276–81. <https://doi.org/10.1016/j.ijid.2020.12.058>.
- Katamba PS, Mukunya D, Kwesiga D, Nankabirwa V. Prenatal hepatitis B screening and associated factors in a high prevalence district of Iira, Northern Uganda: a community based cross sectional study. *BMC Public Health*. 2019;19(1):1–7.
- Dagnaw M, Muche AA, Geremew BM, Gezie LD. Prevalence and burden of HBV–HIV co-morbidity: a global systematic review and meta-analysis. *Front Public Heal*. 2025;13(April):1–16.
- Mohamud AK, Inchon P, Suwannaporn S, Prasert K, Dirie NI. Assessment of prevalence and risk factors associated with hepatitis B virus infection among blood donors in Mogadishu Somalia. *BMC Public Health*. 2024;24(1):1–9.
- Hassan-Kadle MA, Osman MS, Ogurtsov PP. Epidemiology of viral hepatitis in Somalia: systematic review and meta-analysis study. *World J Gastroenterol*. 2018;24(34):3927–57.
- Amponsah-Dacosta E. Hepatitis B virus infection and hepatocellular carcinoma in sub-Saharan Africa: implications for elimination of viral hepatitis by 2030? *World J Gastroenterol*. 2021;27(36):6025–38.
- Roble AK, Roba KT, Mengistie B, Kure MA. Seroprevalence of hepatitis B virus and associated factors among pregnant women attending antenatal care in public health facilities in Jijiga town, Eastern Ethiopia. *Int J Womens Health*. 2020;12:1299–310.
- Dwyre DM, Fernando LP, Holland PV. Hepatitis B. Hepatitis C and HIV transfusion-transmitted infections in the 21st century. *Vox Sang*. 2011;100(1):92–8.
- Hassan SA, Ahmed YMA, Almugadam BS, Hassan YSA. Prevalence and associated factors for hepatitis B infection among pregnant women attending antenatal clinic at SOS hospital in Mogadishu, Somalia. *Front Glob Women's Heal*. 2024;5:1279088.
- Zenebe Y, Mulu W, Yimer M, Abera B. Sero-prevalence and risk factors of hepatitis C virus infection among pregnant women in Bahir Dar city, North-west Ethiopia: cross sectional study. *Pan Afr Med J*. 2015;21:1–7.
- Sellier P, Lopes A, Bergmann JF. Vertical transmission of hepatitis B virus. *Ann Intern Med*. 2014;161(10):762–3.
- Broad J, Robertson RC, Evans C, Perussolo J, Lum G, Piper JD, et al. Maternal inflammatory and microbial drivers of low birthweight in low- and middle-income countries. *Paediatr Int Child Health*. 2024;44(2):79–93. <https://doi.org/10.1080/20469047.2024.2380974>.
- Sirilert S, Tongsong T. Hepatitis b virus infection in pregnancy: immunological response, natural course and pregnancy outcomes. *J Clin Med*. 2021;10(13).
- Carter A, Pandey A, Articles, Global, national burden of HIV / AIDS. regional, and, 1990–2021, and forecasts to 2050, for 204 countries and territories: the Global Burden of Disease Study 2021. *Lancet HIV*. 2024;1–16.
- Jeele MOO, Addow ROB, Adan FN, Jimale LH. Prevalence and risk factors associated with hepatitis B and hepatitis C infections among patients undergoing hemodialysis: a single-centre study in Somalia. *Int J Nephrol*. 2021;2021.
- Dahie HA, Heyle AA. Prevalence of hepatitis B and its associated factors among pregnant women in Mogadishu, Somalia. *Arch Bus Res*. 2017;5(11).
- UNAIDS. Progress report for Somali HIV and AIDS Response 2014. 2015;(June):1–25.
- Tesfu MA, Habtemariam TT, Berhe Belay N. Risk factors associated with hepatitis B virus infection among pregnant women attending public hospitals in addis ababa, Ethiopia. *PLoS ONE*. 2023;18(4 April):1–11. <https://doi.org/10.1371/journal.pone.0284646>.
- Tiwari AK, Aggarwal G, Pabbi S, Mitra S, Yadav N, Verma V, et al. Analytical and clinical performance evaluation of enhanced chemiluminescence-based fourth-generation HIV combo assay: report from tertiary health-care setup in North India. *Asian J Transfus Sci*. 2023;17(2):175–81.
- Tesfu MA, Belay NB, Habtemariam TT. Co-infection of HIV or HCV among HBsAg positive delivering mothers and its associated factors in governmental hospitals in addis ababa, Ethiopia: A cross-sectional study. *PLoS ONE*. 2022;17(8 August):1–14. <https://doi.org/10.1371/journal.pone.0273300>.
- Fariyi AA, Okesanya OJ, Manirambona E, Oso TA, Olaleke NO, Nukpezah RN, et al. Advancing public health policies to combat hepatitis B in Africa: challenges, advances, and recommendations for meeting 2030 targets. *J Med Surg Public Heal*. 2024;2(January):100058. <https://doi.org/10.1016/j.jglmed.2024.100058>.
- Matthews PC, Ocamo P, Wang S, El-Sayed M, Turkova A, Ford D, et al. Enhancing interventions for prevention of mother-to-child transmission of hepatitis B virus. *JHEP Rep*. 2023;5(8):100777. <https://doi.org/10.1016/j.jhepr.2023.100777>.
- Perazzo H, Nunes EP, Cardoso SW, Veloso VG, Grinsztejn B. Alignment of countries in the Americas with the latest WHO guidelines for hepatitis B virus (HBV) infection: a review. *Lancet Reg Heal - Am*. 2024;39:100925. <https://doi.org/10.1016/j.lana.2024.100925>.
- Beykaso G, Mulu A, Giday M, Berhe N, Selamu M, Mihret A, et al. Burden and transmission risks of viral hepatitis in Southern Ethiopia: evidence needed for prevention and control measures. *Risk Manag Healthc Policy*. 2021;14:4843–52.
- Ondondo R, Muthusi J, Oramisi V, Kimani D, Ochwoto M, Young PW, et al. Prevalence of hepatitis B virus infection in Kenya: A study nested in the Kenya Population-Based HIV impact assessment 2018. *SSRN Electron J*. 2022;600:1–20. <https://doi.org/10.1371/journal.pone.0310923>.
- Wondmeneh TG, Mekonnen AT. Epidemiology of hepatitis B virus infection among pregnant women in Africa: a systematic review and meta-analysis. *BMC Infect Dis*. 2024;24(1). <https://doi.org/10.1186/s12879-024-09839-3>.
- Yirsaw BG, Agimas MC, Alemu GG, Tesfie TK, Derseh NM, Abuhay HW, et al. Prevalence of hepatitis B virus infection and its determinants among pregnant women in East Africa: systematic review and Meta-analysis. *PLoS ONE*. 2024;19(7 July):1–17. <https://doi.org/10.1371/journal.pone.0307102>.
- Mudardum AH, Mohammed AA. Prevalence and risk factors for hepatitis B infection among pregnant women attending antenatal clinic in UM Dafog area, South Darfur state, Sudan. *Sudan J Med Sci*. 2019;14(3):116–25.
- Malungu Ngaira JA, Kimotho J, Mirigi I, Osman S, Ng'ang'a Z, Lwembe R, et al. Prevalence, awareness and risk factors associated with hepatitis B infection among pregnant women attending the antenatal clinic at Mbagathi district hospital in Nairobi, Kenya. *Pan Afr Med J*. 2016;24:1–7.
- Taherkhani R, Farshadpour F. Prevalence, genotype distribution and mutations of hepatitis B virus and the associated risk factors among pregnant women residing in the Northern Shores of Persian Gulf, Iran. *PLoS ONE*. 2022;17(3 March):1–14. <https://doi.org/10.1371/journal.pone.0265063>.
- Peng S, Chen H, Li X, Du Y, Gan Y. Maternal age and educational level modify the association between chronic hepatitis B infection and preterm labor. *BMC Pregnancy Childbirth*. 2020;20(1):1–6.
- Al Romaihi HE, Ganesan N, Farag EA, Smatti MK, Nasrallah GK, Himatt SM, et al. Demographics and epidemiology of hepatitis B in the state of Qatar: A five-year surveillance-based incidence study. *Pathogens*. 2019;8(2):1–10.

38. Harris PK. Expression of concern: prevalence of hepatitis B and hepatitis C infection in Libya: results from a National population based survey. *BMC Infect Dis*. 2015;15(1):1.
39. Sanai F, Alkhatry M, Alzanbagi A, Kumar S. Hepatitis B virus infection in Saudi Arabia and the UAE: public health challenges and their remedial measures. *J Infect Public Health*. 2023;16(9):1410–7. <https://doi.org/10.1016/j.jiph.2023.07.008>.
40. Langat B, Muge EK, Night D, Okoth F, Ochwedo KO, Songok EM. Sero-prevalence of hepatitis B virus and compliance with hepatitis B vaccination schedules among outpatient clinic attendees in Nairobi. *PLoS ONE*. 2023;18(2 February):1–11. <https://doi.org/10.1371/journal.pone.0281256>.
41. Makokha GN, Bao H, Hayes CN, Abuduwalli M, Songok E, Hijikata M et al. The prevalence and genotype distribution of hepatitis C virus in Kenya: A systematic review and Meta-Analysis. *J Epidemiol Glob Health*. 2024;677–89.
42. Botheju WSP, Zghyer F, Mahmud S, Terlikbayeva A, El-Bassel N, Abu-Raddad LJ. The epidemiology of hepatitis C virus in central asia: systematic review, meta-analyses, and meta-regression analyses. *Sci Rep*. 2019;9(1):1–15. <https://doi.org/10.1038/s41598-019-38853-8>.
43. Abbasi F, Almkukhtar M, Fazlollahpour-Naghbi A, Alizadeh F, Behzad Moghadam K, Jafari Tadi M, et al. Hepatitis C infection Seroprevalence in pregnant women worldwide: a systematic review and meta-analysis. *eClinicalMedicine*. 2023;66:102327. <https://doi.org/10.1016/j.eclinm.2023.102327>.
44. Loarec A, Carnimeo V, Molino L, Kizito W, Muyindike W, Andrieux-Meyer I, et al. Extremely low hepatitis C prevalence among HIV co-infected individuals in four countries in sub-Saharan Africa. *Aids*. 2019;33(2):353–5.
45. Kassa GM, Walker JG, Alamneh TS, Tamiru MT, Bivegete S, Adane A et al. Prevalence, trends, and distribution of hepatitis C virus among the general population in sub-Saharan africa: A systematic review and meta-analysis. *Liver Int*. 2024;(May):3238–49.
46. Athamneh RY, Abudalo R, Sallam M, Alqudah A, Alquran H, Amawi KF, et al. Sub-genotypes of hepatitis C virus in the middle East and North africa: patterns of distribution and Temporal changes. *Infect Genet Evol*. 2023;109(February):105412. <https://doi.org/10.1016/j.meegid.2023.105412>.
47. He J, Lin J. HCV prevalence during the age range of peak sexual activity. *Lancet Infect Dis*. 2017;17(2):131–2. [https://doi.org/10.1016/S1473-3099\(17\)30003-8](https://doi.org/10.1016/S1473-3099(17)30003-8).
48. Lolekha R, Thisyakorn U, Sharma M. Elimination of mother-to-child transmission of HIV and syphilis. *Springer Briefs Public Health*. 2021. p. 13–23
49. Abdikarim H, Muse YH, Muse AH. Associated factors of awareness and knowledge about HIV/AIDS among women of reproductive age in somaliland: insights from a nationwide survey. *AIDS Res Treat*. 2025;2025(1):3425388.
50. Kurtay S, Hussein AI. Prevalence of human immunodeficiency virus among pregnant women. *Int J Womens Health*. 2022;14(December):1803–6.
51. Alier KP, Cham AM, Oliwa JO, Cheliemy PM, Orotto HH, Mathiang MM, et al. Prevalence of HIV among pregnant mothers receiving antenatal care at Kator primary health care centre, juba, South Sudan. *South Sudan Med J*. 2022;15(3):97–100.
52. Wu S, Wang J, Guo Q, Lan H, Sun Y, Ren M, et al. Prevalence of human immunodeficiency virus, syphilis, and hepatitis B and C virus infections in pregnant women: a systematic review and meta-analysis. *Clin Microbiol Infect*. 2023;29(8):1000–7. <https://doi.org/10.1016/j.cmi.2023.03.002>.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.