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Seroprevalence, Demographic Risk Factors and Trends in Hepatitis C Virus Infection Among Individuals in Luanda, Angola

Running title: Hepatitis C virus infection in Angola

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Abstract

Background: Hepatitis C virus (HCV) infection remains a major public health concern in sub-Saharan Africa (SSA), where epidemiological data are limited, particularly in countries such as Angola. Herein, we estimated the seroprevalence of HCV infection and demographic risk factors in a large urban population in Luanda, the capital city of Angola. **Methods:** This was a retrospective cohort study conducted with clinical records from 5,399 individuals screened for anti-HCV antibodies between 2020 and 2024 at the MEDIAG Laboratory, a private healthcare facility in Luanda, Angola. **Results:** Overall, 1.1% of participants were anti-HCV reactive. The mean age of HCV-positive individuals was significantly higher than non-reactive participants (47.5±15.7 vs. 37.3±12.5 years, p<0.001). Individuals aged over 40 years had a fourfold higher prevalence (2.1%) compared to those under 40 (0.5–0.6%). Men had a higher prevalence than females (1.4% vs. 0.9%) and a higher risk of infection (OR: 1.65, p=0.068). From 2020 to 2024, the prevalence of HCV cases increased (0.9% to 1.1%, p=0.984). HCV cases increased in the groups under 20 years (0% to 5.9%), 20 - 30 years (12.5% to 23.5%) and over 40 years (50% to 64.7%), but decreased in the group 31 - 40 years (37.5% to 5.9%). Also, HCV cases decrease in females (75% to 47.1%) and an increase in men (25% to 52.9%). **Conclusion:** We observed a higher prevalence of HCV among older adults over 40 years and males over the past 5 years (2020 - 2024) in the urban population of Luanda, Angola. Our findings highlight the need for targeted screening strategies focused on high-risk groups and improved surveillance to support HCV elimination goals in Angola.

Keywords: hepatitis C virus; prevalence; risk factors; Angola

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Background

Hepatitis C virus (HCV) infection remains a significant public health concern globally. According to 2019 data, 58 million people are chronically infected and resulting in about 400,000 deaths each year from cirrhosis or hepatocellular carcinoma caused by HCV infection, according to the WHO [1]. While highly effective antiviral treatments now exist, most low- and middle-income countries (LMICs) continue to face challenges in access to diagnostics and care [2]. Sub-Saharan Africa (SSA) is one of the most affected regions, where limited surveillance, unsafe medical practices, and sociocultural factors contribute to the ongoing transmission of HCV [3].

HCV is often asymptomatic in its early stages, making active surveillance and early detection essential to prevent progression to cirrhosis or hepatocellular carcinoma[4]. Despite its growing urban population, Angola remains understudied in the context of HCV epidemiology. The capital city offers a relevant urban setting to explore the demographic distribution and risk factors associated with HCV infection [5–10]. However, the lack of national screening programs and limited public awareness has resulted in insufficient data to guide public health interventions.

Currently, there are few studies on HCV and its respective epidemiological determinants conducted and published in different regions of Angola [5–10]. Therefore, the present study was conducted to estimate the seroprevalence of HCV infection and putative demographic risk factors in a large urban population in Luanda, the capital city of Angola, in order to contribute to a better understanding of HCV dynamics in SSA and support ongoing efforts toward hepatitis elimination [11].

Material and Methods

Study Design and Setting

This was a retrospective cohort study that analysed clinical records from 5,399 individuals who received healthcare between January 2020 and December 2024 at the MEDIAG Clinical Analysis Laboratory, located in Luanda, the capital city of Angola. The research was conducted by the National Centre for Scientific Research (CNIC), an institution engaged in multidisciplinary and interdisciplinary activities related to scientific research, experimental development, technology transfer, innovation, and technology-based entrepreneurship across various fields of knowledge. The study adhered to the ethical principles outlined in the Declaration of Helsinki. Ethical approval was granted by the General Management of the MEDIAG Clinic (approval number DTG-MED-05-007/2025, dated July 07th, 2025). The requirement for informed consent was waived by the Institutional Review Board, represented by the Clinical and Pedagogical Directorate of MEDIAG, due to the retrospective nature of the study. All patient data was anonymised to ensure confidentiality and protect patient identity.

Data/sample Collection and Laboratory Procedure

Sociodemographic information, including age, gender, and year of consultation, was obtained from the medical records. HCV status was determined for all participants through the detection of anti-HCV antibodies, using a chemiluminescence-based immunoassay performed on the CL-1200i Analyser (Mindray, China).

Statistical Analysis

The collected data was analysed using SPSS v29 (IBM SPSS Statistics, UAS). Descriptive statistics were presented as frequencies and percentages for categorical variables. Continuous variables were expressed as means and standard deviations (SD). Group comparisons were conducted using independent-sample t-tests or one-way analysis of variance (ANOVA), as appropriate. Associations between categorical variables were assessed using the Chi-square test. Univariate logistic regression analyses were performed to estimate potential risk factors, with results expressed as odds ratios (OR)

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and 95% confidence interval (CI). All statistical tests were two-tailed, and a p<0.05 was considered statistically significant.

Results

Demographic characteristics and risk factors related to HCV infection. The demographic characterisation of the participants and the putative features related to HCV infection using anti-HCV are presented in Table 1. A total of 5399 medical records were analysed in the present study. The age of the candidates ranged from 1 to 91 years old, with a mean of 37.4±12.6 years old. Individuals aged between 31 – 40 years old (39.1%, 2112/5399), female (64.6%, 3487/5399), from 2022 to 2024 (ranging from 22.5% - 28.3%), were the most predominant. Overall, 1.1% (57/5399) of the individuals were anti-HCV reactive. The mean age of anti-HCV reactive individuals was significantly higher (47.5±15.7 years old) compared to non-reactive individuals (37.3±12.5 years old), with a difference of 10.2 years (p<0.001). The prevalence of HCV positivity in the groups up to 40 years of age varied between 0.5 - 0.6%, while individuals over 40 years of age presented a prevalence of 2.1%, which is 4 times higher than that observed in young individuals under 40 years old. Indeed, univariate analysis showed that young individuals aged 20 to 40 years are 0.28 to 0.30 times less likely to test positive for HCV, compared to adult patients over 40 years (p<0.01). The HCV positivity rate was higher in men (1.4%, 27/1912) compared to that observed in females (0.9%, 30/3487), which was approximately 1.6 times higher, with a borderline significance (p=0.058). Indeed, univariate analysis showed that men [OR: 1.65 (95% CI: 0.98 - 2.78), p=0.068] are more likely to test HCV positive, compared to their counterparts. The prevalence of HCV ranged from 0.9% (8/869) in 2020 to 1.1% (17/1527) in 2024, which represents an increase of 0.2%. As expected, the odds of HCV infection increased from 2020 [OR: 1.02 (95% CI: 0.33 - 3.14), p=0.971] to 2024 [OR: 1.21 (95% CI: 0.52 - 2.82), p=0.656], although without any statistical significance (p>0.05).

Table 1. Demographic characteristics and risk factors related to hepatitis C virus infection in individuals from Luanda, Angola.

		Hepatitis C Virus infection			Univariate analysis	
Independent variables	**N (%)**	**Non-reactive (%)**	**Reactive (%)**	***P*-value**	**OR (95% CI)**	***P*-value**
Overall	5399 (100)	5342 (98.9)	57 (1.1)			
Age (years), Mean ± SD	37.4 ± 12.6	37.3 ± 12.5	47.5 ± 15.7	**<0.001**		
Age distribution						
<20 yrs	207 (3.8)	206 (99.5)	1 (0.5)	**<0.001**	0.23 (0.03 – 1.70)	0.150
20 – 30 yrs	1376 (25.5)	1368 (99.4)	8 (0.6)		0.28 (0.13 – 0.60)	**0.001**
31 – 40 yrs	2112 (39.1)	2099 (99.4)	13 (0.6)		0.30 (0.16 – 0.56)	**<0.001**
>40 yrs	1704 (31.6)	1669 (97.9)	35 (2.1)		1.00	
Gender						
Female	3487 (64.6)	3457 (99.1)	30 (0.9)	0.058	1.00	

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Male	1912 (35.4)	1885 (98.6)	27 (1.4)		1.65 (0.98 – 2.78)	0.060
Year of diagnosis						
2020	869 (16.1)	861 (99.1)	8 (0.9)	0.984	1.00	
2021	532 (9.9)	527 (99.1)	5 (0.9)		1.02 (0.33 – 3.14)	0.971
2022	1214 (22.5)	1200 (98.8)	14 (1.2)		1.26 (0.52 – 3.01)	0.609
2023	1257 (23.3)	1244 (99.0)	13 (1.0)		1.13 (0.46 – 2.73)	0.795
2024	1527 (28.3)	1510 (98.9)	17 (1.1)		1.21 (0.52 – 2.82)	0.656

Note: Bold number means that the results were statistically significant for the chi-square test and/or independent-samples t-test ($p<0.05$).

Trends in hepatitis C virus infection and associated demographic factors between 2020 - 2024

The result of the trend of HCV infection in individuals in Luanda is shown in Table 2. Overall, HCV case detection increased from 14% (8/57) in 2020 to 29.8% (17/57) in 2024. From 2020 to 2024, the mean age of HCV-positive individuals decreased from 48.1±19.1 years to 46.4±17.7 years, although no statistical significance was observed ($p=0.835$). On the other hand, the number of HCV cases increased in the groups under 20 years (0% to 5.9%), 20 - 30 years (12.5% to 23.5%) and over 40 years (50% to 64.7%), while there was a decrease in the age group 31 - 40 years (37.5% to 5.9%), although without statistical significance ($p>0.05$). Regarding gender, a decrease in the HCV case rate was observed in women (75% to 47.1%), while an increase was observed in men (25% to 52.9%), although no statistical significance was observed ($p=0.354$).

Table 2. Trends over time (2018 - 2022) in hepatitis C virus infection in individuals from Luanda, Angola.

Independent variables	**N (%)**	**Years of HCV infection diagnosis (2020 – 2024)**					***P-value***
		2020 (%)	**2021 (%)**	**2022 (%)**	**2023 (%)**	**2024 (%)**	
Overall	57 (100)	8 (14.0)	5 (8.8)	14 (24.6)	13 (22.8)	17 (29.8)	
Age (years), Mean ± SD	47.5 ± 15.7	48.1 ± 19.1	50.0 ± 21.4	50.8 ± 14.2	43.9 ± 10.9	46.4 ± 17.7	0.835
Age distribution							
<20 yrs	1 (1.8)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (5.9)	0.496
20 – 30 yrs	8 (14.0)	1 (12.5)	0 (0.0)	1 (7.1)	2 (15.4)	4 (23.5)	
31 – 40 yrs	13 (22.8)	3 (37.5)	3 (60.0)	3 (23.1)	3 (23.1)	1 (5.9)	
>40 yrs	35 (61.4)	4 (50.0)	2 (40.0)	10 (71.4)	8 (61.5)	11 (64.7)	
Gender							
Female	30 (52.6)	6 (75.0)	4 (80.0)	7 (50.0)	5 (38.5)	8 (47.1)	0.354
Male	27 (47.4)	2 (25.0)	1 (20.0)	7 (50.0)	8 (61.5)	9 (52.9)	

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Discussion

The HCV infection remains a public health concern in sub-Saharan Africa, a region with high burdens of infectious diseases, limited healthcare infrastructure, and socioeconomic inequalities [2]. Our retrospective data collected between 2020 and 2024 in Luanda, the capital city of Angola, provides evidence regarding HCV seroprevalence and associated risk factors, contributing to a better understanding of the epidemic picture of HCV in this African region.

The overall seroprevalence of anti-HCV observed in the present study was 1.1%, a picture consistent with estimates from low-risk populations in other African countries [1]. A meta-analysis conducted by Rao et al. (2015) reported a pooled HCV seroprevalence of 2.98% in the general population of sub-Saharan Africa, highlighting significant regional variation [12]. The consistency with our findings suggests a relatively homogeneous epidemiological pattern in urban areas with similar health service profiles. Between 2020 and 2024, a slight increase was observed in the detection rate of HCV-positive cases, rising from 14% to 29.8%. Although no statistical significance, it may reflect improvements in local diagnostic capacity or increased recruitment of at-risk individuals. This increase underscores the importance of continuous surveillance of HCV infection, particularly in settings where reliable longitudinal data remain scarce. Similarly, from 2018 to 2022, HBV infections increased from 18.2 to 21.9% in Luanda, indicating an increase in risk groups as well as greater circulation of viral infectious agents in the capital of Angola [13].

Age analysis revealed that anti-HCV reactive individuals had a significantly higher mean age compared to non-reactive individuals (47.5±15.7 vs. 37.3±12.5 years; $p<0.001$), with a prevalence of 2.1% among those over 40 years of age, about four times higher than in younger individuals (0.5–0.6%). A study conducted among health professionals in Egypt also observed a high prevalence of HCV and a high risk of infection in adults aged 50 years and older [14]. This association between older age and HCV infection has been widely documented in African studies and is often linked to past medical exposures, such as transfusions or unsafe healthcare procedures performed under low biosafety standards [15,16]. A previous study on migrants from sub-Saharan Africa has also demonstrated increased HCV prevalence among older adults, suggesting long-standing, undiagnosed infections acquired decades earlier [17,18].

It is worth mentioning that although the majority of participants were female (64.6%), males had a significantly higher prevalence of HCV (1.4%) than women (0.9%) ($p = 0.058$), with a 1.65 times higher likelihood of HCV infection among males. This trend is consistent with previous studies attributing it to behavioural and cultural differences, including greater male exposure to invasive practices such as tattoos, traditional rituals, and medical procedures conducted in non-sterile environments [19]. A study conducted in Ghana suggests that cultural practices such as tribal scarification, ritual circumcision, and home births performed by traditional birth attendants are strongly associated with increased HCV risk [20]. The cultural and geographic diversity of sub-Saharan Africa directly influences HCV transmission routes. Unlike high-income countries, where intravenous drug use is the main mode of transmission, in Africa, HCV infection is frequently linked to unsafe medical practices such as the reuse of needles, inadequate blood screening, and procedures performed outside formal healthcare settings [3,17].

We observed an increase in HCV positivity in Luanda, with detection rates rising from 14.0% in 2020 to 29.8% in 2024. This increasing trend might reflect improved diagnostic coverage or an increase in HCV circulation within the urban population. Indeed, a previous study carried out by our research team showed that HCV was related to the area of residence, with 48% of HCV cases observed in urbanised areas [10]. It is worth mentioning that the HCV detection rate among blood donors candidates of Luanda in 2016 was estimated at 5.1% [21], with a subsequent increase to 9.3% observed in 2023 [10], which represents an increase of 1.8 times, showing that the increase in HCV circulation has in fact, intensified in different regions of the Angola.

The mean age of HCV-positive individuals declined slightly from 48.1 to 46.4 years from 2020 to 2024, suggesting relative stability in age-associated risk. However, stratified analysis revealed an increase in HCV seropositivity among individuals <20 years (0.0% to 5.9%), 20–30 years (12.5% to

 doi:10.20944/preprints202507.1435.v1

23.5%), and over 40 years (50.0% to 64.7%), alongside a marked decline in the 31–40-year age group (37.5% to 5.9%), although no statistical significance observed ($p>0.05$). The increased burden among younger cohorts could be indicative of emerging transmission routes, including unsafe cosmetic procedures, intravenous drug use, worsening of sociodemographic conditions, and high-risk sexual behaviours [22]. Regarding gender, there was observed a decrease in female seropositivity (75.0% to 47.1%) and an increase among males (25.0% to 52.9%), although no statistical significance ($p=0.354$), these demographic shifts underscore evolving risk profiles and highlight the urgent need for targeted screening and prevention strategies adapted to younger and male populations, which might be increasingly contributing to ongoing HCV transmission dynamics in this urban setting of Angola.

This study presents some limitations. Firstly, the retrospective design limits the ability to establish causal relationships between risk factors and HCV infection. Therefore, a longitudinal study would be necessary to confirm temporal trends and incidence rates. Secondly, we use solely anti-HCV antibody testing, which cannot distinguish between resolved and active infections. The absence of confirmatory HCV RNA testing means that some individuals classified as positive could not have current viremia, potentially overestimating the prevalence of active HCV infection. Thirdly, although demographic data were collected, behavioural, clinical, and socioeconomic information, such as history of medical procedures, traditional practices, blood transfusions, or injection exposures, were not included. These data could have provided a better understanding of transmission routes and specific risk profiles. Finally, the study was conducted in an urban setting, which may limit generalizability to rural populations in Angola, where healthcare access, cultural practices, and transmission dynamics may differ substantially. Despite these limitations, the study highlights the urgent need for improved HCV diagnostics, including serological and molecular diagnostics, as well as the implementation of larger population surveillance in Angola.

Conclusion

We observed increased exposure and vulnerability to HCV among adults over 40 years and males in the capital of Angola, between 2020 and 2024. Our findings also indicate a shift in the epidemiological profile and highlight the need for screening strategies targeting high-risk populations and integrated surveillance systems to support HCV elimination efforts in Angola. Further studies should focus on the molecular characterisation of local HCV strains, identifying emerging transmission routes among younger cohorts, as well as assessing behavioral and structural risk factors.

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Ethics declarations: The need for informed consent to participate was waived by an Institutional Review Board (IRB), with official letter number DTG-MED-05-007/2025, approved on July 07th, 2025.

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Data Availability Statement: Data is provided within the manuscript. The data supporting this study's findings are available on request from the corresponding author.

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