American Journal of
Biomedical Science & Research

www.biomedgrid.com
ISSN: 2642-1747

Research Article

Sociodemographic Characteristics and Risk Factors Related to Denv Infection Among Individuals From Luanda, Angola

Domingos Jandondo[1,2], Kuta Luís[2], Euclides Sacomboio[1,4], Joana Morais[1]* and Cruz S Sebastião[1,3,4]*

[1]*Instituto Nacional de Investigação em Saúde (INIS), Luanda, Angola*

[2]*Faculdade de Ciências da Saúde e Bem Estar, Universidade Metodista de Angola, Luanda, Angola*

[3]*Centro de Investigação em Saúde de Angola (CISA), Caxito, Angola*

[4]*Instituto de Ciências da Saúde (ICISA), Universidade Agostinho Neto (UAN), Luanda, Angola*

***Corresponding author:** Cruz S Sebastião, Centro de Investigação em Saúde de Angola (CISA), Caxito, Angola.

Joana Morais, Instituto Nacional de Investigação em Saúde (INIS), Luanda, Angola.

To Cite This Article: *Domingos Jandondo, Kuta Luís, Euclides Sacomboio, Joana Morais* and Cruz S Sebastião. Sociodemographic Characteristics and Risk Factors Related to Denv Infection Among Individuals From Luanda, Angola. Am J Biomed Sci & Res. 2023 20(3) AJBSR.MS.ID.002718,* DOI: 10.34297/AJBSR.2023.20.002718

Received: September 21, 2023; **Published:** October 27, 2023

Abstract

Background & Objectives: Dengue caused by dengue virus (DENV) is the most widespread arbovirosis in the world. Around 100 million people are infected annually, causing a high economic burden for public health, especially in low- and middle-income countries. Herein, we investigate the sociodemographic characteristics and risk factors related to DENV infection among individuals from Luanda, the capital city of Angola.

Methods: This was a cross-sectional study carried out with 507 individuals screened for DENV in Luanda, between April to December 2021.

Results: Overall, the DENV infection was 2.4%. The DENV positivity rate reduced with increasing age (41.7% in individuals under 20 years to 33.3% in individuals over 30 years). A lower risk of infection (OR: 0.64, p=0.507) in individuals aged over 40 years. DENV infection rate was higher among females, presenting 1.54 times more chances (CI: 0.48 - 4.91, p=0.468). All cases of DENV infection were from individuals living in urbanized regions. No statistically significant differences were observed between DENV with age group, gender, or residential area (p>0.05).

Interpretation & Conclusion: Our findings emphasize the need to implement programs or activities focused on the targeted prevention of infections transmitted by mosquito bites, early identification of signs and symptoms and effective treatment, especially in regions with high population density. The creation of programs for the surveillance of non-malarial febrile syndromes is crucial. In addition, further studies on risk factors for DENV infection should be carried out, especially in regions of Angola with high population density.

Keywords: DENV, Vector-borne diseases, Risk factors, Luanda, Angola

Introduction

Dengue is an infectious disease known to be transmitted through arthropods and is caused by infection with the dengue virus (DENV), transmitted by Aedes aegypti and Aedes albopictus, the vectors responsible for the transmission of DENV [1,2]. Climatic

factors have played a crucial role in the epidemiological pattern of DENV infection cases, severity, changes in affected age groups as well as the expansion and spread from urban to rural areas among several LMICs [1]. Annually, around 100 million people are infected with DENV, causing a high economic burden for both governments and individuals, especially in low- and middle-income countries (LMICs) [3]. Four different DENV serotypes are transmitted by urban cycle mosquitoes, capable of causing different clinical conditions, ranging from less severe to severe, generally influenced by the interaction of factors such as virus, age and immune status of the host [4]. Vector-borne diseases (VBD) represent a major burden on public health in several LMICs, such as Angola [5].

Several factors could affect the transmission of DENV in LMICs, including vector efficiency, viral infectivity, host vulnerability and environmental factors, such as increasing urbanization [2]. Indeed, previous studies carried out in Angola showed that some populations in Luanda, the capital city of Angola, live in slums with limited health and sanitation services, favouring the circulation of mosquitoes and the presence of vector-borne diseases [6]. Furthermore, other studies have also shown that Luanda is a region with sociodemographic conditions vulnerable to the emergence of outbreaks and epidemics related to infectious agents transmitted by vectors [7-12]. DENV is probably under-recognized and under-reported in Africa on the one hand due to the low awareness of healthcare providers and, on the other hand, due to the existence of other prevalent febrile illnesses and the lack of diagnostic tests or systematic surveillance [13]. Therefore, in many cases, DENV infection can be confused with malaria, for example, leading to poor patient management that can present unfavorable clinical outcomes [14].

Recently, our research team reported the existence of co-circulation of DENV with malaria and SARS-CoV-2, indicating the need to integrate screening for agents of mosquito bite transmission into the testing algorithm for patients suspected of having COVID-19, at least in the current scenario of endemic circulation of numerous variants of SARS-CoV-2 in Angola [15]. DENV and malaria represent common VBDs with a high importance to public health, due to high morbidity and mortality for countless patients around the world [14]. Therefore, the creation of programs for the surveillance of non-malarial febrile syndromes as well as studies on the circulation of DENV identifying the vulnerable population becomes crucial, especially in scenarios of co-circulation of other viruses, since vulnerable populations can contract the infection and develop a serious clinical condition due to their low immunological capacity to respond naturally to infections. In this study, we investigate the sociodemographic characteristics and risk factors related to DENV infection among individuals from Luanda, the capital city of Angola, to support public health institutions in implementing strategies for early identification of signs and symptoms and effective treatment, especially in regions with high population density.

Material & Methods

Study Design and Setting

This was a cross-sectional study carried out with 507 individuals screened for DENV at the National Institute for Health Research (INIS), located in Luanda, the capital city of Angola, between April to December 2021. The INIS is an Angolan institute of scientific research whose main objective is to generate, develop and disseminate scientific, technological, and strategic knowledge about health and its determinants. The study was approved by the scientific council of the NIS through the Ministry of Health of Angola and the scientific council of the Methodist University of Angola. In addition, we requested oral authorization from participants or their legal guardians, for those under 18 years of age, before being enrolled in the study. The information obtained was completely anonymized and used only for this project. The results were used for academic purposes to contribute to improving screening and control measures for the circulation of DENV in the population.

Data, Sample Collection, and Laboratory Procedure

Sociodemographic characteristics such as age, gender and area of residence of the participants were collected by the research team using the questionnaire or national notification form for DENV. For laboratory processing, it was necessary to collect an estimated volume of 5 mL of participants' whole blood intravenously in a tube containing ethylenediaminetetraacetic acid (EDTA) and subsequently send it to the molecular biology laboratory for molecular examinations. Initially, the samples were centrifuged and 140µL of plasma samples were used for manual extraction of total RNA using the QIAamp Viral RNA kit (QIAGEN, Germany).

After extraction, the RNA was preserved at -80°C until further analysis. The presence of DENV RNA was screened using real-time reverse-transcription polymerase chain reaction (RT-PCR) with the Applied Biosystems 7500 Fast RT-PCR System (Thermo Fisher Scientific), To this end, we used the Centers for Disease Control and Prevention (CDC) Trioplex real-time RT-PCR assay was used [16,17]. RT-PCR was performed using 10µL of RNA in a final reaction volume of 25µL containing primers and probes aimed at the qualitative detection of DENV, Zika virus (ZIKV) and chikungunya virus (CHIKV). Positive and negative control samples were included in the laboratory assay plate as recommended by the manufacturer. Samples that presented CT values lower than 31 were considered positive while samples with CT values equal to or greater than 31 were considered negative.

Statistical Analysis

The data collected for this study were processed from a statistical point of view in SPSS version 29 (IBM SPSS Statistics). All frequencies and percentages shown in the table were presented as part of the descriptive analyses carried out. The mean and standard deviation (SD) data were presented after their normal distribution was proven. The Chi-square test (X2) and univariate logistic regression were applied to qualitative variables to verify interactions between the variables. Whenever possible, the variables were dichotomized to facilitate their analysis and interpretation. Odds ratios (OR) with 95% confidence intervals (CI) were also calculated and reported p-values are two-tailed and considered significant only when $p<0.05$.

Results

The sociodemographic description of the studied population, as well as the putative risk factors for DENV infection, are shown in Table 1. In total, 507 subjects participated in this study. The ages of the patients studied ranged from 10 to 82 years. The average age was 28±14 years. Individuals over the age of 30 (42.6%, 216/507), males (52.1%, 264/507) and residents of urbanized areas (99%, 502/507) were predominant. Overall, the DENV infection rate was 2.4% (12/507). The average age of infected individuals (22.7±17.3) was lower than the average age of negative individuals (27.6±13.4), although no statistically significant differences were observed (p>0.05). The DENV positivity rate reduced with increasing age (from 41.7% in individuals under 20 years old to 33.3% in individuals over 30 years old).

No statistically significant relationship was observed between DENV infection and age group (p>0.05), although we observed a lower risk of infection (OR: 0.64, p=0.507) in individuals aged over 40 years. Although our population is predominantly male (52.1%), the DENV infection rate was higher among females, presenting 1.54 times more chances (CI: 0.48-4.91, p=0.468) of infection compared to men. Despite this, no statistically significant relationship was observed between DENV infection and gender (p>0.05). Regarding the distribution of the infection according to place of residence, we observed that all cases of DENV were from individuals living in urbanized regions, constituting a region with a high risk of DENV infection.

Discussion

DENV infection is endemic in Luanda, the capital city of Angola, with a strong possibility of outbreaks emerging [9,12]. To date, DENV-2 is predominant and has been responsible for the public health burden of DENV-related crises and deaths, although our research team had already identified DENV-1 (unpublished results) co-circulating in the 2018 outbreak [8]. The burden of dengue fever in Luanda is aggravated by poor basic sanitation in residential areas, which favours the continuous emergence of mosquitoes, poor availability of medical facilities, weak capacity to carry out the randomized diagnosis in the population, inadequate mosquito control measures and without forgetting the weather conditions that favour the expansion of vectors in the capital. In this study, the prevalence of DENV was 2.4% (Table 1), which was lower than that observed in previous studies carried out in Angola, ranging from 11% to 27.6%.6,15 Furthermore, our results were lower compared to the infection rate reported for sub-Saharan Africa between 2010 and 2020, which was around 8.4% to 29% [18-20].

Table 1: Sociodemographic characteristics and risk factors related to DENV infection among individuals from Luanda, Angola.

Independent Variables	N (%)	DENV Infection			Univariate Analysis	
		Neg (%)	Pos (%)	P-value	OR (95% CI)	p-value
Overall	507(100)	495(97.6)	12(2.40)			
Age (Mean±SD)	27.5±13.5	27.6±13.4	22.7±17.3	0.214		
Age distribution						
<20 yo	174(34.3)	169(34.1)	5(41.7)	0.794	1	-
20-30 yo	117(23.1)	114 (23.0)	3(25.0)		0.89 (0.21-3.80)	0.874
>30 yo	216(42.6)	212 (42.8)	4(33.3)		0.64 (0.17-2.41)	0.507
Gender						
Male	264(52.1)	259(52.3)	5(41.7)	0.465	1	-
Female	243(47.9)	236(47.7)	7(58.3)		1.54 (0.48-4.91)	0.468
Residence						
Urbanized	502(99.0)	490(99.0)	12 (100)	0.726	1	
Non-urbanized	5(1.00)	5(1.00)	0(0.0)		0.00 (0.00-0.00)	0.999

Several studies have reported that vector efficiency, viral infectivity, host immunological vulnerability, environmental changes and increased urbanization are factors that enhance the transmission of DENV and other VBDs in the community, especially in resource-limited countries [1,4,14]. According to the results obtained in this study, the urbanized regions of Luanda, a region where there is a higher concentration of the population, was the one that presented all cases of DENV infection (Table 1). Similar to our findings, previous studies including a systematic review and meta-analysis carried out in Africa also showed that urbanized areas are one of the main risk factors for DENV infection [2,3,21].

Previous studies have shown that DENV infection has taken a new direction in the epidemic, affecting more young people compared to adults [22]. which corresponds to the findings of the present study, where the average age of the population with DENV infection was lower than that of the uninfected population, with a difference of 4.9 years of age, although this difference is not statistically significant (p>0.05), control measures must be concentrated on the young population, which since they have lower immunity, can on one hand easily contract the DENV infection and on the other hand develop the severe disease (Table 1). The reduction in DENV positivity with increasing age was also observed in a study previously

carried out by our research team [15]. Likewise, in previous studies we observed a 3.78 times greater risk of infection in urbanized regions compared to non-urbanized regions, which reinforces the need to control the spread of DENV infection in regions with high population concentration.15 Contrary to our findings, we previously observed that men were 1.44 times more likely to be infected by DENV, while in this study it was women who were 1.54 times more likely to be infected when compared to men [15].

Previously published studies have reported statistically significant differences between genders and the results of serological tests for DENV, such as NS1 antigen, IgM antibody and hemorrhagic findings [23]. Our findings suggest that Angola's Ministry of Health must create conditions to facilitate diagnostic capacity in the population at the level of primary units, to ensure adequate diagnosis and surveillance of malarial fevers and non-malarial fevers in the country's capital. Despite this, the determinants related to VBDs, including dengue fever and/or other non-malarial fevers, immunological profile, severity and clinical outcome, should be the subject of strong investigation in the Angolan population, to allow the identification of vulnerable people quickly and therefore prevent the emergence of outbreaks related to VBDs in Angola.

Conclusion

In conclusion, our findings showed that DENV infection remains a concern to public health in Angola. Despite advances in the development and construction of centralities and large infrastructures, Luanda still represents a place with a high risk of mosquito circulation and a high risk of outbreaks related to mosquito bites, emphasising the need to implement programs focused on the targeted prevention of DENV and other infections transmitted by mosquito bites, especially in urbanized regions, where there is a high population density. Moreover, the creation of programs for the surveillance of non-malarial febrile syndromes is crucial and will bring great benefits to public health in Angola.

Acknowledgments

The authors would like to thank all study participants. Furthermore, we would like to thank the INIS|CISA for their logistical and administrative support.

Data Availability Statement

The data supporting this study's findings are available on request from the corresponding author.

Conflict of Interest Statement

The authors declare no conflict of interest.

Author Contribution Statement

Conceptualization: DJ and CSS. investigation: DJ, KL, and CSS. Methodology: DJ, ES, JM, and CSS. Validation: CSS and JM. Data curation: DJ, ES, CSS. Formal analysis: CSS. Data collection: DJ and KL. Supervision: JM and CSS. Writing - original draft: Dj and CSS. Writing - review & editing: DJ, ES, JM, and CSS. All authors approved the final manuscript for publication.

References

1. Mwanyika GO, Mboera LEG, Rugarabamu S, Baraka Ngingo , Calvin Sindato, et al. (2021) Dengue Virus Infection and Associated Risk Factors in Africa: A Systematic Review and Meta-Analysis. Viruses 13(4): 536.
2. Were F (2012) The dengue situation in Africa. Paediatr Int Child Health 32(sup1): 18-21.
3. Guo C, Zhou Z, Wen Z, Yumei Liu, Chengli Zeng, et al. (2017) Global Epidemiology of Dengue Outbreaks in 1990-2015: A Systematic Review and Meta-Analysis. Front Cell Infect Microbiol 7: 317.
4. Halstead S (2019) Recent advances in understanding dengue. F1000Res 8: 1279.
5. INE M (2017) Inquérito de Indicadores Múltiplos e de Saúde 2015-2016(IIMS) 1-559.
6. Sebastião CS, Neto Z, Jandondo D, Mirandela M, Morais J, et al. (2022) Dengue virus among HIV-infected pregnant women attending antenatal care in Luanda, Angola: An emerging public health concern. Scientific African 17: e01356.
7. Hill SC, de Vasconcelos JN, Granja BG, Julien Thézé, Domingos Jandondo, et al. (2019) Early genomic detection of cosmopolitan genotype of dengue virus serotype 2, Angola, 2018. Emerg Infect Dis 25(4): 784-787.
8. Neto Z, Martinez PA, Hill SC, Domingos Jandondo, Julien Thézé, et al. (2022) Molecular and genomic investigation of an urban outbreak of dengue virus serotype 2 in Angola, 2017-2019. PLoS Negl Trop Dis16(5): e0010255.
9. Hill SC, Vasconcelos J, Neto Z (2019) Emergence of the Asian lineage of Zika virus in Angola: an outbreak investigation. Lancet Infect Dis 19(10): 1138-1147.
10. Hill SC, Neto de Vasconcelos J, Granja BG, Julien Thézé, Domingos Jandondo, et al. (2019) Early Genomic Detection of Cosmopolitan Genotype of Dengue Virus Serotype 2, Angola, 2018. Emerg Infect Dis 25(4): 784-787.
11. Hill SC, Vasconcelos J, Neto Z, Domingos Jandondo, Líbia Zé-Zé, et al. (2019) Emergence of the Zika virus Asian lineage in Angola: an outbreak investigation. Lancet Infect Dis 19(10):1138-1147.
12. (2013) Ministry of Health of Angola. Ongoing Dengue Epidemic -Angola MMWR 62(24): 504-507.
13. Amarasinghe A (2011) Dengue Virus Infection in Africa. Emerg Infect Dis 17(8): 1349-1354.
14. Wiwanitkit V (2011) Concurrent malaria and dengue infection: a brief summary and comment. Asian Pac J Trop Biomed 2011(4): 326-327.
15. Sebastião CS, Gaston C, Paixão JP, Euclides N M Sacomboio, Zoraima Neto, et al. (2021) Coinfection between SARS-CoV-2 and vector-borne diseases in Luanda, Angola. J Med Virol 94(1): 366-371.
16. Santiago GA, Vázquez J, Courtney S, Katia Y Matías, Lauren E Andersen, et al. (2018) Performance of the Trioplex real-time RT-PCR assay for detection of Zika, dengue, and chikungunya viruses. Nat Commun 9(1): 1391.
17. Centers for Disease Control and Prevention (2017) Trioplex Real-time RT-PCR AssayCDC 57.
18. Eltom K, Enan K, El Hussein ARM, Elkhidir IM (2021) Dengue Virus Infection in Sub-Saharan Africa Between 2010 and 2020: A Systematic Review and Meta-Analysis. Front Cell Infect Microbiol 11: 678945.
19. Simo FBN, Bigna JJ, Kenmoe S, Marie S Ndangang, Elvis Temfack, et al. (2019) Dengue virus infection in people residing in Africa: a systematic review and meta-analysis of prevalence studies. Sci Rep 9(1): 13626.
20. Mwanyika GO, Mboera LEG, Rugarabamu S (2021) Dengue Virus Infection and Associated Risk Factors in Africa: A Systematic Review and Meta-Analysis. Viruses13(4): 536.

21. Mwanyika GO, Mboera LEG, Rugarabamu S, Baraka Ngingo, Calvin Sindato, et al. (2021) Dengue Virus Infection and Associated Risk Factors in Africa: A Systematic Review and Meta-Analysis. Viruses 13(4): 536.

22. Teixeira MG, Costa MCN, Coelho G, Barreto ML (2008) Recent Shift in Age Pattern of Dengue Hemorrhagic Fever, Brazil. Emerg Infect Dis 14(10): 1663-1663.

23. Chakravarti A, Roy P, Malik S, Siddiqui O, Thakur P, et al. (2016) A study on gender-related differences in laboratory characteristics of dengue fever. Indian J Med Microbiol 34(1): 82-84.