COMPARATIVE ANALYSIS OF THE INCIDENCE OF COVID-19 AND MALARIA FATALITY RATE IN NIGERIA

Richard Olutan & Sunday Abatan

Department of Demography and Social Statistics Federal University Oye Ekiti

Corresponding Email: richardolutan@gmail.com

INTRODUCTION AND BACKGROUND

Malaria poses a significant health threat, especially in sub-Saharan Africa, causing substantial morbidity and mortality. In 2018, global statistics revealed 228 million cases and 405,000 fatalities, with 93% concentrated in sub-Saharan Africa. Pregnant women bore a considerable burden, accounting for 11 million malaria cases and 900,000 instances of low birth weight in newborns. Children under five constituted two-thirds of global deaths, emphasizing the vulnerability of marginalized populations (Ajayi, Ajumobi & Falade, 2020). Malaria's impact spans all age groups, with pregnant women and young children particularly susceptible, making it a leading cause of mortality among children under five in low-developed countries (WHO). The clinical presentations and empirical treatment of COVID-19 and malaria are indistinguishable, attributed to shared pathophysiological traits. Similar high rates in rural and urban slums are linked to factors like pre-existing conditions, poor infrastructure, limited healthcare access, and poverty, facilitating transmission. Both diseases are perilous due to their comparable clinical manifestations (Ajayi et al., 2020). Understanding mortality risks necessitates acknowledging age as a marker of cumulative damage, associated with chronic diseases and disabilities (Nepomuceno et al., 2020). Population age structure significantly influences COVID-19 vulnerability and fatalities across countries. A study found a fourfold lower standardized mortality ratio in Africa compared to Europe and North America and twofold less compared to Asia and South America (Mougeni, Mangaboula, and Lell, 2020, as cited in Hussein et al., 2020). The differences in population age sex composition of countries have put limits to how comparison of demographic rates can be done between countries. Different pieces of literature have made research to look into the effect of population age structure on both COVID-19-caused mortality and malaria-caused mortality.

However, in all of these studies, none has directly applied a demographic technique to analyze for adjustment in age-sex composition. This study therefore aims at standardizing and comparing the age sex cause specific mortality of COVID-19 and Malaria through the use of direct standardization. The study will therefore produce demographic rates that can henceforth then be used for policy implication that would help in the management of the two endemic diseases.

METHODOLOGY

This study used data from secondary data and also pooled data from Max Planck Institute for Demographic Research under the operation of CoverageDB published the COVID-19 Age-Sex data for cases and Deaths. The data was published by Open Science Framework. Malaria data was made available by the Institute for Health Metrics and Evaluation (IHME). This dataset is called the Global Burden for Diseases. The Institute for Health Metrics and Evaluation was established by the University of Washington. The Covid-19 data spans from the beginning of covid-19 cases in Nigeria which is 2021 to 2022 while the malaria data is for the year 2018.

The study used an experimental and diagnostic design. The diagnostic design here is based on descriptive design which explains the confirmed cases and fatality of the two diseases. The Analysis of this study will make use of demographic techniques through the use of the following statistical software; Ms. Excel, STATA, and Population Analysis Software (PAS). The age distribution of the incidence and fatality of Covid-19 and Malaria was presented with a Population Pyramid. An Age-Sex case fatality rate and standardized mortality rate was computed using Population Analysis Software (PAS). The STATA version 17-MP was used to test for the hypothesis using a T-test, Variance ratio test, and Two-way ANOVA test.

RESULTS AND KEY FINDINGS

The results are presented as follows; The age comparative age structure of COVID-19 and Malaria

Fig.1 Covid-19 Incidence Pyramid **Fig.2 Malaria incidence pyramid**

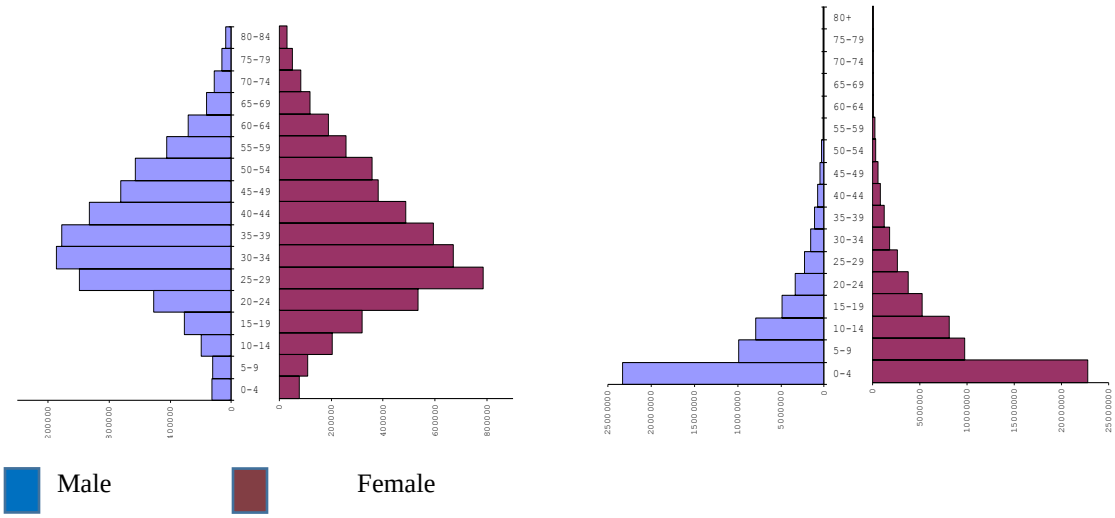

Table 4.5: Two-group mean comparison output of Covid-19 and Malaria incidence

Variable	Number of Age group	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
Covid-19 cases	17	776022.2	147713.2	609037.2	462884.1	1089160
Malaria	17	6708377	2848731	11700000	669336.2	12700000
combined	34	3742199	1496409	8725489	697732.4	6786666
diff		-5932354	2852558		-11821883.3	-121883
diff = mean(Covid) - mean(Malaria)						
Ho: diff = 0		d.f = 32		t = -2.08		
Ha: diff < 0		Ha: diff != 0			Ha: diff > 0	
Pr(T < t) = 0.02		Pr(|T| > |t|) = 0.05			Pr(T > t) = 0.98	

Author's Computation (2023) and STATA 12.0 Output

The table shows that there is a significant difference in the covid-19 and malaria incidence since the p-value is less than 0.05.

Table 4.6: Two group mean comparison test COVID-19 and Malaria fatality.

Variable	Number of Age group	Mean	Std. Err	Std. Dev.	[95% Conf. Interval]	
Malaria	17	9.0	3.7	15.31	1.13	16.88
Covid-19	17	2.5	0.9	3.50	0.71	4.31
combined	34	5.8	1.96	11.43	1.77	9.74
diff		-6.5	3.81		-14.26	1.27
diff = mean(Covid)-mean(Malaria)						
Ho: diff = 0			t =	-1.70	d.f = 32	
Ha: diff < 0		Ha: diff != 0		Ha: diff > 0		
Pr(T < t) = 0.98		Pr(|T| |t|) = 0.04		Pr(T > t) = 0.02		

Author's Computation (2023) and STATA 12.0 Output

The table shows that there is a significant difference in the COVID-19 and malaria fatality rates at $p < 0.05$.

Table 4.8: Two-way full factorial Analysis of variance

Source		Partial SS	df	MS	F	Prob > F
Model		2787.2	3	929.1	18.33	0.0000
Diseases		174.9	1	174.9	3.45	0.073
Age group		114.5	1	114.5	2.26	0.1433
Diseases#Agegroup		643.4	1	643.4	12.69	0.0013
Residual		1520.8	30	50.7		
Total		4308.0	33	130.6		
No of obs - 34			R-squared = 0.65			
Root MSE = 7.12			Adj R-squared = 0.61			

Author's Computation (2023) and STATA 12.0 Output

The table output of the coefficient of determination shows that 64.7% of the variation in the fatality of COVID-19 and malaria is explained by age group.

DISCUSSION OF FINDINGS

The study, "Comparing COVID-19 and Malaria Fatality Rates in Nigeria," aimed to adjust for age in the Age-Specific Incidence Fatality of COVID-19 and Malaria for meaningful comparison. Standardized fatality rates were calculated for COVID-19 (0.20) and Malaria (2.40) using direct standardization. Results indicated a regressive fatality rate age structure for COVID-19 and a stationary incidence age structure, while Malaria exhibited a regressive fatality rate age structure and a progressive incidence age structure. Elimian et al. (2020) supported the findings that the majority of COVID-19 patients are older, and Abulude & Abulude (2020) corroborated that most patients are male. Significant differences in COVID-19 and Malaria incidence in Nigeria ($p < 0.05$) were noted, with Malaria incidence surpassing COVID-19, aligning with Simon-Oke, Awosolu, & Odeyemi's (2023) findings of 67.6% and 12.4% prevalence, respectively. A significant difference in COVID-19 and Malaria fatality rates was also observed ($p < 0.05$), consistent with Simon-Oke et al. (2023) regarding age groups.

Variations in the age-sex pattern of COVID-19 and Malaria incidence and fatality rates were noted, supported by Leong et al.'s (2021) global temporal pattern study. The low case fatality rate of COVID-19 in Nigeria was affirmed by Nas et al. (2020). Moreover, the study revealed that 59.8% and 64.7% of the variation in COVID-19 and Malaria incidence and fatality, respectively, was attributed to age. Levin et al.'s (2020) study emphasized age composition's significant role in COVID-19 fatality rate variation across geographical locations.

CONCLUSION AND RECOMMENDATION

The study aimed to adjust for age effects on the incidence fatality rates of COVID-19 and malaria and identified higher case fatality rates among males in Nigeria. Both diseases exhibited a retrogressive population pyramid, while COVID-19 had a stationary and malaria-progressive pyramid. Unadjusted, COVID-19 showed a higher case fatality rate than malaria, but after standardization, malaria surpassed COVID-19.

Conclusively, significant differences in incidence patterns and fatality rates were observed between COVID-19 and malaria. Recommendations include maximizing standardization techniques for demographic rate comparison, improving government data collection and disease surveillance, smoothing age data for error adjustment, and promoting ongoing disease comparisons for informed policymaking. Government focus on vulnerable age groups for both malaria and COVID-19 is crucial.

REFERENCES

Abulude, F., & Abulude, I. (2020). Sars-Cov-2 Pandemic in Nigeria: The Impact on Age and Sex Distributions. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3712574.

Ajayi, I. O., Ajumobi, O. O., & Falade, C. (2020). Malaria and COVID-19: commonalities, intersections, and implications for sustaining malaria control. *The Pan African medical journal*, *37*(Suppl 1), 1. https://doi.org/10.11604/pamj.supp.2020.37.1.25738

Elimian, K., Ochu, C., Ebhodaghe, B., Myles, P., Crawford, E., Igumbor, E., Ukponu, W., Olayinka, A., Aruna, O., Dan-Nwafor, C., Olawepo, O., Ogunbode, O., Atteh, R., Nwachukwu, W., Venkatesan, S., Obagha, C., Ngishe, S., Suleiman, K., Usman, M., Yusuff, H., Nwadiuto, I., Mohammed, A., Usman, R., Mba, N., Aderinola, O., Ilori, E., Oladejo, J., Abubakar, I., & Ihekweazu, C. (2020). Patient characteristics associated with COVID-19 positivity and fatality in Nigeria: retrospective cohort study. BMJ Open, 10. https://doi.org/10.1136/bmjopen-2020-044079.

https://www.who.int/news-room/fact-sheets/detail/malaria

Hussein, M. I. H., Albashir, A. A. D., Elawad, O. A. M. A., & Homeida, A. (2020). Malaria and COVID-19: unmasking their ties. *Malaria journal, 19(1),* 457. https://doi.org/10.1186/s12936-020-03541-w

Leong, R.; Lee, T.-S.J.; Chen, Z.; Zhang, C.; Xu, J. Global Temporal Patterns of Age Group and Sex Distributions of COVID-19. Infect. Dis. Rep. 2021, 13, 582–596. https://doi.org/10.3390/idr13020054

Levin, A. T., Hanage, W. P., Owusu-Boaitey, N., Cochran, K. B., Walsh, S. P., & Meyerowitz-Katz, G. (2020). Assessing the age specificity of infection fatality rates for COVID-19: systematic review, meta-analysis, and public policy implications. *European journal of epidemiology*, *35*(12), 1123–1138. https://doi.org/10.1007/s10654-020-00698-1

Mougeni F, Mangaboula A, Lell B. The potential effect of the African population age structure on COVID-19 mortality. medRxiv. 2020. https://doi.org/10.1101/2020.05.19.20106914.

Nas, F., Ali, M., Azu, L., Abdallah, M., & Yusuf, S. (2020). Epidemiology of novel COVID-19 in Nigeria. , 1, 49-56. https://doi.org/10.21608/mid.2020.103530.

Nepomuceno, M. R., Acosta, E., Alburez-Gutierrez, D., Aburto, J. M., Gagnon, A., & Turra, C. M. (2020).Besides population age structure, health and other demographic factors can contribute to understanding the COVID-19 burden. Proceedings of the National Academy of Sciences (PNAS), 117(25), 13881-13883. https://doi.org/10.1073/pnas.2008760117

Nigeria Centre for Disease Control (NCDC), *COVID-19 NIGERIA*, 2021

Sasson, I. (2021). Age and COVID-19 mortality: A comparison of Gompertz doubling time across countries and causes of death. *Journal of Population* Sciences *volume 44* - article 16 | pages 379–396, https://doi.org/10.4054/DemRes.2021.44.16

Simon-Oke, A. I., Awosolu, O. B., & Odeyemi, O. (2023). Prevalence of Malaria and COVID-19 Infection in Akure North Local Government Area of Ondo State, Nigeria. *Journal of parasitology research*, *2023*, 9529563. https://doi.org/10.1155/2023/9529563

World Health Organization. Population-based age-stratified sero-epidemiological investigation protocol for COVID-19 virus infection. Version 1.1, 17 March 2020.

World Health Organization. WHO Coronavirus (COVID-19) Dashboard. [Accessed on: 26 August 2021]. Available at: https://covid19.who.int/

Worldometer, *Corona Virus Pandemic*, 2021 Available from worldometers.info/coronavirus/

SUPPLEMENTARY MATERIALS