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A Statistical Study of Death Due to Communicable Diseases in Nigeria

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ABSTRACT

Communicable diseases remain a major contributor to mortality in Nigeria, largely driven by weak health infrastructure, inadequate sanitation, and limited disease surveillance systems. A retrospective study was conducted using World Health Organization mortality data covering the period 2018 to 2021. The analysis focused on deaths attributed to ten major communicable diseases, including malaria, lower respiratory tract infections, diarrhoeal diseases, tuberculosis, birth asphyxia and birth trauma, complications of preterm birth, neonatal sepsis and other infections, meningitis, and HIV/AIDS. The annual and overall proportionate mortality was determined using descriptive statistics; the normality was confirmed using Shapiro-Wilk tests ($p > 0.05$) permitting one-way ANOVA ($\alpha = 0.05$) to determine time difference. Lower respiratory infections (21.0%) and malaria (20.9%), major contributors, accounted for >40% of deaths; followed by diarrhea diseases (18.1%) and tuberculosis (10.3%); lesser contributors include neonatal sepsis (5.0%), meningitis (4.3%), and HIV/AIDS (4.2%). Many diseases like tuberculosis and HIV/AIDS show a declining trend. Results of ANOVA ($F = 4.95$, $p = 0.0081$) indicated significant differences across years. Tukey's post hoc test indicated lower mortalities in 2021 than 2018-2019. The findings indicate that the burden of the leading causes has been reduced slightly, but the progress remains insufficient. Increased funding for vector control, immunization, maternal-neonatal care, disease surveillance systems, and equitable allocation of resources can help accelerate the reduction in mortality.

Keywords: Communicable diseases; Mortality burden; Retrospective study

INTRODUCTION

It is estimated that millions of lives are lost every year owing to the burden of communicable diseases. Nigeria bears one of the heaviest communicable disease burdens in the world, accounting for the highest share of global malaria deaths and among the highest burdens of HIV/AIDS and tuberculosis globally (WHO, 2024). In spite of impressive improvement in global health interventions and medical science, communicable diseases still claim the lives of millions of people every year. Many of these deaths are preventable, especially in low- and middle-income countries such as Nigeria where the healthcare system remains inadequate and preventable deaths continue to occur at unprecedented levels. Nigeria is the most populous nation in Africa, with a population of over 200 million. The epidemiology of Nigeria is characterized by the coexistence of a number of diseases that combined account for a significant percentage of all deaths. However, statistical assessments of their relative contribution to total mortality are limited (Haider, 2021). When poverty, lack of sanitation, malnutrition, weak disease surveillance system and poor access to quality healthcare services are present, communicable diseases flourish. No preventable measures are taken leading to deaths. Thus, it can become very serious public health issue if not taken care of with evidence-based measures.

A number of diseases have been identified as responsible for a substantial proportion of mortality among Nigerians. Consequently, there is a need to study these diseases individually to examine their consequences and subsequently assess their impact at the population level. Despite continuous efforts, malaria remains one of the

foremost infectious killers in the country. Approximately 25% of malaria cases and deaths globally are reported in Nigeria (WHO, 2024). Evidence from community-level investigations further corroborates this burden; for instance, a retrospective study conducted in Adiyan, Ogun State, utilising antimalarial drug sales as a proxy indicator, documented distinct temporal and demographic patterns of malaria prevalence between 2019 and 2022, highlighting the utility of innovative surveillance approaches in characterising localised disease burden (Ayenigba & Afariogun, 2026). The disease disproportionately affects children under five years of age and pregnant women (Ibrahim *et al*., 2023). Respiratory infections constitute another preventable cause of death, with young children and other vulnerable patients lacking access to antibiotics and supportive care frequently succumbing to pneumonia and bronchitis (Okonkwo *et al.,* 2024). Diarrhoeal diseases account for a considerable proportion of child mortality, a burden exacerbated by inadequate access to clean water, sanitation, and hygiene infrastructure across numerous Nigerian communities (Mutevedzi *et al.,* 2025). Tuberculosis remains a significant public health challenge, with Nigeria ranking among the highest-burden countries globally, a situation further complicated by the emergence of multidrug resistance and an elevated rate of HIV-tuberculosis co-infection (Olaleye *et al.,* 2023). Other communicable diseases of concern include birth asphyxia and birth trauma, complications of preterm birth, neonatal sepsis and infections, meningitis, and HIV/AIDS, which collectively contribute to a substantial mortality burden necessitating systematic data collection to inform public health policy and guide resource allocation.

The inability to measure the burden posed by communicable diseases in Nigeria is due to the multiplicity of issues in the health system which effectively mask mortality but also make concerted efforts to prioritize them rather difficult. Nigeria's disease surveillance system, though operational, suffers from underreporting, low quality of data, poor case definitions, and a wide gap between the actual occurrence and reported cases of diseases. These challenges lead to a serious underestimation of the actual mortality burden and delay the detection of outbreaks (Aborode *et al.*, 2021). In Nigeria, a greater number of people die from communicable diseases outside of a formal health system, and are most likely to do so in rural and underserved urban areas. They cannot be captured by conventional surveillance as a result. In addition, their contribution to the mortality statistics is generally not recognized (Dhage & Nagtode, 2024). Absence of standardised mortality reporting systems, reliance on mostly low-quality verbal autopsies, and competing health priorities that detract resources and attention from communicable disease prevention means there is a data void preventing a fuller understanding of the true disease burden (Lawn *et al*, 2008.). In addition, the disjointedness of data collection has hindered the production of comparable data on the relative contribution of different communicable diseases to total mortality within a time period and a geographical area as a consequence of disease-specific programs that are vertically organized, limited interaction between health sectors, and suboptimal investment in integrated surveillance (Usman *et al.,* 2024.).

This research aims to fill an important gap in Nigerian health knowledge by conducting an empirical investigation of the death from communicable diseases using systematically generated data from 2018 to 2021. This period witnessed significant epidemiological transition in Nigeria and offers sufficient time range for trend analysis. Understanding disease-specific mortality patterns is crucial. However, there is a lack of comprehensive statistical analysis that examined the yearly and total relative contribution of major communicable diseases to total mortality in Nigeria, limiting the evidence available to policymakers and programme managers to optimally allocate limited resources for maximum public health impact. In addition, the lack of formal statistical assessment to determine whether mean contributions of communicable diseases in different years exhibit significant differences has precluded the identification of emerging disease trends. It has also hindered the recognition of successful interventions and the detection of any shifts in disease burden that ought to direct policy or program modifications. Research on mortality from specific communicable diseases in Nigeria often uses cross-sectional designs that are geographically restricted in time (Tesfay *et al*., 2022.) Consequently, they are unable to characterize the trajectories of disease burdens and assess how diseases differentially contribute to total mortality. In addition, previous studies have mostly not used rigorous statistical methods to test whether disease contributions differed significantly between years. This may have led to missed opportunities to identify temporal patterns in disease contribution that may have been useful for designing contributing disease prevention, control, and elimination strategies in Nigeria.

The study aims to comparatively analyze the annual and total relative contribution of each of the communicable diseases (malaria, lower respiratory infections, diarrheal diseases, tuberculosis, birth asphyxia and birth trauma, preterm birth complications, neonatal sepsis and infections, meningitis, and HIV/AIDS mortality) to total death in Nigeria in 2018–2021 implementation period using descriptive statistical analysis and proportionate mortality analysis. The study also aims to statistically analyze the contribution of various communicable diseases to mortality from 2018 to 2021 if there is a significant

difference in the mean contribution through parametric or non-parametric hypothesis testing procedures (Tessema *et al.,* 2023.). With a baseline understanding of disease-specific mortality contributions and temporal patterns, evidence generated by this study will support priority-setting processes, resource allocation decisions, and program planning efforts aimed towards a reduction in preventable mortality from communicable diseases in Nigeria. Also, recognizing communicable diseases with statistically significant decreases in their shares of mortality contribution over time will highlight new disease threats that will require more surveillance and response capacity or success stories in which interventions may be demonstrating a measurable population-level impact (Shahbazi *et al.,* 2025.). Evidence of this nature will facilitate the transmutation of global pledges to reduce mortality from communicable diseases into locally relevant actions that not only aim at Nigeria's specific disease profile and public health priorities but enhance continental and global health efforts.

In order to achieve these aims, the study adopts a comprehensive statistical framework, utilizing mortality data from various sources, standardized disease definitions that follow international classification norms, and appropriate analytical tools to test hypotheses regarding the contributions of disease burden in different time periods (Jamison *et al.,* 2013.). The study combines mortality information from secondary data sources such as records from a facility-based survey and health facility surveys and vital registration systems. Nigeria has a diverse geographic and socio-economic area. It matches selected disease transmission dynamics and health access.

The proposed outcomes of the statistical examination of communicable disease mortality in Nigeria will have significant benefits for numerous stakeholder groups interested in enhancing the health of the population and reducing avoidable deaths (Muhammad *et al,* 2017). The quantified contributions made by diseases and the identified temporal trends will clarify for policy makers and government health agencies which communicable diseases to prioritise investment to build up infrastructure for their prevention, diagnosis and treatment. Healthcare workers and program managers will be able to allocate resources, investments in staff training and other programmes at various levels of healthcare facilities depending upon the comparative burden and trends of epidemic maladies. According to the study, this research will provide empirical data and statistical methods against which to compare future trends in mortality from communicable diseases. It creates an infrastructure for the ongoing surveillance of changes in disease burden and the effectiveness of interventions. This research generates robust evidence of the relative mortality burden of major communicable diseases in Nigeria, but it has also produced statistically significant changes in the relative share of disease contributions from 2018 to 2021. In this way, the study contributes to the global evidence base on disease burden from low-and-middle-income countries while generating local evidence that can help Nigeria achieve the SDG targets of preventable deaths and health for all Nigerians.

METHODOLOGY

Study Design

This study adopted a retrospective observational design grounded in a quantitative framework to examine mortality trends due to communicable diseases over a four-year period. Both descriptive and inferential statistical techniques were applied to guide the analysis.

The analytical procedure followed a structured sequence aligned with the study objectives:

Burden Analysis of Communicable Diseases

- Identification of leading communicable diseases over the study period
- Estimation of annual mortality burden for each disease
- Determination of each disease's contribution to total deaths

Assessment of Temporal Differences in Mortality

- Computation of mean mortality rates across the four years
- Statistical testing to determine whether observed differences in mean mortality rates across years were significant

Evaluation of Proportional Mortality Distribution

- Calculation of percentage distribution of deaths by disease
- Assessment of proportional mortality burden for each condition
- Presentation of results using pie chart visualization to illustrate relative shares

Sources of the Data

For the purpose of this study, secondary data was used which was obtained from World Health Organization (WHO) which is a credible source of health data and it uses standardized data reporting methodology. The total annual deaths from communicable diseases in Nigeria between the years 2018 and 2021 will be analysed. Also, the

study will focus on the deaths by 10 major communicable diseases which are: Malaria, Lower Respiratory Infections, Diarrheal Diseases, Tuberculosis, Birth Asphyxia and Birth Trauma, Preterm Birth Complications, Neonatal Sepsis and Infections, Meningitis and HIV/AIDS.

Variables

The key variables analyzed include:

1. **Cause of Death**: The specific communicable disease responsible for mortality (e.g., Malaria, HIV/AIDS, Tuberculosis, Meningitis).
2. **Year**: The calendar year in which the mortality data was recorded (2018, 2019, 2020, 2021).
3. **Mortality Count**: The number of estimated deaths attributable to each disease in each year.

Methods of Data Analysis

Test of Normality

1. The Kolmogorov-Smirnov (K-S) test for normality is used to test for the distribution of the contributions f various communicable diseases to mortality in Nigeria. (Habibzadeh 2024; Hasiloglu and Hasiloglu-Ciftciler 2023)

The hypotheses for the test are defined as follows:
H_0: The data are normally distributed.
H_1: The data are not normally distributed.

$$D = Max\left|F(m_i) - \frac{c}{n};\ F(m_i) - \frac{c}{n-1}\right|$$

where

$$F(m_i) = P(X \leq x)$$

$$F(m_i) = P\left(X \leq \frac{x-\mu}{\sigma}\right)$$

$$\mu = \frac{1}{n}\sum x_i$$

$$S = \sqrt{\frac{1}{n}\sum (x-\mu)^2}$$

In this case, c refers to the total number of observations that are equal to or less than the value m.
Decision Rule: Reject the null hypothesis when p-value < α and do not reject H_0 when p-value ≥ α

One-Way Analysis of Variance (ANOVA)

The one-way Analysis of Variance (ANOVA) was employed to examine whether mean mortality contributions differ significantly among selected communicable diseases. The analytical model is expressed as:

$$Y_{ij} = \mu + \tau_i + \varepsilon_{ij}$$

2. where Y_{ij} is the mortality contribution of the j^{th} observation in the i^{th} disease group; μ is the overall mean mortality contribution; τ_i is the fixed effect associated with the i^{th} disease and ε_{ij} is the random error term, which assumed to be independently and identically distributed i.e. $\varepsilon_{ij} \sim N(0, \sigma^2)$.(Juarros-Basterretxea *et al.*, 2024); Milanes-Baños, 2024).

Assumptions

Before conducting the One-Way ANOVA, the following assumptions were tested:

1. Normality**:** The dependent variable should be approximately normally distributed within each group. Check using Shapiro-Wilk test, Q-Q plots, or histograms.
2. Homogeneity of Variances (Homoscedasticity): The variance among groups should be equal. Tested using Levene's test or Bartlett's test.
3. **I**ndependence**:** Observations are independent within and across groups.
4. Interval/Ratio Data**:** The dependent variable is measured at a continuous level.

Hypotheses

H_{0_2}: There is no significant difference in the mean mortality contributions among the different communicable diseases.

H_{1_2}: At least one disease group has a significantly different mean mortality contribution compared to the others.

Decision Rule

If the ANOVA p-value is less than 0.05, we reject H_0 which means that not all the means are equal. When the p-value is greater than 0.05, we fail to reject H_0 which indicates there is no difference in mortality contributions. If the ANOVA indicates significant statistical effects, and not all the group means are equal, some post hoc analyses, such as Tukey Honestly Significant Difference (HSD) test, will take place to check which groups are different from each other. These multiple comparison procedures

attempt to control the Type I error rate while also finding simultaneous significant differences for group means. Therefore, this allows for better identification of what is causing the overall variation detected by ANOVA. (Rao, *et al.*, 2024).

RESULTS

Annual and Overall Relative Contribution of Each Communicable Disease to Total Mortality

Table 1: Percentage Annual and Overall Relative Contribution

Cause	2018 (%)	2019 (%)	2020 (%)	2021 (%)	Overall (%)
Malaria	19.65	20.41	22.11	21.59	20.89
Lower respiratory infections	21.14	20.65	20.59	21.58	20.98
Diarrhea diseases	19.10	17.95	17.35	17.71	18.06
Tuberculosis	10.65	10.89	10.43	9.11	10.30
Birth asphyxia and birth trauma	9.19	9.52	9.41	9.70	9.44
Preterm birth complications	6.72	6.93	6.85	7.08	6.89
Neonatal sepsis and infections	4.85	5.00	4.93	5.06	4.96
Meningitis	4.21	4.09	4.28	4.47	4.25
HIV/AIDS	4.49	4.57	4.06	3.70	4.22

Lower respiratory infections and malaria were the two biggest causes, each accounting for just over 20% overall. The yearly statistics of the disease showed similar trends over the years with slight variations. Moderate contributions came from diarrhea diseases, tuberculosis, and birth-related problems (birth asphyxia and preterm). Deaths caused by diarrhea showed a decrease. Similarly, tuberculosis deaths also showed a decrease. This reflects the use of a public health program. Birth-related issues remained unchanged as we need an increase in maternal neonatal care. The least contributing factors were neonatal sepsis and meningitis and HIV/AIDS having less than 5% overall. Nonetheless, HIV/AIDS outbreak was evidently declining, indicating effective measures. According to the statistics, disease prevention, early detection and timely access to quality and affordable health care services, are essential.

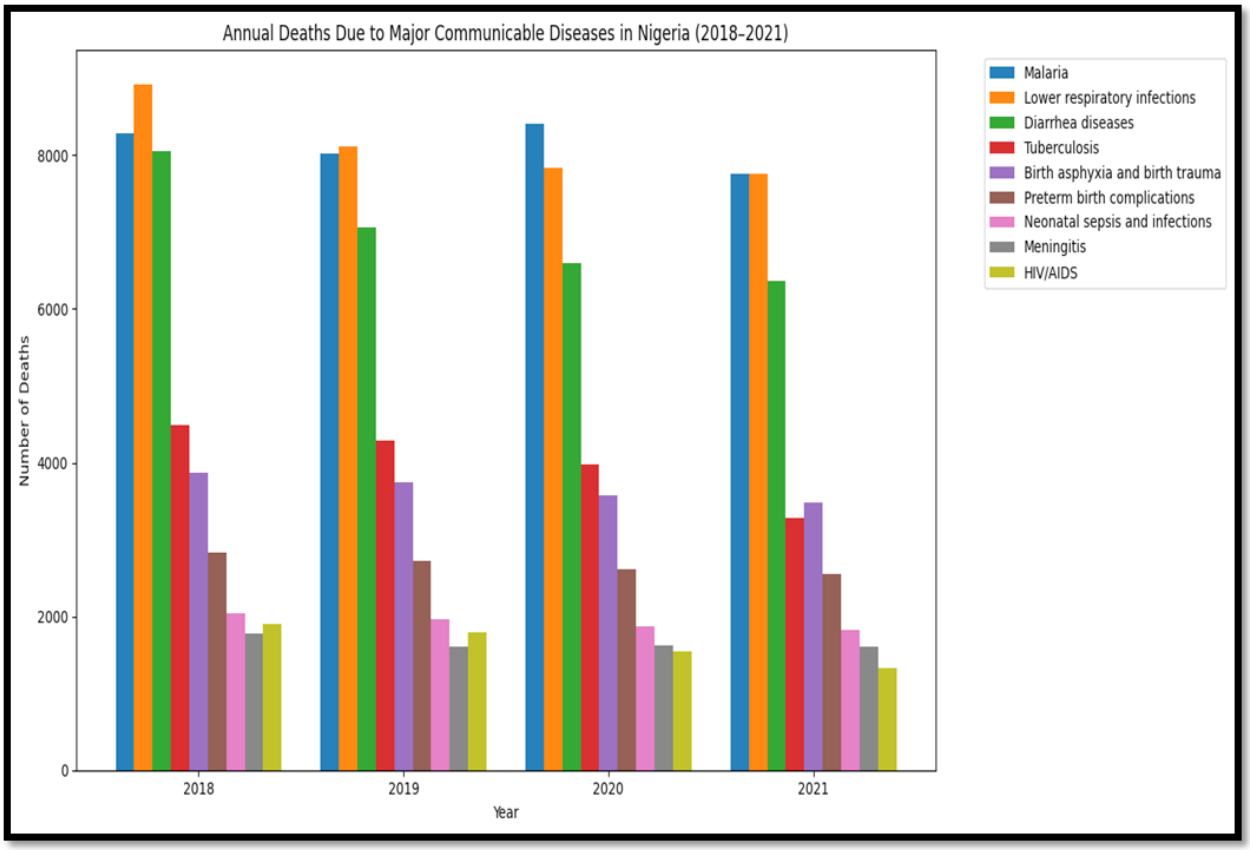

Figure 1: Annual Deaths Due to Major Communicable Diseases in Nigeria

As shown in Figure 1 above, the leading causes of deaths across the years were lower respiratory infections as well as malaria followed by diarrheal diseases and tuberculosis. Most diseases, especially tuberculosis and HIV/AIDS, are on a downward trend over the years due to enhanced public health efforts.

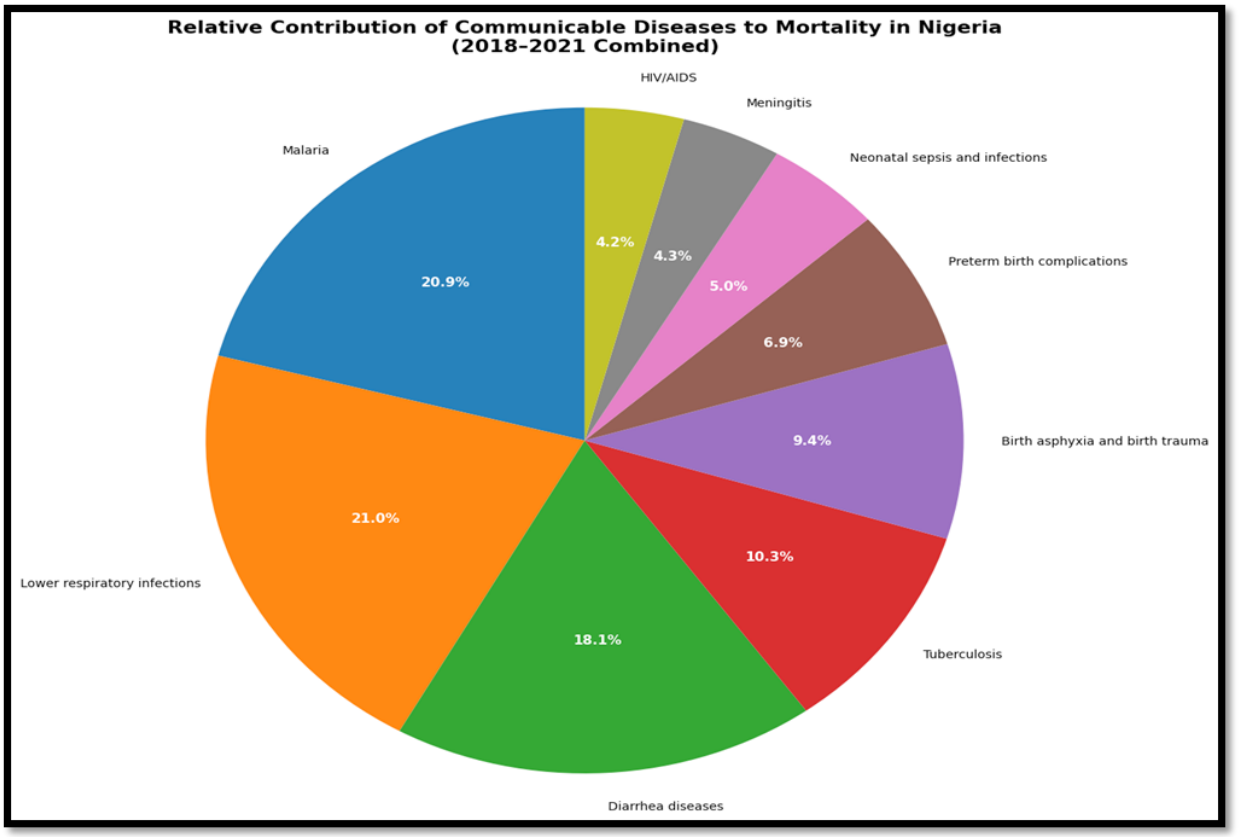

Figure 2: Pie chart showing Relative Contribution of Communicable Diseases to Mortality in Nigeria.

As illustrated in Figure 2, lower respiratory infections and malaria which contributed to 21.0 and 20.9 percent respectively were the major causes of death resulting from communicable diseases in Nigeria. Jointly they were responsible for over 40 percent of deaths between 2018-2021. There were also significant contributors to the burden of disease including diarrhoea disease (18.1%) and TB (10.3%). On the other hand, the share of HIV/AIDS (4.2%), meningitis (4.3%) and neonatal sepsis and infections (5.0%) were much lower.

Statistical Test for Significant Difference in Mean Disease Contributions to Mortality across Years

Before undertaking a statistical analysis to determine whether differences in mean contributions to mortality vary across years-after accounting for both random and systemic error-it is essential to first establish normality. This diagnostic step aids in identifying the proper statistical test, either a parametric test like one-way ANOVA or a non-parametric test like the Kruskal-Wallis Test.

Test of Normality

To determine what statistical analysis could be carried out on the communicable diseases' mortality data, Shapiro-Wilk normality test was conducted.

Table 2: Normality Test Results

Disease	Shapiro-W Statistic	p-value	Conclusion (α = 0.05)
Malaria	0.958	0.768	Normally Distributed
Lower respiratory infections	0.841	0.200	Normally Distributed
Diarrhea diseases	0.911	0.485	Normally Distributed
Tuberculosis	0.931	0.603	Normally Distributed
Birth asphyxia & birth trauma	0.971	0.850	Normally Distributed
Preterm birth complications	0.964	0.806	Normally Distributed
Neonatal sepsis & infections	0.973	0.859	Normally Distributed
Meningitis	**0.717**	**0.018**	**Not Normally Distributed**
HIV/AIDS	0.951	0.724	Normally Distributed

Hypothesis

H_{01}: Data follows a normal distribution

H_{11}: Data does not follow a normal distribution

Decision rule: Reject H_0 if p-value ≤ 0.05

The Shapiro-Wilk test shows that the mortality data of all communicable diseases from the year 2018-2021 in the data set have a p-value greater than 0.05. Thus, the 2018-2021 data is normally distributed. Accordingly, this proves that the assumption of normality holds true thus parametric statistics specifically one way ANOVA can be used to conduct hypothesis testing of mortality trend over years.

ANOVA Test for Mean Contribution of Communicable Diseases to Mortality across the Year

Hypothesis

H_{02}: There is no significant difference in the mean contributions of various communicable diseases to mortality across the years

H_{12}: There is a significant difference in the mean contributions of various communicable diseases to mortality across the years

ANOVA Table

Source of Variation	SS (Sum of Squares)	Df	MS (Mean Square)	F	p-value
Between Years	2999203.03	3	999734.34	**4.95**	**0.0081 ****
Between Diseases	253540657.70	8	31692582.21	-	-
Residual (Error)	4844440.90	24	201851.70		
Total	**261383301.63**	**35**			

Conclusion

Because the F-statistic is 4.95 and its p-value is 0.0081 and $p < 0.05$, we reject the null hypothesis. This means that there is enough evidence at the 5% level of significance to conclude that the average mortality contribution of communicable diseases is not the same across the years 2018 – 2021.

Tukey Post Hoc Analysis

The post hoc analysis of which year (or years) differed was conducted due to the results of ANOVA indicating that the mortality rate varies significantly across the years. To carry this out, Tukey's Honestly Significant Difference (HSD) test was utilized for pairwise comparisons on the mean mortality for all 4 years.

Year	Mean Mortality Rate
2018	5686.90
2019	5477.08
2020	5227.68
2021	4885.25

Pairwise Comparisons (95% confidence):

Comparison	Mean Diff	p-value	Significant
2018 vs 2019	209.82	0.806	No
2018 vs 2020	459.22	0.204	No
2018 vs 2021	801.65	0.008	**Yes**
2019 vs 2020	249.40	0.703	No
2019 vs 2021	591.83	0.043	**Yes**
2020 vs 2021	342.43	0.344	No

As compared to the years 2018 and 2019, the mortality for the year 2021 was significantly less. Also, there were no significant differences between years 2018 vs. 2019, 2019 vs. 2020, and 2020 vs. 2021. Communicable disease mortality thus showed a substantial decline in the year 2021 as compared to earlier years.

DISCUSSION OF RESULTS

The results of this study show constant and clear patterns of mortality from communicable diseases in Nigeria between 2018 and 2021. The main causes of death were lower respiratory infections and malaria, which collectively accounted for more than 40 percent. This dominance is consistent with national verbal autopsy data for 2013–2018 which indicated that malaria was responsible for 23–

35% of deaths among children aged 1–59 months, while pneumonia (the major component of LRI) contributed around 10–12% of deaths (Odejimi *et al.,* 2022). The continued presence of these two conditions as main causes of death reflects longstanding public health challenges that are caused primarily by poor air quality, insufficient vector control and environmental exposure, and limited access to timely care. Interestingly, this study's record stability in malaria mortality contrasts declines occurring globally, and cites that Nigeria has sub-Saharan Africa's highest malaria mortality burden (Omojuyigbe, *et al.,* 2023.). The stagnation in malaria deaths illustrates the underlying systemic challenges to malaria elimination. Key impediments are poor distribution and use of insecticide-treated nets, the absence of surveillance infrastructure, emerging antimalarial drug resistance, and socio-cultural behaviours that affect adherence to preventive measures (Omojuyigbe *et al*., 2023.). According to a study, the National Malaria Strategic Plan 2021–2025 has set ambitious targets for mortality reduction. Notwithstanding the said, mortality data from the study indicated that malaria contributes significantly to overall mortality. In other words, the challenge of turning policy goals into measurable population impact remains daunting.

The deaths from diarrheal diseases and tuberculosis showed a gradual decline over the four-year period studied, indicating progress. The outcome from this study confirms the wider epidemiology evidence. The Global Burden of Disease (GBD) analyses for Nigeria reported that there was a huge fall in tuberculosis incidence, 87.6% fall, and prevalence, 20.0% fall, from 2000 to 2016. Moreover, the modeled TB deaths were estimated to be 39,933 (95% UI 30,488-55,039) in 2016 (Ogbo, *et al.,* 2018.) Efforts to address suboptimal breastfeeding practices have also been linked to improved diarrheal disease outcomes. In Nigeria in 2016, it was estimated that suboptimal breastfeeding practices contributed to 56.5% of late neonatal; 39.0% post-neonatal and infancy; and 22.8% overall under-5 deaths from diarrhea (a total of 22,371 preventable deaths and 1.9 million DALYs) (Ogbo, *et al.,* 2019.). The downward trends in this evaluation are likely the result of the combined roles of larger water, sanitation and hygiene (WASH) programs, breastfeeding promotion campaigns and greater tuberculosis case detection & treatment coverage. However, diarrheal diseases and tuberculosis still made up 18.1% and 10.3% of overall mortality in this study indicating that interventions to date have not fully addressed structural deficiencies. Ongoing problems like poor water infrastructure, overcrowding, behavioural risk factors (like alcohol use and smoking linked to TB death) (Ogbo *et al.,* 2018.), and lack of health education at community levels are keeping transmission and death going and there needs to be stable and targeted investment to tackle both proximal and distal determinants of disease. Mortality due to HIV/AIDS showed a sharper decline throughout the study period. This is in line with national and regional trends thought to be due to expanded ART coverage, increased testing capacity, and enhanced prevention. The decline in deaths observed in this study from 2018 to 2021 reflects the gradual impact of these interventions, which implementation being proven effective through global evidence of ART scale-up as the primary driver of HIV mortality decline. However, the published literature does not present direct population-level time-series data quantifying HIV mortality declines in Nigeria; facility-based data show high case-fatality rates. Our discussion covers a tertiary emergency ward series (2015–2017), reporting a 35.7% case fatality ratio among hospitalized children with HIV (Muhammad *et al*., 2017.). The 4.2% contribution of HIV/AIDS to total communicable disease mortality is not impressive or too significant; however, there remain significant disparities in access to care in various regions, especially in conflict-affected and hard-to-reach areas with service delivery gaps. Disparities underscore the need for an equity-focused health response to secure uniform impact of HIV control and response gains on populations and prevent the neglect of HIV vulnerable subgroups, exempting children, pregnant women, and marginalized communities from national HIV response.

The results of the inferential statistical analyses presented enhances the interpretation of the descriptive mortality trends through providing strong evidence of temporal change. The ANOVA results showed statistically significant differences in contributions to mortality between years ($F = 4.95$, $p = 0.0081$) indicating that communicable disease mortality was not constant over 2018-2021. The post hoc Tukey analysis revealed the year 2021 had significantly lower mortality than 2018 and 2019. This change is likely a result of the cumulative effect of multiple public health initiatives. Cumulatively they likely include; enhanced immunisation coverage, maternal and child health initiatives. Cumulatively it most probably also includes adaptations by the health system due to the COVID-19 outbreak. Nonetheless, the lack of significant variation between years suggests incremental progress rather than transformation, leaving improvements vulnerable to a policy reversal or shock in health systems. Although ANOVA based temporal analyses of communicable diseases mortality are rarely reported in the Nigerian literature, with most studies relying on GBD modelling, logistic regression and trend testing (Ogbo *et al.,* 2018.; Mokuolu et al., 2022) the method used in this paper provides a complementary and statistically robust method for evaluating annual changes. The results of the study show that although measurable progress has been made, it

is not enough. The decline needs to be accelerated to meet the national and global targets.

Although they contribute smaller shares than other diseases to total communicable diseases mortality in our study, meningitis, neonatal sepsis, and preterm birth complications are still epidemiologically important diseases and believable from national data. Verbal autopsy analyses from 2013–2018 revealed that neonatal infections (sepsis, pneumonia, meningitis) accounted for 44% of all neonatal deaths in Nigeria. Intrapartum injury contributed 21 to 29% depending on the classification method. (Odejimi *et al.,* 2022.) Facility-based studies have demonstrated improvements over time including a large neonatal intensive care cohort with 14,760 admissions from 2007 to 2018 in which overall mortality reduction was from 17.8% to 13.0% ($p < 0.0001$) with 45% term-baby mortality reduction and 28.4% preterm mortality reduction (Mokuolu *et al.,* 2022.). Although mortality rates continue to be high among extremely preterm (<28 weeks gestation, 65.5% mortality) and very low birthweight (<1,000 g, 38.0% mortality) babies (Mokuolu *et al.,* 2022.). The distribution of meningitis in this study exhibited a non-normal distribution, suggesting sporadic but severe outbreaks, particularly in the north within the African meningitis belt. Continuous vaccination, preparedness for outbreaks, and the capacity for rapid response are necessary. The high concentration of deaths among children under five in northern geopolitical zones (approx. 84% of under-five deaths nationally) (Odejimi *et al*., 2022.) highlights serious regional inequities consistent with those of the current study. Summarizing the above findings, while Nigeria has made some strides in reducing communicable disease death, structural problems such as limited skilled birth attendance, inadequate neonatal intensive care services, under-resourced health system, inefficient surveillance, and socio-cultural barriers to care-seeking still affects health outcome in the country.

CONCLUSION

Trends in the mortality of communicable diseases in Nigeria from 2018 to 2021 highlight persistent and emerging patterns of public health significance. The lower respiratory infections and malaria continued to be the leading causes of death. More than 40% of communicable diseases related deaths were due to this disease. They continue to stress the existing structural challenges in environment, healthcare delivery and prevention capacity. In contrast, the mortality reduction observed for tuberculosis, HIV/AIDS and diarrhoeal diseases is due to the scaling up of disease-specific interventions, especially the expanded access of antiretroviral drugs, strengthened diagnostics and improved case management. Overall, these trends correspond with global trends and show that there is gradual but meaningful improvements in the control of some infectious diseases in Nigeria.

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