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A GEOGRAPHICAL ANALYSIS OF UNDER-FIVE MORTALITY IN KANO METROPOLIS

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ABSTRACT

This study presents a geographical analysis of under-five mortality (U5M) in Kano Metropolis using hospital-based records from 2013 to 2023. Data were obtained from pediatric mortality registers of three major health facilities: Murtala Muhammad Specialist Hospital, Aminu Kano Teaching Hospital, and Sheikh Isyaka Rabiu Pediatric Hospital. A total of 1,465 mortality cases from twelve major diagnosed illnesses were analyzed using ArcGIS for spatial mapping and descriptive statistics. Localities were geocoded and aggregated using the National Population Commission (NPC) Locality Compendium and Population Cluster Map to identify hotspot areas. The results revealed significant spatial clustering of U5M across the metropolis. Very High-Risk clusters included Na'ibawa (313 cases), Dorayi Karama (297), Sheka (291), and City Municipal (288), while City Dala (265), Rijiyar Lemo (257), and Gwagwarwa (225) also recorded high mortality density. Clinical analysis showed that infectious diseases account for approximately 70% of under-five deaths. The three leading causes — Malaria 25% (n=361), Sepsis 14.6% (n=214), and Pneumonia/Respiratory Diseases 14.0% (n=207) — constituted over 53% of all deaths. Other contributors included measles, diarrhea, meningitis, gastro-infections, and malnutrition. The study concludes that U5M in Kano Metropolis is strongly shaped by spatial, environmental, and healthcare-access factors, with many deaths being preventable. It recommends place-based targeted interventions, improved infection control, enhanced vaccination coverage, and strengthened prenatal and neonatal care, particularly in high-burden clusters of Kumbotso, Gwale, Municipal, and Nassarawa LGAs.

Keywords: Under-five Mortality, Geographical Analysis, Spatial Clustering, GIS, Malaria, Kano Metropolis, Hotspot Mapping.

INTRODUCTION

Children are the foundation of future economies; investing in their survival will provide dividends for communities now and in future generations. However, the most recent estimates on under-five mortality (U_5M) leave little doubt that the journey to ending all preventable child deaths is far from over. This is because, globally, in 2023 alone, 4.8 million children died before reaching their fifth birthday, mostly from preventable causes which includes 2.3 million deaths in the neonatal period (i.e., aged 0–28 days) and 2.5 million deaths among children aged 1–59 months. The mortality rate for this age group was highest in Sub-Saharan Africa, at 44 deaths per 1,000 children aged 28 days, which is nearly 30 times higher than the lowest regional rate of 1.5 deaths per 1,000 neonates in Australia and New Zealand, and more than twice the global average of 20 deaths per1,000 children aged 28 days, (United Nations Inter-Agency Group for Child Mortality Estimation UN-IGME, 2023).

Under-five Mortality (U_5M) is defined as the death of a live born child that occur from birth and before reaching the age of five years (0-59 months) (UN-IGME, 2013). The death of children under-five years of age is a prominent public health issue that has long been used as one of the essential indicators of the level of socio-economic development of a nation. It is a factor that defines the well-being of a population and is usually taken as one of the development indicators of health and socio-economic status, which indicate the quality of life of a given population, as measured by life expectancy (Bello & Joseph, 2014). Hence, its indication is very important for the evaluation of public health status and strategy. For these reasons, there has been an increasing understanding that reducing under-five mortality at international and regional levels has become a key pointer not only for the health and socioeconomic status of the population, but also a matter of human rights and overall progress towards the Sustainable Development Goals (SDGs).

Despite global progress under the Sustainable Development Goals (SDGs), infant and child mortality rates in Nigeria remain unacceptably high. The situation is particularly dire in Northern Nigeria, which exhibits the country's most alarming child health indicators (National Population Commission-NPC, 2019). Kano State, a region characterized by high fertility rates, epitomizes this crisis. The Nigeria Multiple Indicator Cluster Survey (MICS 2021) provides stark evidence of intra-state disparities, revealing that all early childhood mortality rates (except neonatal) are consistently highest in the Kano North senatorial district. A child's chance of surviving to their fifth birthday is 64 percent higher in Kano Central and 27 percent higher in Kano South compared to Kano North (National Bureau of Statistics-NBS & UNICEF, 2021). With an under-five mortality rate nearing 200 deaths per 1,000 live births (158/1000) in the state, these intolerably high numbers highlight an urgent need to address the specific survival necessities of children in this region (NBS & UNICEF, 2021).

Statement of the Problems

The problem of under-five child mortality is complex and multidimensional, and several factors may contribute to inequalities in child survival. As regards to the major and direct causes of death, it is estimated that more than half of under-five deaths in the world are attributable to a very small number of conditions. Pneumonia, diarrhea, malaria, measles and HIV/AIDS remain the leading causes of death among children under age five (UNICEF, 2020). The impacts of different health conditions vary by age and sex as a result of both biological and behavioural factors that determine susceptibility to certain illness or injuries.

The environment where children are born and raised is a significant determinant of their survival. In many parts of Kano, this environment is increasingly unhealthy, continually threatening children's lives with preventable diseases (Antai, 2011). Studies have shown that factors such as poor general hygiene, maternal healthcare-seeking behavior, and cultural perceptions of disease causation and treatment play a crucial role in child mortality (Fagbamigbe & Idemudia, 2017; Adewuyi & Adefemi, 2017). Thus, it is an area that many researchers focus on and that has attracted the attention of policy-makers and program implementers worldwide. The current study is a contribution to add knowledge to community on Public Health in an attempt of reducing child mortality rate and improving healthy child survival in Kano State and Nigeria in general, from geographical perspective.

Research Questions

i. What is the spatial pattern of Under-five mortality in Kano Metropolis?
ii. What are the leading Clinical causes of mortalities among Under-five in the study area?

Aim of the Study

The study aims to analyze geographical variations in under-five mortality in Kano Metropolis and identify associated risk factors at the local level, in order to guide the design of evidence-based interventions for reducing under-five mortality disparities.

Objectives of the Study

The study was set to achieve the following objectives;

i- map the spatial pattern of Under-five mortality in Kano Metropolis.
ii- identify the major clinical causes of mortalities among Under-five in the study area.

Scope of the Study

This study focused on analysis of under-five mortality and associated risk factors across Kano Metropolis. The study was limited to child death on hospital records basically and consider only the Pediatric units of three selected health facilities in the State for eleven-year period (2013-2023). The study emphasized on major diagnosed causes of under-five deaths, such as complications of birth (Low Birth Weight, asphyxia, trauma, malformation), Jaundice, malnutrition and specific infections such as malaria, diarrhea, measles, HIV, and acute respiratory infections (ARI/Pneumonia) etc.

Significance of the Study

This study is valuable and would be useful to the national and international communities since public health advocates have recommended for multi-sectoral interventions to address the challenges of child mortality. It will explore why under-five mortality is clustered within certain individuals, families or communities. Rather than generating causality conclusions, this study aims to arrive at a better understanding of the association between the determinant factors of child mortality that could be credible and consistent with the available information. The findings will assist planners and policy makers to take suitable decision to lower the rates of infant and child mortality not only of Kano State but also entire regions of northern Nigeria.

Study Area

Kano Metropolis lies within Kano State which is located between latitudes 11º 50’ and 12º 7’North of the Equator, and longitudes 8º 22’ and 8º 47’East of the great meridian (Mohammed, 2015). It occupies an area of about 683km^2, with an aerial distance of 19km from east to west and about 15km from north to south (Olofin, 1987). It comprises of eight Local Government Areas: Dala, Fagge, Gwale, Kumbotso, Municipal, Nassarawa, Tarauni and Ungogo (Figure1).

It is bordered by Madobi and Tofa Local Government Areas (LGAs) to the South West, Gezawa LGA to the East, Dawakin Kudu LGA to the South East, and Minjibir LGA on the North East, and Dawakin Tofa to the North West.

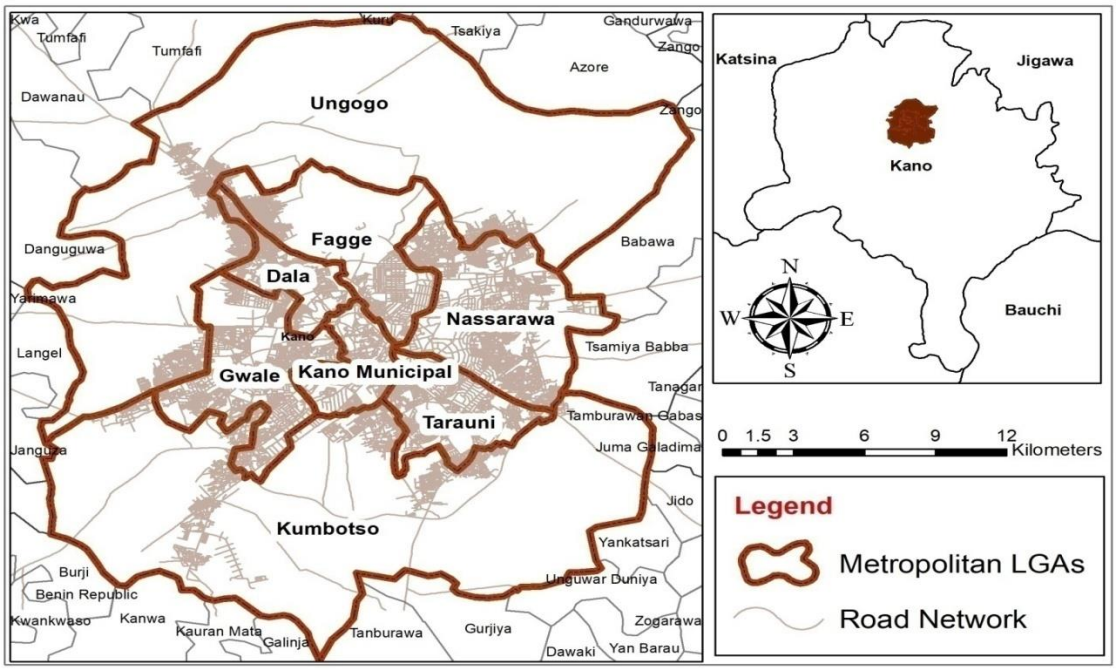


Figure.1: Kano Metropolis Showing the Study Area

Source: Cartography Laboratory, Geography Department BUK

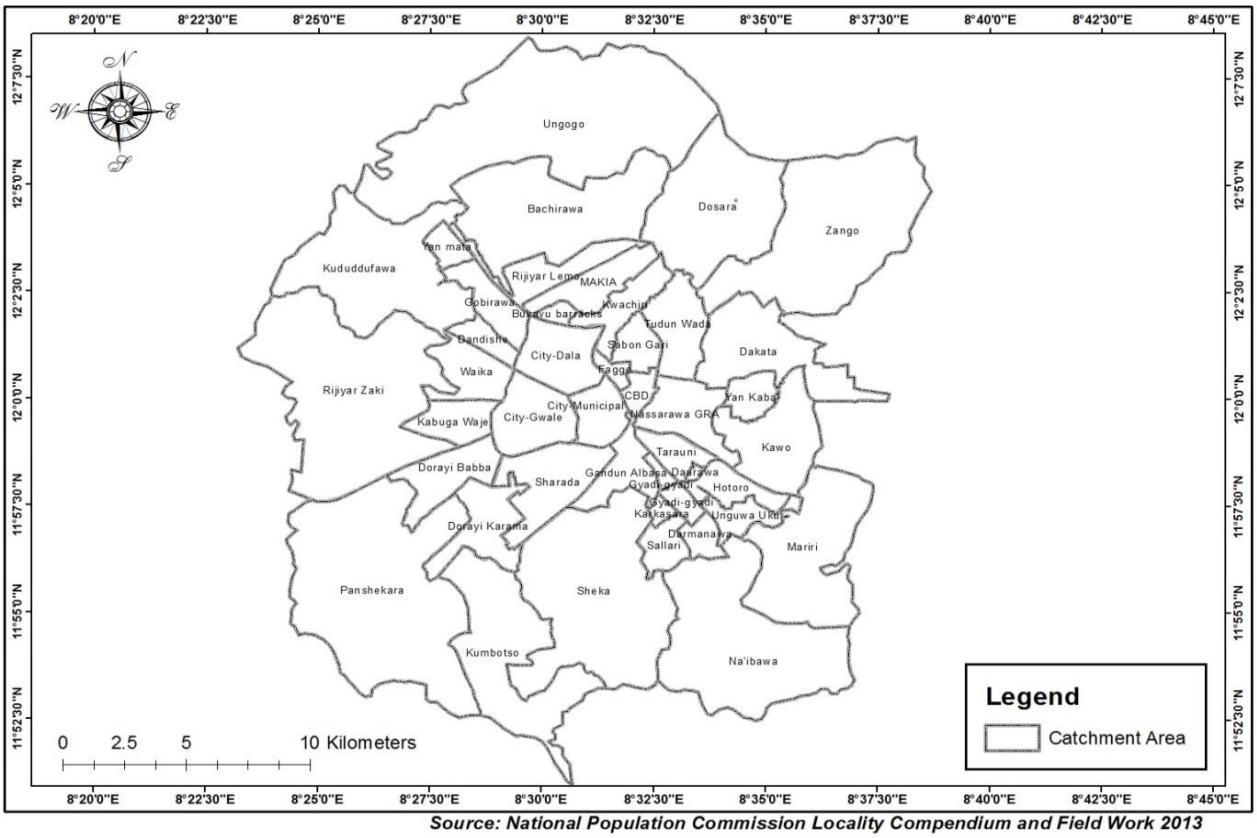
METHODOLOGY

The study employed a healthcare facility-based research design using pediatric mortality records collected from selected hospitals in Kano Metropolis. The primary data source consisted of hospital records of deceased under-five children from selected healthcare facilities. Information collected from the records included age at death, sex, residential locality, diagnosed cause of death, admission date, duration of admission, nutritional status, immunization status, and parental characteristics such as educational level and occupation.

Purposive sampling technique was used in selecting the healthcare facilities because the selected hospitals possess pediatric units and are among the most patronized healthcare facilities in the metropolis. The sampled hospitals include Murtala Muhammad Specialist Hospital, Aminu Kano Teaching Hospital, and Sheikh Isyaka Rabiu Pediatric Hospital. These hospitals were chosen because they provide major pediatric healthcare services to the population.

Data was analyzed based on number of deceased under-five children collected from the sampled Health Facilities records. For the purpose of creating clusters of U5 mortality to ease mapping processes, Locality Compendium was used. The locality Compendium is the one generated from 2006 Enumeration Area Demarcation (EAD) by the National Population Commission for the generation of 2006 Census frame (Enumeration Areas polygons) which are used as guide maps in administering Census NPC 01 questionnaire in all the spatial units in the Federation including Kano State.

Thus, Population Cluster Map of National Population Commission (NPC) Kano office (Figure 2), was adopted from Hassan and Liman (2015). Each locality (from child's address) was placed into its Spatial units and Population Cluster (Table 1).



Source: National Population Commission Locality Compendium and Field Work 2013

Figure 2: Spatial Units Adopted from Hassan and Liman (2015)

The coordinates of all localities identified in the hospital-based data were generated from the database of all settlements in Nigeria created by e-Health. Then geocoded into high risk, moderate and low mortality areas. This data analyzed using Arc GIS, produced hotspot maps showing the spatial distribution based on high, moderate and low incidence areas. Also, descriptive statistics as percentages, charts, line graphs, and cross tabulations are used to describe the incidence and spatial variations of the diagnosed illnesses, as well as the characteristics of U5 mortality in the study area.

RESULTS AND DISCUSSION

The result was presented through descriptive statistics in tabular and graphic forms. Hotspot maps used to describe the spatial distributions in mortality cases in the Study area. Results from the analyzed data on U5 mortality study in Kano metropolis are grouped into Population Clusters of the area based on locality Compendium.

For easy mapping, all the population clusters are categorized into five, based on the density of mortality cases in each cluster. All clusters with cases between 226 to 313 are grouped into Very High Risk, cases between 139 to 225 are High Risk. Moderate Risk areas include those with cases between 99 to 138 cases, while cluster with 35 to 98 are Low risks, then, less than 35 (<35) cases are categorized under Very Low Risk.

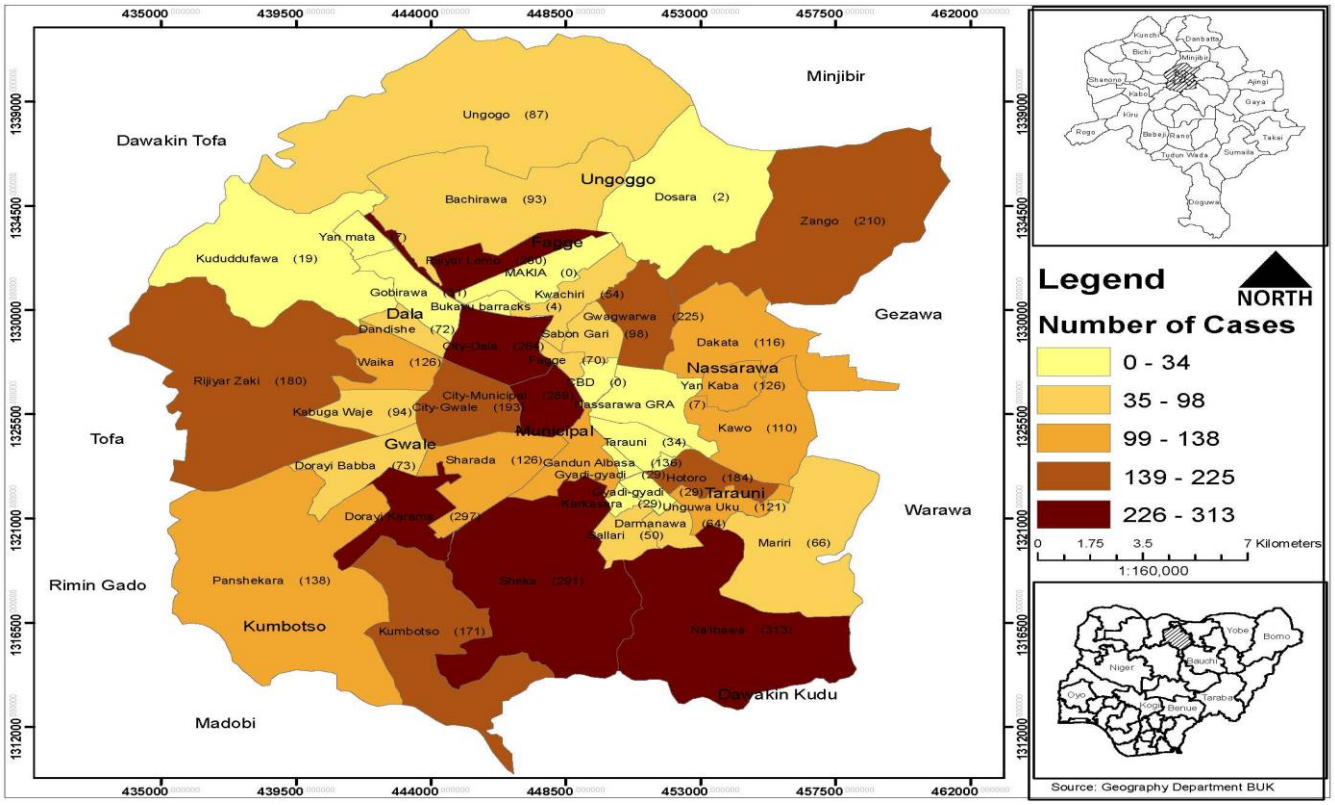


Figure 3: Distribution of U5 mortality by Population Clusters in Kano Metropolis

Source: Data Analysis, 2025

The findings shown on Figure 3 depicts significant variation in U5 mortality density across various population clusters within Kano Metropolis. The distribution of mortality is clustered, with some areas showing alarmingly high cases while others report relatively low zones. Among the identifiable Very High-Density Clusters, Na'ibawa 313, Dorayi Karama 297, Sheka 291, and City Municipal 288 stand out with the highest frequencies. Other notable clusters with high frequencies include City Dala with 265 cases, Rijiyar Lemo 257 entries, Gwagwarwa 225 entries, and Zango 211 entries. Conversely, numerous clusters show an unsignificant portion of the data, 567 entries accounting for 10.4% of the total, is categorized as "others," indicating areas with unidentified location information within the Metropolis.

Comparing these findings with global research on under-5 mortality, particularly in urban areas of low- and middle-income countries, reveals both consistencies and specific nuances (Akinyemi et al., 2021; UN IGME, 2023; Bocquier et al., 2023). Globally, while overall under-5 mortality rates have declined, Sub-Saharan Africa continues to bear the heaviest burden, accounting for approximately 58% of all U5 deaths in 2023, with Nigeria being one of the countries with the highest absolute numbers of child deaths (UNICEF, 2024). This broad regional context aligns with the expectation of significant under-5 mortality in Kano.

Table 1: The Leading Morbidity Caused Under-Five Mortality

S/N	Illness	Frequency	%
1	Malaria	361	25
2	Sepsis	214	14.6
3	Pneumonia/Respiratory Diseases	207	14
4	Prematurity	112	7.5
5	Malnutrition	94	6.4
6	Jaundice	96	6.6
7	Neurological /Brain Disorder	52	3.5
8	Measles	69	4.7
9	Diarrhea/Dysentery/Gastrointestinal Infection	84	5.7
10	Birth Asphyxia	73	5.0
11	Heart Diseases	57	4.0
12	Meningitis	46	3.0
	Total	1465	100

Source: Data Analysis, 2025

Table 1 above presents records of 1,465 total cases specifically on the 12 major illness caused under-five mortality in Kano Metropolis. It comprises death cases resulted from the 12 diagnosed illness, out of these deaths, the top Three Leading Causes are Malaria, Sepsis, and Pneumonia/Respiratory Diseases (combined) is more than half 53% (n=782).

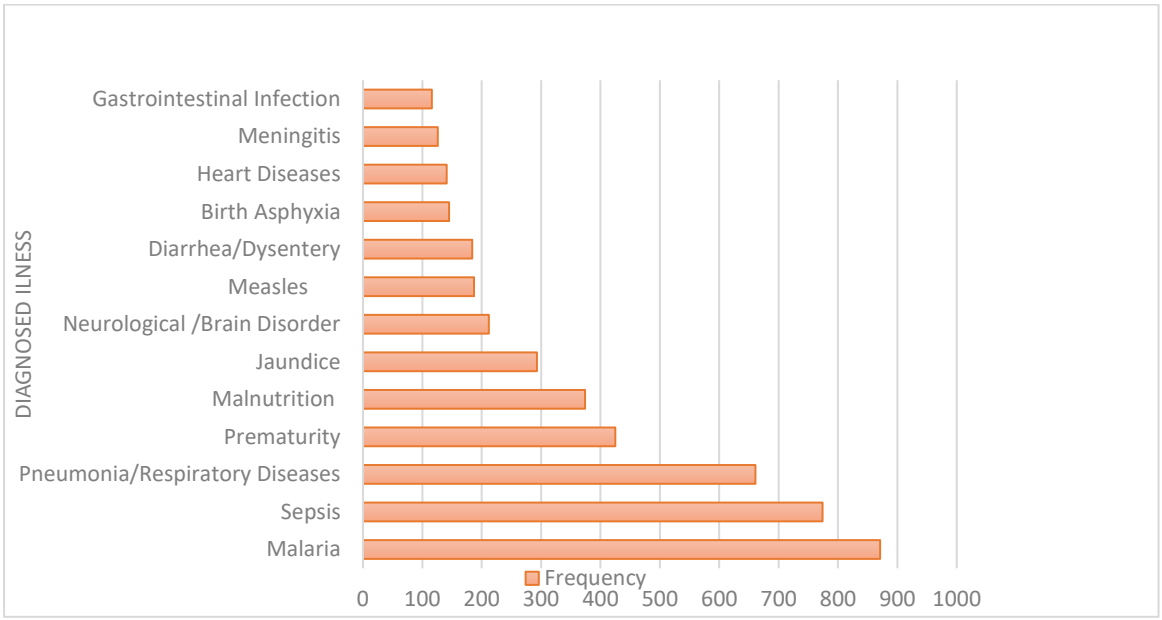


Figure 4: Proportion of Leading Morbidity Caused Under-Five Mortality in the study Area
Source: Data Analysis, 2025

The Figure 4 above provides proportion of illness based on the leading illness as they comprised the highest percentage of all the recorded cases of Under-five Mortality. Among the major diagnosed illnesses, Malaria has the single largest cause of under-five mortality 25% (n = 361) which reflect the endemic nature of malaria and indicates potential gaps in malaria prevention and treatment programs in the study area. Sepsis with 14.6% (214 cases) is the second highest cause, indicating severe bacterial infections among under-five children, often secondary to other conditions and poor hygiene practices causing diarrheal diseases and other complicated health problems. Pneumonia/Respiratory Diseases is 14.0% with 207 cases shown a significant respiratory burden affecting children, which is related to poor air quality,

poor sanitation/hygiene conditions, and inadequate vaccination coverage (e.g. pneumococcal vaccine) in some parts of the study area.

Therefore, these leading causes of under-five mortality dominated by Infectious Diseases, because approximately 70% of deaths are caused by malaria, sepsis, pneumonia, measles, diarrhea, meningitis, and Gastro Infections. These disease pattern in Kano metropolis aligns with typical under-five mortality causes in sub-Saharan Africa, where infectious diseases predominate. However, the high proportion of sepsis (14.6%) was a little higher than some regional averages, suggesting particular challenges with infection control in the area.

Conclusion

Overall, the chapter concludes that under-five mortality in Kano Metropolis is strongly shaped by spatial, environmental, demographic, and healthcare-related factors. The integration of GIS and public health analysis provided important evidence for identifying mortality hotspots and designing targeted interventions to improve child survival outcomes.

The data reveals a predominantly infectious disease burden causing under-five mortality in Kano metropolis, with Malaria, Sepsis, Abdominal disorder and Pneumonia/respiratory diseases accounting for over half of all deaths. This pattern suggests that many of these deaths are preventable through improved healthcare access, better infection control, enhanced vaccination programs, and addressing underlying social determinants of health. The findings provide a clear evidence base for prioritizing public health interventions in the region. Areas with high cases like Kumbotso, Gwale, Municipal and Nassarawa urgently need better prenatal care, delivery services, and neonatal intensive care facilities, for the greatest impact on child mortality reduction. This necessitates localized strategies, improved healthcare access, and continued spatial epidemiological research for effective intervention.

Recommendation

The study recommends deployment of community health workers and supplies to identified high-mortality LGAs of Kumbotso, Nassarawa, Gwale, and Tarauni**,** particularly within their most affected population clusters like Na'ibawa, Sheka, Gwagwarwa, Dorayi karama, and kano City Municipal and Dala. Others are RijiyarLemo, Rimin kebe and Zangon Dakata. The dramatic differences between districts suggest that resources, healthcare access, or maternal health conditions vary significantly across Kano city. Improving Pediatric care, and community health education programs should be prioritized in the high-risk locations. Conversely, a multi-sectoral effort is essential to tackle root causes. This includes conducting door-to-door vaccination drives to reach "zero-dose" children in hotspots, integrating malnutrition screening into every health contact, and prioritizing sustainable clean water and sanitation projects in the highest-risk communities. Success depends on using the generated geospatial maps for real-time decision-making and holding authorities accountable through public scorecards tied to mortality reduction in these priority zones.

REFERENCES

Abdullahi, A. A., & Abubakar, I. R. (2021). Spatial inequalities in healthcare accessibility in Nigeria: Evidence from spatial analysis of under-five mortality. *BMC Public Health, 21*(1), 1943. https://doi.org/10.1186/s12889-021-12002-1

Akinyemi, J. O., Bamgboye, E. A., & Ayeni, O. (2015). Trends in neonatal mortality in Nigeriaand effects of bio-demographic and maternal characteristics. *BMC Pediatrics, 15*(1), 36. https://doi.org/10.1186/s12887-015-0349-0

Auwal, M., Ibrahim, I. M., & Sani, U. (2021). Determinants of under-five mortality in Kano State, Nigeria. *Bayero Journal of Pure and Applied Sciences, 14*(2), 102–110.

Babalola, S., Fatusi, A., &Anyanti, J. (2021). Spatial pattern and determinants of under-five mortality in Nigeria: Insights from Bayesian hierarchical modelling. *PLOS ONE, 16*(8), e0255985. https://doi.org/10.1371/journal.pone.0255985

Bello, M., & Joseph, O. O. (2014). Under-five mortality in Nigeria: a comparative analysis of 2003 and 2013 NDHS. European Scientific Journal, 10(36), 185-197.

Carter, E. D., & Njeru, A. (2022). Spatial epidemiology and child mortality in sub-Saharan Africa: Using GIS to inform health interventions. *International Journal of Health Geographics, 21*(1), 12. https://doi.org/10.1186/s12942-022-00310-2

Causes of infant and under-five morbidity and mortality among hospitalized patients in Southern Nigeria: A hospital-based study. (2024). *Journal of Public Health Research, 13*(1), Article 22799036241231787. https://doi.org/10.1177/22799036241231787

Fagbamigbe, A. F., & Idemudia, E. S. (2017). Survival analysis of time to under-five mortality and its associated factors in Nigeria: evidence from the 2013 Nigeria Demographic and Health Survey. Journal of Biosocial Science, 49(5), 659-674.

Hassan, N. I. (2015). "Population Clusters and Commercial Bus Movement Generation in Kano Metropolis". An MSc. Dissertation in the Department of Geography, Submitted to the School of Post Graduate Studies, Bayero University, Kano October, 2015.

Mohammed, H. (2015). How many child deaths can be averted in Nigeria? Assessing state-level prospects of achieving 2030 Sustainable Development Goals for neonatal and under-five mortality. (2022). PLOS ONE, 14(9), e0223985. https://doi.org/10.1371/journal.pone.0223985

United Nations Children's Fund (UNICEF). (2023). *Levels & trends in child mortality: Report 2023, estimates developed by the UN Inter-agency Group for Child Mortality Estimation (UN IGME).* New York: UNICEF.

United Nations Inter-Agency Group for Child Mortality Estimation (UN IGME). (2023). Levels and Trends in Child Mortality: Report 2023. United Nations Children's Fund.

Wali, H. N., & Abdullahi, S. (2023). Micro-economic analysis of the drivers of under-five mortality in Kano Metropolis, Nigeria. International Journal of Multidisciplinary Research and Analysis, 6(4), 1483–1490. https://doi.org/10.47191/ijmra/v6-i4-18

World Health Organization (WHO). (2024). *Children: improving survival and well-being.* Geneva: WHO. https://www.who.int/news-room/fact-sheets/detail/children-reducing-mortality