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SPATIO-TEMPORAL ASSESSMENT OF INFANT MORTALITY IN GOMBE METROPOLIS

GOMBE STATE, NIGERIA

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ABSTRACT

Infant mortality refers to the number of deaths of infant under one year of age per 1000 live birth in a given population. It is an important indicator of the overall health and well-being of a society, reflecting factors such as access to healthcare, nutrition, sanitation and socio-economic conditions. This study has the following objectives; mapping-out the spatial distribution of infant mortality cases, assess the temporal variation of infant mortality and identify the gender with the highest infant mortality rate. Primary data {GPS Point and interviews} and secondary data {Hospital records} were used for the achievement of the aim and objectives of the study. Simple descriptive statistical methods and ArcGIS 2019 software were employed in the analysis of the data collected. The research found out that the infant mortality is highest among the male gender with 57% then followed by female with 43%, this is because the male gender is biologically weaker and more susceptible to disease and premature death than the female. Major causes of infant mortality found by the study are; low birth weight respiratory failure, apnea attack, pneumonia, sepsis, meningitis, severe birth asphyxia, Septembers is, burn injury, measles, and dehydration. The area with the highest number of infant mortality is Tudun-wada with (567), followed by Bogo (523), then Gabukka (434). The factors that contributed to high infant mortality in the areas includes environmental factors i.e. location of the areas in the Slum and. Infant mortality was highest in the years 2014 (599) followed by year 2015 (593) and (571) recorded in 2016. The study concluded that infant mortality is decreasing due to improvement in health conditions and efforts made by government at all levels as well as the support and intervention from partners. There is need for effective allocation of funds by the Federal, State and LGA to strengthen community health care centres and increase programmes to create awareness.

Keywords: Assessment, Diseases, Gombe, Gender, Infant, Mortality,

INTRODUCTION

Infant mortality is a critical public health concern worldwide and one of the key indicators of the quality of primary health delivery systems and the overall health status of a nation. Some populations are healthier than others, but developing countries exhibit enormous variation in infant mortality levels. High infant mortality rate (IMR) reflects the presence of unfavorable social, economic, and environmental conditions during the first year of life (World Health Organization, 2015). An infant is helpless of him/herself, highly vulnerable, and completely dependent on others for care and development, and survival. Millions of infants have died and continue to die from various causes many of which are preventable. Diarrheal is one of the top five preventable killers of children under five years old in developing countries and most dangerous for the young, with about 90% of

deaths from diarrhea occurring in small children (Adam, 2016).

However, increased policy discussion on child's health has led to calls for more timely and local measurements of trends in infant mortality in places where the impact of intervention strategies are weak especially in many low-income countries particularly Sub-Saharan Africa (WHO, 2015). Infant mortality, also known as under-one mortality refers to the death of children under the age of one; it estimates the number of new born babies that will die before reaching their first birthday, based on current age specific mortality rate for each country (Tawiah, 2019). Under-one mortality is measured as a rate per 1000 live birth which provides a robust measure of the health of children; it reflects the probability of a new born dying before reaching the age of one (WHO, 2015).

Although global under-one mortality is declining, MDG-4 was not reached by the end of 2015. Indeed, in some countries, little or no progress has been made towards this goal (WHO, 2021). To improve progress and to monitor the effects of public health interventions, accurate up to date estimates of national and sub-national infant mortality rate are essential (WHO, 2021). In developed countries, vital registration system records all births and deaths, which mean that under one mortality rate, can be directly calculated. But developing countries lack vital registration system and child mortality has to be estimated using data collected in surveys (Rustein 2020; UNICEF 2020). Most countries in Africa including Nigeria have seen little or no change in their under-one mortality rate over the past years (UNICEF 2020; WHO, 2021).

A vital registration system that captures all births and deaths is the optimal way to monitor trends in child mortality, however, very few developing countries have complete vital registration system (Abbas, 2012; Ruzicka, 2019). Infant mortality is generally measured using surveys that ask women to report the birth and death of their children. Several survey methods exist for capturing this information: complete birth histories captures detailed information on every child dead or alive, including date of birth and date of death, summary birth histories ask only how many live birth each mother has ever had and how many of them have survived (Abbas, 2012). Nigeria decreed the registration of all vital events in 1979, the country is yet to implement compulsory registration, due to this most deaths in Nigeria go unregistered and it is not possible to generate comprehensive population based mortality data (Abbas, 2012; UNICEF 2020). Hospital-based data recorded by medically qualified staff can yield useful information to characterize infant mortality which occurred in hospitals, and this research will also focus on hospital data to obtain information on infant deaths within Gombe metropolis, Nigeria. The study aimed at mapping-out the spatial distribution of infant mortality cases in Gombe metropolis, assessing the temporal variation of infant mortality in Gombe metropolis from 2014-2019, identifying the gender with the highest infant mortality rate in the study area and finding out the medical causes of infant's mortality in the study area

Study Area

Gombe State (the Jewel in the Savannah) is located in the Sudan savannah region of the country at the North-East of river Benue and East of Yankari Game Reserve bordering with Adamawa, Bauchi, Borno and Yobe States covering a total area of 20,256.5sq/km. the approximate altitude of Gombe ranges from 400-500m above mean level. Topography is mainly mountainous, undulating and hilly to the Southeast and open plains in the central Northeast, west and northwest (Abbas, 2012).

Gombe urban area. is located approximately in the center of Gombe State which lies between latitudes $10^{0}0^{1}$ and 10^{0} 20.^{1}N and on longitudes $11^{0}1^{1}$ and $11^{0}19^{1}$E with an altitude of 500m above sea level, and covers an area of about 52.434sqkm (Gombe State Annual Diary, 2022). Gombe urban area is bounded by Kwami Local Government Area in the North and almost surrounded by Akko Local Government Area in the South East and South West (figures 1).

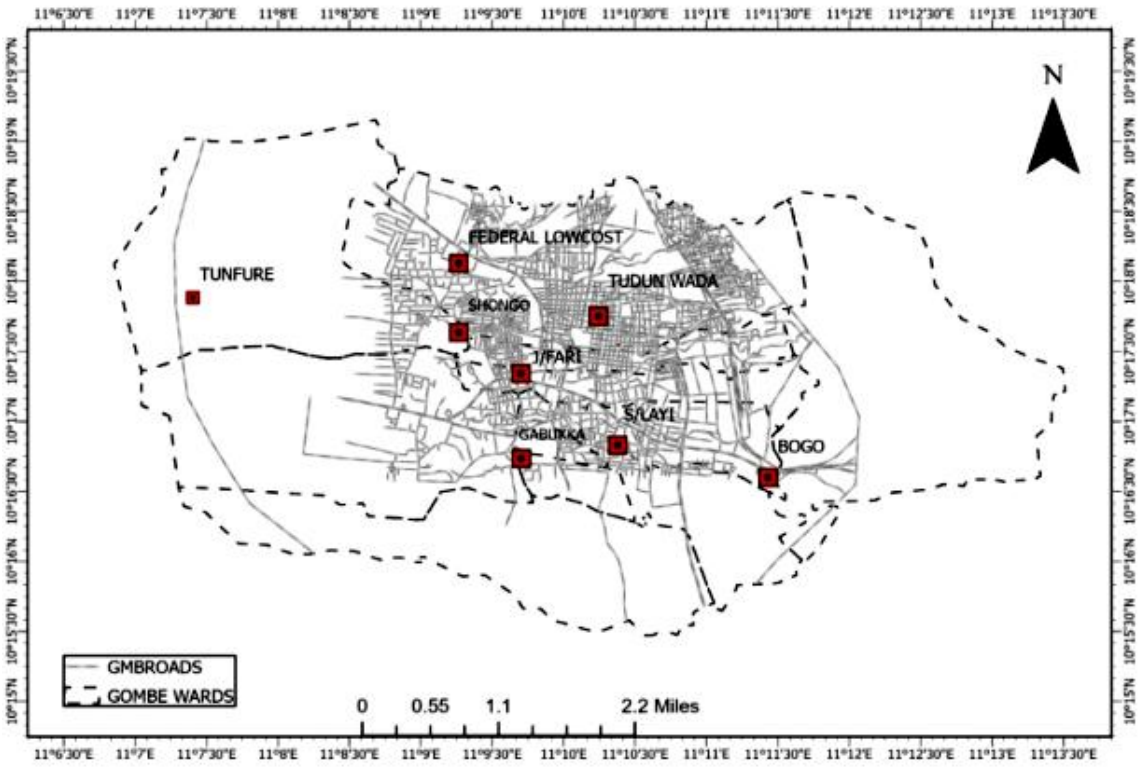

Figure 1: Gombe Town
Source: Gombe State University Cartography Lab.

The study area is linked to other regions by roads like Gombe Biu – Maiduguri Road, Gombe to Bauchi Road, Gombe – Yola Road, Gombe – Patiskum Road and Gombe – Dukku Road (figure2). urban area is divided into different residential quarters which include, GRA, Federal Low Cost, Arawa, State Low Cost, Kumbiya-kumbiya, Pantami, Jekadafari, Tudun Wada, Madaki, Dawaki, Bolari, Yalanguruza, Shamaki etc (Abbas 2012).

The population of the study area as at 2006 was 266,844 people. (National Population Commission, 2006) at a growth rate of 3.2 per cent per annum it has been projected to reach 414,737 by the year 2020. The ethno-linguistic composition of Gombe Urban Area includes among others; the Fulani, Tera, Bolewa, Tangale, Jukun, Hausa, Kanuri, Yoruba, and Igbo. In addition to the speaking of all these various languages, Hausa language serves as a lingua-franca in the course of daily interaction among peoples. English language remains the official language as obtains in all part of the country (Abbas 2012).

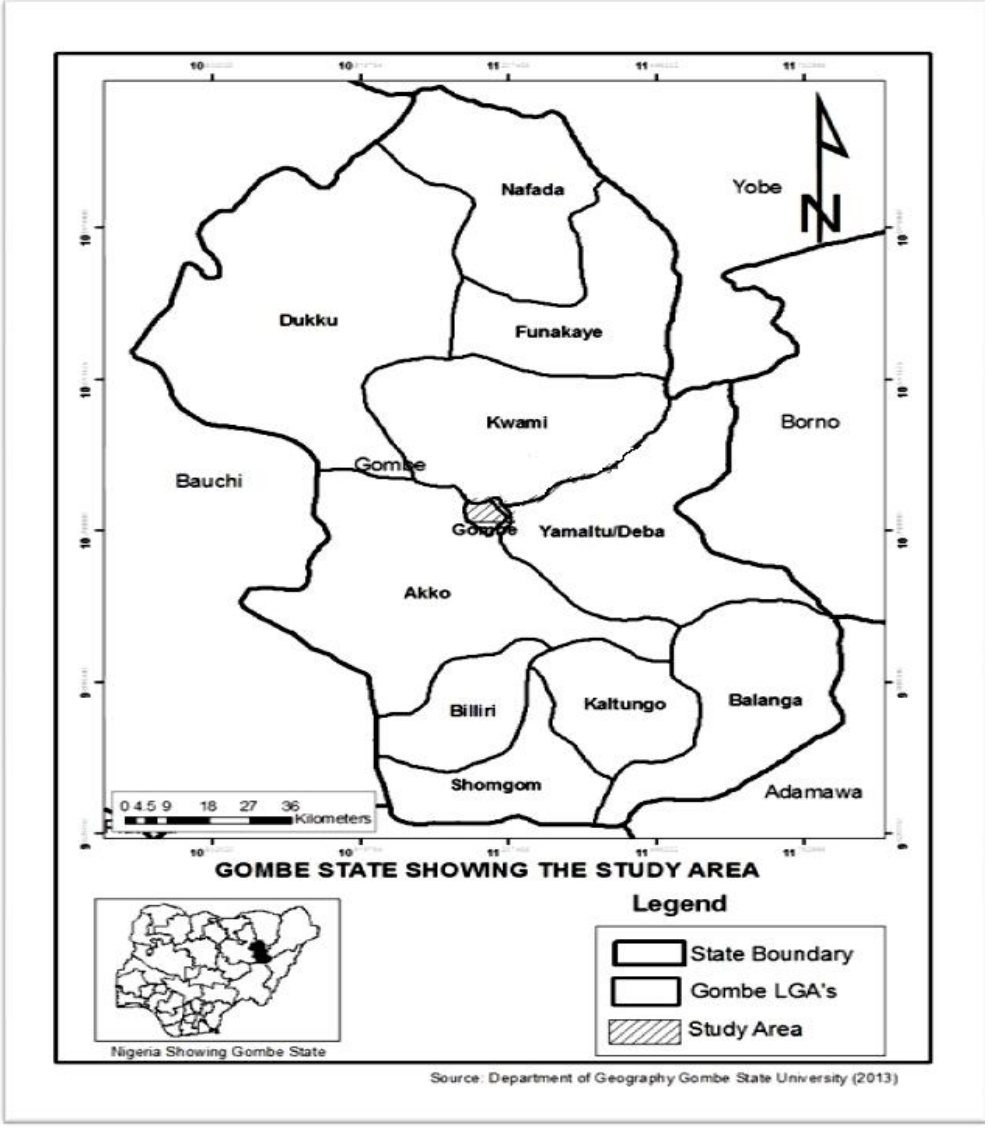

Figure 1: Gombe State showing study area
Source: Gombe State University Cartography Lab.

MATERIALS AND METHODS

Quantitative and Qualitative data were used. The quantitative data consists of the spatial distribution of infant mortality, temporal variation of infant mortality, gender with the highest infant mortality rate among others. While Qualitative data includes interviews with heath personnel, stakeholders in the health related institutions about the Medical causes of infant mortality, measures adopted by the state government to prevent and control infant mortality, efforts made by the general public and NGOs in curtailing the menace.

Secondary data were sourced from the hospital records of Federal Teaching Hospital and Specialist Hospital Gombe as well as subsidiary primary Healthcare facilities located inside Gombe urban centre. While primary date were sourced using interview schedules. Those interviewed include medical doctors, nurses, heath attendance, hospital

staff, parents who are found in the hospital during the data collection.

ArcGIS Map software was used to plot a map of spatial patterns of infant mortality in the study area. Simple statistical techniques were adopted to compute the number and percentage of deaths per gender for the period of six years. A line graph was used to show the medical causes of infant mortality in the study area.

RESULTS AND DISCUSSION

Infant Mortality in Gombe Metropolis

The findings of the study were presented as shown in Figure 3. The spatial distribution of infant mortality in Gombe metropolis between 2014 and 2019 reveals that there were a total of three thousand two hundred and fifty-two (3,252) deaths of infants in the study area within the stated period. The distribution is uneven as shown by the colour representation/distributions of the legend. The area with the highest number of infant mortality recorded cases, is Tudun-wada with five hundred and sixty-seven (567) deaths, having 18% of all cases, followed closely by Bogo with five hundred and twenty-three (523), making 16%, the third in trend is Gabukka with four hundred and thirty-four (434) cases of infant mortality, which has 13.3%, the next highest is Sabon-layi with four hundred and twenty-five (425) cases of infant mortality, having 13%, also Shongo followed with four hundred and ten (410), having 13%, the last area with a high number of infant mortality cases is Jekadafari with four hundred and one (401), making 12%.

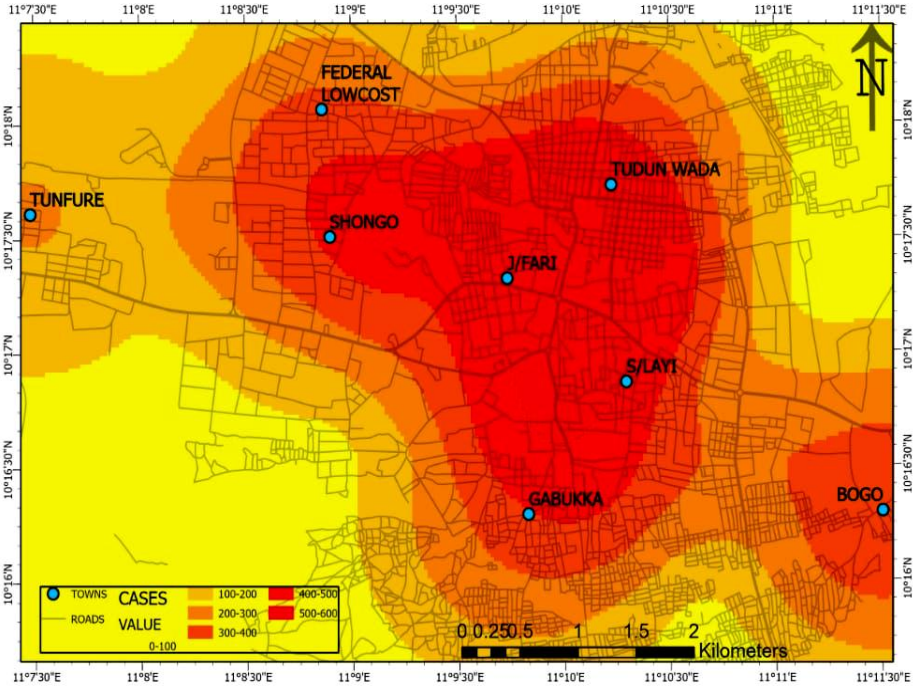

Figure 3: Spatial Distribution of Infant Mortality in Gombe Metropolis from 2014 to 2019
Source: Federal Teaching Hospital and Specialist Gombe 2021

The environmental factors that contributed to high infant mortality in the area as shown in Table 1 are slum and marshy parts of the town are seen in places that are mostly flooded during rainy seasons. The living conditions in these areas are poor and lack access to basic

necessities of life like clean water, good sanitary condition and poor nutrition. While areas with the lowest infant death is Tumfure with two hundred and fifty-four (254) cases of infant mortality having 8%, the least is Federal-Low-cost with two hundred and thirty-eight (238) cases of infant deaths making 7.5% of all cases. Lower record of cases in Federal lowcost and Tumfure could be attributed to their location which is on the higher altitude of the Akko escarpment thereby limiting the effects of flooding, so also the good quality and standard of life of majority of the inhabitants in this axis has influenced infant survival positively.

Table 1: Annual recorded cases of infant mortality in gombe metroplis from 2014-2019

Year	Total Cases	Increase + Decrease _	Percentage	% Difference
2014	599		18.42	
2015	593	-6	18.23	-1.00
2016	571	-22	17.56	-3.7
2017	523	-48	16.08	-8.4
2018	499	-24	15.34	-4.5
2019	467	-32	14.36	-6.4
Total	**3,252**		**100**	

Source: Federal Teaching Hospital and Specialist Gombe 2021
Average 3252/6 = 542

Assessing the Temporal Variation of Infant Mortality in Gombe Metropolis from 2014-2019

There were three thousand two hundred and fifty-two (3,252) total recorded cases of infant mortality in Gombe metropolis from 2014 to 2019. Table 1 shows that infant mortality was highest in the year 2014 with five hundred and ninety-nine (599) cases, the second highest is the year 2015 with a total number of five hundred and ninety-three (593) cases, while the third highest is 2016 with five hundred and seventy-one (571) cases of infant mortality. The years with the least decrease in infant deaths in descending order is the year 2017 with five hundred and twenty-three (523) deaths, followed by four hundred and ninety-nine (499) cases of infant death in the year 2018, and the year with the lowest recorded deaths was in 2019 with four hundred and sixty-seven (467) cases of infant mortality.

The possible factors behind the high number of infant mortality cases in 2014, 2015 and 2016, is because there were fewer maternity clinic in those areas and access to health centers became difficult especially when the need for medical attention arose in the night. Also lower attention was given to government and private health centers by the government and regulatory agencies. However, in the years 2017, 2018 and 2019 the cases of infant mortality reduced. The decline could be attributed to construction of more maternity clinics in area by government and private sector to take care of mothers and infants especially in terms of treatment and medical advice. This made health care more easily accessible because of proximity to the healthcare centers.

From the year 2014 to 2019, there was a decrease of 22% of infant mortality cases in the area, the reason of the decrease of the infant mortality cases, is because of the attention given to health sectors. The total average of infant deaths in the six years from 2014 to 2019 is five hundred and forty-two (542). The years 2014, 2015 and 2016 exceeded the average number with 57 (599), 51 (593) and 29 (571) cases respectively

while 2017, 2018, 2019, were below the average with 523, 499, and 467 respectively. Meanwhile, the year 2016 has the highest percentage decrease difference of -8.4%.

The infant mortality was on the decrease in Gombe, from 599 cases in 2014 to 467 cases in 2019, a decrease of nearly 22% in the six-year period (2014-2019). All hands should be on deck to sustain the decrease, and to maintain the tempo so that infant mortality will continue to reduce in Gombe.

According to the results obtained in Table 2 there were more male cases of deaths with 1,867 making (57%) than female cases of deaths with 1,385 making (43%) of infant mortalities in the study area over the period of six (6) years from 2014 to 2019. The years with the highest percentage of male infant death was 2015 and 2018 with 60% each, next is the year 2019 with 59%, followed by 2017 with 58%, and the years with the lowest cases are the years 2014 and 2016 with 56% each.

Table 2: Annual recorded gender with highest infant mortality in gombe metropolis from 2014-2019

YEAR	MALES	%	FEMALES	%	TOTAL	%	TOTAL % PER YEAR
2014	320	56	251	44	571	100	17.6
2015	337	60	262	40	599	100	18.4
2016	334	56	259	44	593	100	18.2
2017	301	58	222	42	523	100	16
2018	298	60	201	40	499	100	15.3
2019	277	59	190	41	467	100	14.4
TOTAL	**1,867**	**57**	**1,385**	**43**	**3,252**	**100**	**100**

Source: Source: Federal Teaching Hospital and Specialist Gombe 2021

The years with the highest female percentage of deaths are 2014 and 2016 with 44% each, followed by 2017 with 42%, then 2019 with 41%, lastly the years 2015 and 2018 had the least cases of 40% each (Figure 4). The above statistics corresponds to the global mortality records where infant mortality is higher in the male child than in the female child in most parts of the world. This has been explained by sex differences in genetic and biological make up, with the male gender being biologically weaker and more susceptible to diseases and premature death. According to UN population Division (2017), from the detailed vital registration analysis of countries, new born female children have a biological advantage in survival over newborn male children. They have lesser vulnerability to perinatal conditions (including birth trauma, intrauterine hypoxia and birth asphyxia, prematurity, respiratory distress syndrome and neonatal tetanus), congenital anomalies and such infectious diseases as intestinal infections and lower respiratory infections.

From the data obtained on infant mortality in the study area as shown in figure 3, infant mortality was affected more by factors of low birth weight over the six years' period from 2014-2019 accounting for one hundred and ninety-five (195) cases out of the total three thousand two hundred and fifty-two (3,252) total cases recorded over the five years period. There is a strong inverse association between birth weight and Neonatal and post neonatal mortality. A low birth weight of 2.4kg and below is dangerous for infant survival (Marie, 2000).

From the result obtained, it is important to note that low birth weight of an infant is primarily a function of the nutrient intake of the mother. A situation where a pregnant woman does not eat the required diet either due to poverty or ignorance will result in the child she is carrying having insufficient

nutrient for its upkeep. This in the long run can result in low birth weight. The other causes could be inadequate prenatal care.

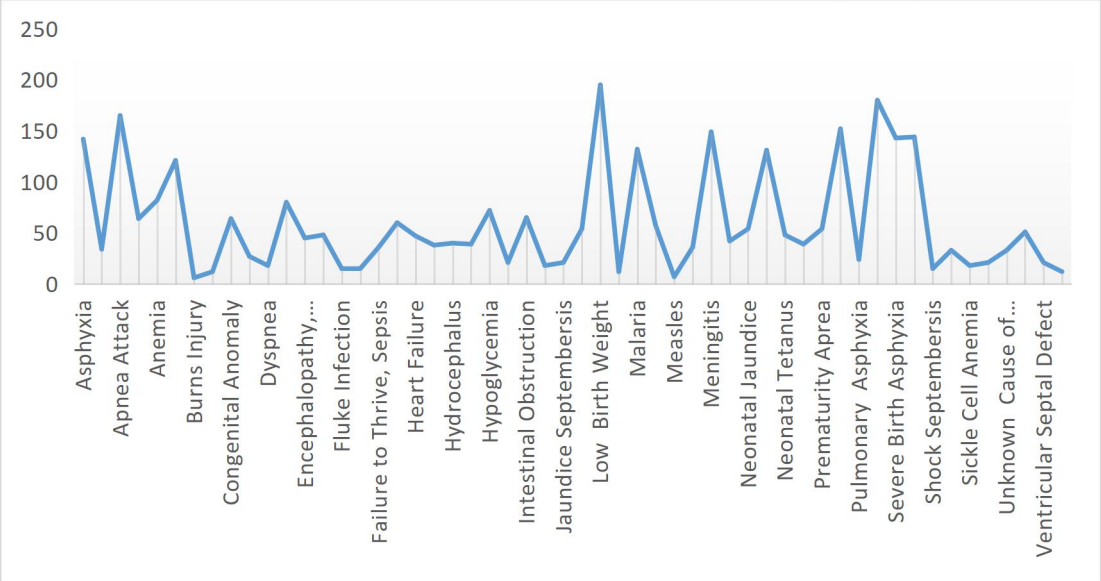

Figure 4: Major medical causes of deaths among infants in the study area
Source: Federal Teaching Hospital and Specialist Hospital Gombe 2021

Another cause of low birth weight according to Boston children's hospital is premature birth, being born before 37 weeks' gestation. Other maternal factors responsible for low birth weight of infant according to Isaac (2018) are: pregnant mother's health, drug abuse, age of mother (too young or old).

The study discovered that the next highest disease responsible for the infant death in the study area is respiratory failure with one hundred and eighty (180) cases out of the total number of three thousand two hundred and fifty-two (3,252) cases. Respiratory failure is a syndrome in which the respiratory system fails in one or both of its gas exchange functions (Marie, 2015).

The third highest disease is apnea attack with one hundred and sixty-four (164) cases of infant death it occurs when the muscles that support the soft tissues in the throat such as tongue, and soft palate, temporarily relax, then the airway is narrowed or closed and breathing is momentarily cut off. Next is pneumonia with one hundred and fifty-two (152) cases of infant death in the study area. This is an infection of the lungs caused by bacteria, viruses, fungi, or parasites. The fifth highest disease of infant mortality in the study are is meningitis with one hundred and forty-nine (149) cases, this is an inflammation of the protected membranes covering the brain and spinal cord, meningitis can lead to brain swelling and cause permanent disability, coma and even death. These findings were supported by Marie, (2015) who reported that low birth weight, Respiratory failure and pneumonia are the leading causes of infant mortality in Upper Volta region in Ghana.

The next condition responsible for infant mortality in Gombe metropolis is a medical condition known as sepsis. It is a life threatening condition caused by the body's response to infection. The body normally releases chemicals into the blood stream to fight an infection. Sepsis occurs when the body's response to these chemicals is out of balance, which triggers changes that damages

the organs and leads to subsequent death. The different types of sepsis that resulted in infant mortality in the study area over the six year period are shock sepsis, neonatal sepsis and jaundice sepsis.

Measures Adopted in Preventing and Controlling Infant Mortality in the Study Area

An interview with Dr. James E. Madi JP (Director of Special Services, State Ministry of Health Gombe) revealed that Non-Governmental Organization's (NGO) in collaboration with the state government introduced a program called 'Maternal Neonatal Child Health' (MNCH), the program introduced free drugs during pregnancy, free folders, taking care of difficult delivery, and free immunization. All the above programs were introduced to protect and prevent infant death. Some of the NGO's include; Planned Parenthood Federation of Nigeria (PPFN), UNICEF, UNPA, United Nation (UN), Marie Stopes (MS), Save the Children International (SCI), John Snow International (JSI), IPAS, E4A also known as Mamaye. The NGO's above and the state government joined hands together and contributed to the reduction of infant mortality in the entire State (Gombe State Ministry of Health 2019).

Government on its part has also created at least one maternity clinic in each of the 11 wards in Gombe LGA to make health care readily available and accessible to residents of the area and to reduce mother and infant mortality. Also awareness campaign has been embarked upon by Government to educate the public on the importance of utilizing maternal healthcare services and the routine immunization for children in the media such as in the radio and television stations.

CONCLUSION

The findings revealed a high level of under-one mortality of 3,252 which occurred in Gombe metropolis from 2014-2019 as a result of lack of access to medical facilities, poverty, poor sources of drinking water, poor environment and lack of nutritious food, which lead to diseases such as low birth weight, apnea attack, malaria, measles, meningitis etc., however, infant mortality is on the decrease from 571 cases in 2014 to 467 cases in 2019, a decrease of nearly 19%. A lot of work still has to be done to reduce infant mortality by creating awareness, establishment of more health care centers and improving sanitary condition in the poor areas of the state.

Recommendations

1. Considering the rate of under-one mortality in the State, there is a need for government agencies and nongovernmental organizations to do all they can to reduce the rate of under-one mortality from the local level up to the regional level by creating awareness, establishment of more health care centres and improving sanitary condition in the poor areas.

2. Furthermore, there should be effective allocation of funds by the State government to strengthen community healthcare centres and increase programmes to create awareness.

3. There should be a regular monitoring of vital events through effective vital registration exercise this will help in revealing the trend of under-one mortality. Low birth weight, sepsis, asphyxia and others as the leading causes of under-one mortality need to be taken seriously. This calls for effective health education on proper treatment of related complications.

REFERENCES

Adam A (2016) Gender Differentials and Disease-Specific Cause of Infant mortality: A Case Study in an Urban Hospital in Accra, Ghana, African

Journal of Reproductive Health June 2016; 20 (2): 104.

GDHS (2003): Ghana Demographic and Health survey: *World Bank Catalog*. GHA 2003 DHS WLM SEPTEMBER 29, 2011.

Gombe State Ministry of Health 2019). Annual Performance Evaluation Record Document.

Marie C. (2015): The Contribution of Low Birth Weight to Infant Mortality and Childhood Morbidity. *Published by Med mobile website.*

Rustein R. (2020) Approaches to the Measurement of Childhood Mortality*: A Comparative Review Population Index 57(3); 368-382.*

Ruzicka L. (2019): Differential Mortality: *Methodological Issues and Biosocial Factors. Clarendon Press, 2019,259p.*

Tawiah E. O. (2019): Child mortality differentials in Ghana: *a preliminary report.* Published on line Retrieved on 31 July 2008.

UNICEF (2020): Multiple indicator cluster survey Manual 2005. *Monitoring the situation of Children and Women.* Available from http: www.child nfo.org /mic 3 manual httml.

World Health Organization (WHO 2015): Maternal Mortality and Childhood Mortality in 2015; estimates developed by WHO, UNICEF and UNEPA Geneva.

WHO (2021): International Statistical Classification of Diseases and Related Health Problems. *Tenth Revision (ICD-10)* geneva available form https://www.who int classification/icd