IRESPUB Journal of Environmental & Material Sciences
ISSN: 2770-4084
Volume: 1 | Issue: 2 | NOV - DEC 2021 | Available Online: www.irespub.com

# An assessment of trends and spatial distribution of cases of malaria fever in Mubi south local government area Adamawa state, Nigeria

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**ABSTRACT**
The study shows that the trends of malaria in the selected areas of Mubi south have been positively increasing yearly as from 2015-2018. The study shows that cases of malaria fever in the selected areas of Mubi south is not spatially distributed among the areas, with some areas experiencing high cases of malaria fever while other areas experienced low cases. The study identified the causes and effects of malaria fever in the study areas and the possible way of tackling it. Indiscriminate waste disposal in unauthorized places, provides breeding grounds for mosquitoes, serves as the main cause of malaria fever in the study areas which leads to death .The findings of the study shows that almost all the populace has access to Long Lasting Insecticides Treated Nets (LLITN) that serves as a way of preventing the widespread of malaria cases. Data was analyzed using the SPPS package and result presented in simple percentages. The study recommends that there's need for community collaboration in malaria controls programs in all stages to decentralized malaria operations and also educating people on good environmental management and set law against dumping of refuse in unauthorized area. Both primary and secondary data where used for the study.

**KEYWORDS**
malaria; spatially; trends; management

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## INTRODUCTION

Malaria affects an estimated 250 million people each year and is the most wide-spread parasitic disease encountered (Grimberg & Mehlotra, 2011).Malaria continues to be a major impediment to health in sub-Saharan Africa, where it frequently takes the greatest toll on young children and pregnant women (WHO, 2005, Hamel *et* al., 2011, Kendall 2011). About 90% of all malaria deaths occur in sub-Sahara Africa (Sachs, 2002; Sachs and Malaney *et* al., 2002; MOH, 2003). Malaria caused by *plasmodium falciparum* predominates in Africa where the mortality attributed to it approaches 1 million annually, and account for 90% of the global malaria burden (Breman *et* al., 2004). The majority of these death are children under the age of five, some children suffer acute attacks of cerebral malaria that lead to coma and death. Others succumb to severe anemia that follows repeated infections or due to the consequences of low birth weight caused by malaria infection in pregnancy (MOH, 2003). In severe cases of cerebral malaria, surviving children may be left with epilepsy, speech disorders and blindness (WHO and UNICEF, 2003; CDC, 2004).

Malaria consumes a significant proportion of time, money and human resources available to health systems in Africa (Malaney *et* al., 2004). Malaria is caused by a protozoan parasite of genus *Plasmodium*. There are four species of *Plasmodia,* which infect man: *Plasmodium vivax, P. falciparum, P. malariae and P.ovale*

Many Anopheles species has been reported in Nigeria*. An. gambiae* and An. *funestus* complex has been reported as the two major Anopheles species in Southern Nigeria that are vectors of malaria with *An. moucheti* and *An. nili*. The *An. gambiae* group consists of at least seven species which includes *An. gambiae*, *An. arabiensis* which are good vectors of malaria and are known to coexist in most part of West Africa.

In Northern Nigeria, *An. gambiae* was reported as the only Anopheles species in Sokoto metropolis also *An. gambiae, An. arabiensis* and *An. funestus* was reported as the mosquito species in Kastina metropolis, Katsina state, while in Yola, the dry season mosquito collection for *anophelines* were; An. *gambiae complex* (64%),

In 2017, according to the commissioner for health, Dr. Fatima Atiku Abubakar, malaria accounted for 70% of over 850,000 cases of reported fever in Adamawa state. "Malaria burden in the state as at 2017 is 70% (605,366 out of 856,086) reported cases of fever, where most of the affected people were women and children, leading to a seasonal malaria chemoprevention campaign targeting children in high risk locations like Mubi (north and south) and Michika is simply w The epidemiology of malaria over small areas remains poorly understood, and this is particularly for malaria during epidemics in Northern part of Nigeria, where transmission intensity is low and is also characterized by acute illness within and varies between years. There have been epidemics of malaria affecting 73% of children under five years and 37% of Adults specifically pregnant women, causing deaths of 47% of the infected population in Mubi south. A common feature of malaria in Mubi south is that, there is always overall low potential disease risk in an average year. Despite the availability of basic malaria control tools, it has not been clear why malaria has been on the increase. It was therefore important to establish the knowledge levels of the community on the causes of malaria and the available control strategies, with the aim of controlling and preventing future outbreaks

**MATERIAL AND METHODS**

Mubi South is one of the active serving twenty-one local government areas richly blessed with natural solid minerals located in the northern corner of Adamawa state Senatorial Zone with its capital administrative headquarters in the Gella town, thus forming a federal constituency together with Maiha and Mubi North local government area with a total of ten electoral wards.

Mubi South Local Government Area is sited in Gella town with the area council consisting of Mubi South, Duvu, Chaba, Girburum, Gella, Gude, Kwaja, Lamorde, Yadafa, Mujara, Nassarawo, Nduku and Mugulbu. Mubi South is located in Adamawa State Nigeria with GPS Coordinates of Latitude 10.1874 E, and Longitude 13.3958 E.

According to Thomas Brinkhoff, (2017), the population of Mubi South is estimated to be about 129,956 and 173,700, in respect to the 2016 population projection. Its Area is: 414 km$^2$ – Density: 419.6/km$^2$ and it situated at elevation 592meters above sea level.

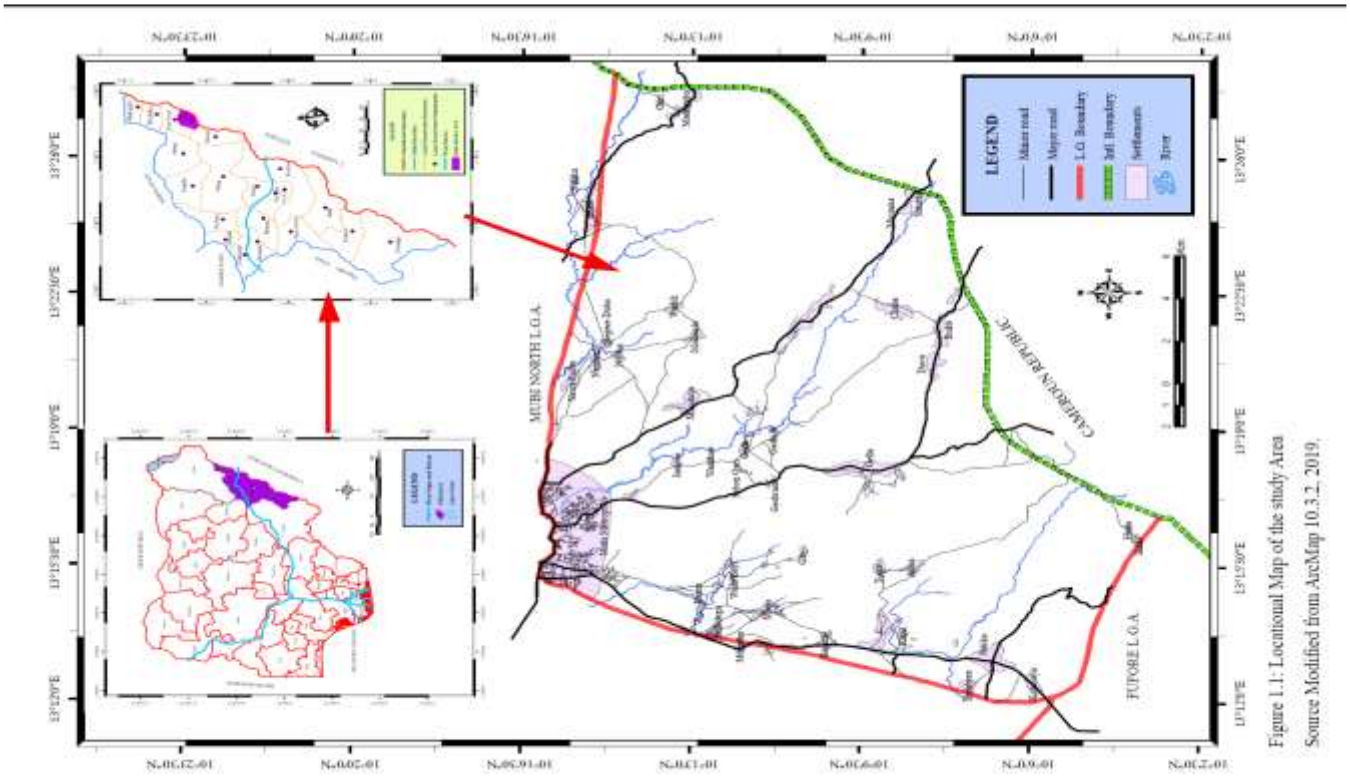



**FIGURE 1:** Locational Map of the Study Area
*Source: Modified from ArcMap 10.3.2, 2019.*

The total population size of the study site is unknown. Therefore, the sample size requirement for questionnaire where determined using the Cochran's formula for calculating sample size for infinite population (Cochran 1977) which is expressed as.

$$n_{o=}\frac{Z^2P(1-P)}{e^2}$$

Where;
$n_o$= desired sample size
Z = standard normal deviation set at 95% confidence level (1.96)
P = percentage picking a choice or response (0.5)
$e^2$ = confidence interval (0.05)
This implies that for the five sites entire unknown population, the sample size for questionnaire to be administered will be.

$$n_{o=}\frac{(1.96)^2(0.5)(1-0.5)}{(0.05)^2}=384.16$$

Therefore, the total sample size is 384 respondents. But due to financial factor, 250 questionnaires were administered across the selected areas in Mubi south local government area.

Purposive sampling and simple random sampling were used in this research. Purposive sampling was used in the selection of sites which includes; Nassarawo, Gude, Mugulbu, Gella and Lamurde. And simple random sampling was used in the selection of respondents. Questionnaires were administered randomly in the selected sample areas.

Data was collected through physical observation, purposive discussion with some affected victims, hospitals, dispensaries and clinic records, and with the help of questionnaires.

**RESULTS AND DISCUSSION**

**TABLE 1:** Causative Vector

| Vector | Lamurde | Gella | Gude | Mugulbu | Nassarawo |
|---|---|---|---|---|---|
| Cockroach | - | - | - | - | - |
| Mosquito | 50(100%) | 46(100%) | 50(100%) | 50(100.0%) | 50(100.0%) |
| Housefly | - | - | - | - | - |
| Rat | - | - | - | - | - |
| **Total** | **50(100%)** | **46(100%)** | **50(100%)** | **50(100%)** | **50(100%)** |

*Source: field survey, 2020*

The main reason why data was collected on this particular aspect was to know if the respondents of the study area have a good picture on the major reasons that are behind malaria infection in terms of vector. The results in table 1 revealed that almost all the respondents in the study area know that malaria fever is caused by mosquito.

**TABLE 2:** Mode of Transmission

| Mode of transmission | Lamurde | Gella | Gude | Mugulbu | Nassarawo |
|---|---|---|---|---|---|
| Eating contaminated food | - | - | - | - | - |
| Drinking contaminated water | - | - | 2(4%) | - | - |
| Bite of mosquito infected with malaria | 50(100%) | 46(100%) | 47(94%) | 50(100%) | 50(100%) |
| Coming in contact with a malaria patient | - | - | 1(2%) | - | - |
| **Total** | **50(100%)** | **46(100%)** | **50(100%)** | **50(100%)** | **50(100%)** |

*Source: field survey, 2020*

Malaria is said to be transmitted through the bite of an infected female anopheles mosquito so with regards to the study areas in question, the knowledge of how the transmission occurs was tested, were the analysis of result in table 2 shows that almost all the respondents in the study area knows that malaria fever is been transmitted through the bite of mosquito infected with malaria.

**TABLE 3:** Method of waste disposal

| Method | Lamurde | Gella | Gude | Mugulbu | Nassarawo |
|---|---|---|---|---|---|
| Dumping of waste in unauthorized places | 28(56%) | 31(67.4%) | 28(56%) | 28(56%) | 34(68%) |
| Burning | 10(20%) | - | 15(30%) | 6(12%) | - |
| Land filling | 11(22%) | 14(30.4%) | 7(14%) | 14(28%) | 15(30%) |
| Incinerators | 1(2%) | 1(2.2%) | - | 2(4%) | 1(2%) |
| Others | - | - | - | - | - |
| **Total** | **50(100%)** | **46(100%)** | **50(100%)** | **50(100%)** | **50(100%)** |

*Source: field survey, 2020*

The results in table 3 indicates that the common method of waste disposal practiced within the study areas is dumping of waste in unauthorized places, which in turn will have a high impact in the spread of malaria fever in the areas.

**TABLE 4:** Respondents that suffered from malaria

| Malaria illness | Lamurde | Gella | Gude | Mugulbu | Nassarawo |
|---|---|---|---|---|---|
| Yes | 45(90%) | 39(84.8%) | 39(78%) | 45(90%) | 45(90%) |
| No | 5(10%) | 7(15.2%) | 11(22%) | 5(10%) | 5(10%) |
| **Total** | **50(100%)** | **46(100%)** | **50(100%)** | **50(100%)** | **50(100%)** |

*Source: field survey, 2020*

The results in table 4 indicates that almost all the respondents in the study areas have suffered from malaria illness, with few who did not. This is because malaria is the most common fever among others.

**TABLE 5:** Cost of treatment

| Cost | Lamurde | Gella | Gude | Mugulbu | Nassarawo |
|---|---|---|---|---|---|
| Low | 30(60%) | 19(41.3%) | 27(54%) | 27(54%) | 20(40%) |
| Moderate | 12(24%) | 21(45.7%) | 9(18%) | 16(32%) | 24(48%) |
| High | 5(10%) | 5(10.9%) | 9(18%) | 6(12%) | 5(10%) |
| Very high | 3(6%) | 1(2.2%) | 5(10%) | 1(2%) | 1(2%) |
| **Total** | **50(100%)** | **46(100%)** | **50(100%)** | **50(100%)** | **50(100%)** |

*Source: field survey, 2020*

The result from table 5 above indicates that the cost of malaria treatment in the study area is mostly low, and this is because the government provides the medication to be given in the various health care centers (government) across the study area.

**TABLE 6:** Number of mortality

| Number of mortality | Lamurde | Gella | Gude | Mugulbu | Nassarawo |
|---|---|---|---|---|---|
| None | 43(86%) | 36(78.3%) | 39(78%) | 42(84%) | 42(84%) |
| 1 | 5(10%) | 5(10.9%) | 6(12%) | 4(8%) | 2(4%) |
| 2 | 1(2%) | 5(10.9%) | 2(4%) | 4(8%) | 5(10%) |
| 3 | 1(2%) | - | 3(6%) | - | 1(2%) |
| **Total** | **50(100%)** | **46(100%)** | **50(100%)** | **50(100%)** | **50(100%)** |

*Source: field survey, 2020*

The table 6 above presents the analysis of mortality records in families. Most of the respondents have recorded no cases of mortality in their families, with just little proportion that have recorded, were some record 1, some 2 and others 3.

**TABLE 7:** Method of prevention

| Prevention | Lamurde | Gella | Gude | Mugulbu | Nassarawo |
|---|---|---|---|---|---|
| Mosquito nets | 35(70%) | 40(80%) | 40(80%) | 37(74%) | 41(82%) |
| Mosquito coils and flitting | 14(38%) | 5(10%) | 5(10%) | 11(22%) | 6(12%) |
| Anti-malaria drugs | 1(2%) | 1(2%) | 5(10%) | 2(4%) | 3(6%) |
| None | - | - | - | - | - |
| **Total** | **50(100%)** | **46(100%)** | **50(100%)** | **50(100%)** | **50(100%)** |

*Source: field survey, 2020*

The response from the respondents in the study area on the various methods used in controlling malaria infection is displayed in the table 7 above, whereby the use of mosquito nets carries a large proportion within the study area and this is because the government have tried their possible best in providing Long Lasting Insecticide Treated Nets (LLITN) to the inhabitants.

**TABLE 8:** Personal hygiene practiced by the respondents

| Personal hygiene | Lamurde | Gella | Gude | Mugulbu | Nassarawo |
|---|---|---|---|---|---|
| Refuse disposal | 18(36%) | 22(47.8%) | 21(42%) | 21(42%) | 19(38%) |
| Sewage disposal | 3(34%) | 17(37%) | 3(6%) | 19(38%) | 19(38%) |
| Discharge of stagnant water | 10(20%) | 6(13%) | 10(20%) | 8(16%) | 11(22%) |
| Clearing of surrounding bushes | 5(10%) | 1(2.2%) | 16(32%) | 2(4%) | 1(2%) |
| Others | - | - | - | - | - |
| **Total** | **50(100%)** | **46(100%)** | **50(100%)** | **50(100%)** | **50(100.0%)** |

*Source: field survey, 2020*

The result from table 8 shows the most common personal hygiene practiced by the respondents in the study area in other to tackle the spread of malaria fever. Where refuse disposal seems to be the most common personal hygiene practiced by the inhabitants.

**TABLE 9:** Environmental sanitation

| Period | Lamurde | Gella | Gude | Mugulbu | Nassarawo |
|---|---|---|---|---|---|
| Daily | 5(10%) | 5(10.9%) | 12(24%) | 6(12%) | 5(10%) |
| Weekly | 30(60%) | 29(63%) | 22(44%) | 29(58%) | 30(60%) |
| Monthly | 15(30%) | 12(26.1%) | 16(32%) | 15(30%) | 15(30%) |
| 0nce a year | - | - | - | - | - |
| **Total** | **50(100%)** | **46(100%)** | **50(100%)** | **50(100%)** | **50(100%)** |

*Source: field survey, 2020*

The results from table 9 indicates that most of the respondents carry out their environmental sanitations weekly, with only few proportion who does it daily or monthly.

**TRENDS OF MALARIA CASES IN THE STUDY AREA**

The table 10 below shows the results obtained from the secondary data sources which includes various health care centers in the study area; Lamurde P.H.C.C (Lamurde), Gella P.H.C.C (Gella), Gude P.H.C.C (Gude), Mugulbu P.H.C.C (Mugulbu), and General hospital Mubi (Nassarawo).

**TABLE 10:** Annual cases of malaria per wards

| Years Wards | Lamurde | Gella | Gude | Mugulbu | Nassarawo |
|---|---|---|---|---|---|
| **2014** | 1208 | 1057 | 882 | 916 | 2651 |
| **2015** | 1234 | 1119 | 897 | 1211 | 3073 |
| **2016** | 1327 | 1051 | 939 | 973 | 3079 |
| **2017** | 1397 | 1237 | 1099 | 1275 | 3155 |
| **2018** | 1345 | 1432 | 957 | 1375 | 3358 |
| **TOTAL** | **6511** | **5896** | **4774** | **5750** | **15316** |

*Source: field work, 2020*

The above table 10, shows the annual cases of malaria recorded in each ward of the study area. This data is sourced from the various health care centers found in the study area.

**TABLE 11:** Trends equation

| Wards | Coefficient | Std. Error | T-statistics | Probability |
|---|---|---|---|---|
| **Lamurde C** | 1171.100 | 46.36123 | 25.26033 | 0.0001 |
| **Time** | 43.70000 | 13.97844 | 3.126244 | 0.0522 |
| **Gella C** | 918.8000 | 99.31136 | 9.251711 | 0.0027 |
| **Time** | 86.80000 | 29.94350 | 2.898792 | 0.0626 |
| **Gude C** | 849.2000 | 79.64136 | 10.66280 | 0.0018 |
| **Time** | 35.20000 | 24.01277 | 1.465886 | 0.2389 |
| **Mugulbu C** | 855.4000 | 147.8580 | 5.785281 | 0.0103 |
| **Time** | 98.20000 | 44.58086 | 2.202739 | 0.1149 |
| **Nassarawo C** | 2614.400 | 123.7820 | 21.12101 | 0.0002 |
| **Time** | 149.6000 | 37.32166 | 4.008396 | 0.0279 |

*Source: Authors computation using Eview 8.0, 2020.*

The table 11 above was used in assessing the trends of cases of malaria fever in the study area, which was obtained from a regression analysis, were all malaria cases recorded in each ward were regretted against time. The coefficient values of each ward were only considered for the purpose of this research. Where the coefficient values try to indicate the average increase of malaria cases per ward without time changing (Constant) and also the average annual increase of malaria cases yearly per ward (Time) throughout the years (2014-2018).

From table 11; In Lamurde ward, without time changing, cases of malaria will always be 1171.100 in a year, which is the constant value from the table. However, it is increasing by an average of 43.70000 yearly.

In Gella ward, without time changing, cases of malaria will always be 918.8000 in a year, which is the constant value from the table. However, it is increasing by an average of 86.80000 yearly.

In Gude ward, without time changing, cases of malaria will always be 849.2000 in a year, which is the constant value from the table. However, it is increasing by an average of 35.20000 yearly.

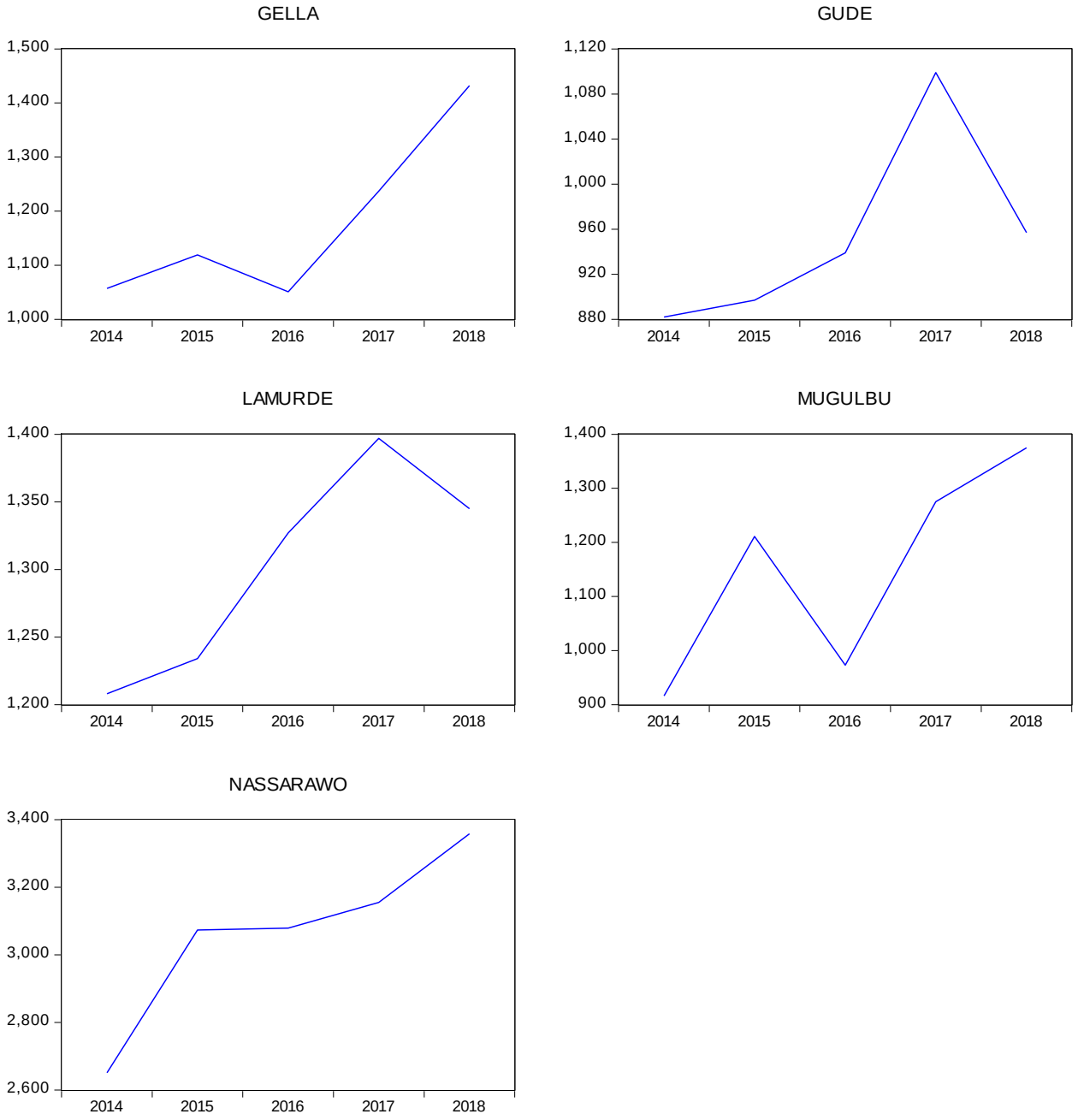
In Mugulbu ward, without time changing, cases of malaria will always be 855.4000 in a year, which is the constant value from the table. However, it is increasing by an average of 98.20000 yearly.

In Nassarawo ward, without time changing, cases of malaria will always be 2614.400 in a year, which is the constant value from the table. However, it is increasing by an average of 149.6000 yearly.

**NOTE:** Nassarawo ward with the highest increase rate of malaria cases per year (2614.400) is due to some human activities and population of people which may lead to the spread of mosquitoes in the area.

And Gude ward with the lowest increase rate of malaria cases per year (35.20000) is due to rise and fall of malaria cases within the years (2014-2018)

**Graphical Trends**




*Source: Authors computation using Eview 8.0, 2020.*

The graphs above show how the cases of malaria have been increasing as well as decreasing over the years (2014-2018) in the study areas.

According to the graphs, cases of malaria have been increasing positively from 2016-2018 in all the wards (Gella, Mugulbu and Nassarawo) except in Gude and Lamurde were there was a decrease in the cases from 2017-2018.

**TABLE 12:** Descriptive statistics of the variables

| Wards | Mean | Median | Maximum | Minimum |
|---|---|---|---|---|
| **Lamurde** | 1302.200 | 1327.000 | 1397.000 | 1208.000 |
| **Gella** | 1179.200 | 1119.000 | 1432.000 | 1051.000 |
| **Gude** | 954.8000 | 939.0000 | 1099.000 | 882.0000 |
| **Mugulbu** | 1150.000 | 1211.000 | 1375.000 | 916.0000 |
| **Nassarawo** | 3063.200 | 3079.000 | 3358.000 | 2651.000 |

*Source: Authors computation using Eview 8.0, 2020.*

Table 12 above shows the mean, median, maximum and the minimum values of each ward of the study area, within the five years (2014-2018) were;

MEAN: it is a value that is gotten when all variables are summed up and divided by the number of observations.
MEDIAN: the median value is obtained when all variables are arranged in either ascending or descending order. The variable at the middle is said to be the median value e.g
MAXIMUM: the maximum is the highest variable among the variables.
MINIMUM: the minimum is the lowest variable among the variables.

**SPATIAL DISTRIBUTION OF MALARIA CASES IN THE STUDY AREA**

The objective of this study is to assess the spatial distribution of cases of malaria fever in selected areas of Mubi south local government area. Where the results obtained from the various health care centers indicates that cases of malaria fever in the selected areas of Mubi south local government area is not evenly spatially distributed and this is due to some factors which include: human activities that provides breeding grounds for mosquitoes such as indiscriminate waste disposal in unauthorized places and also the climate of an area also determines the distribution of cases of malaria fever in the area.

To show how cases of malaria fever in the study area is spatially distributed, a map was prepared by the researcher, were the distribution of malaria cases on the map were categorized into three: areas with high cases (Nassarawo), areas with moderate cases (Lamurde, Gella, and Mugulbu) and lastly areas with low cases (Gude).

**Table 13:** Showing the locational characteristics of health care facilities in the study area

| Facility Name | Ward | Facility UID | Facility Code | Latitude | Longitude |
|---|---|---|---|---|---|
| Gella Primary Healthcare Centre | Gella | 68166631 | 02/15/1/1/1/0013 | 10.1569 | 13.3021 |
| Malluha Primary Healthcare Clinic | Gella | 41041819 | 02/15/1/1/1/0023 | 10.1709 | 13.2997 |
| Gude Primary Healthcare Centre | Gude | 54939364 | 02/15/1/1/1/0015 | 10.1973 | 13.3082 |
| Gydkwara Health Post | Gude | 37150405 | 02/15/1/1/1/0047 | 10.1906 | 13.2941 |
| Monduva Primary Health Clinic | Gude | 84297282 | 02/15/1/1/1/0048 | 10.2294 | 13.3165 |
| Monduva Primary Healthcare Center | Gude | 63648893 | 02/15/1/1/1/0024 | 10.2183 | 13.3228 |
| Ngavahi Health Post | Gude | 69045264 | 02/15/1/1/1/0032 | 10.2077 | 13.2879 |
| WuroPatuji Primary Health Clinic | Gude | 62138645 | 02/15/1/1/1/0037 | 10.2657 | 13.2845 |

| | | | | | |
|---|---|---|---|---|---|
| Arhan-Kunu Primary Health Clinic | Lamurde | 74403228 | 02/15/1/1/1/0001 | 10.2673 | 13.2364 |
| Asaal Nursing Home | Lamurde | 30682089 | 02/15/1/1/2/0001 | 10.2621 | 13.2581 |
| Beeky Health Clinic | Lamurde | 40716760 | 02/15/1/1/2/0002 | 10.265 | 13.2526 |
| Ecogate Clinic and Maternity | Lamurde | 20037373 | 02/15/1/1/2/0052 | 10.2587 | 13.2515 |
| Gaya Health Post | Lamurde | 55074715 | 02/15/1/1/1/0012 | 10.2525 | 13.2621 |
| Lamurde Primary Healthcare Centre | Lamurde | 18557469 | 02/15/1/1/1/0020 | 10.2432 | 13.2561 |
| Malangacha Health Post | Lamurde | 26872525 | 02/15/1/1/1/0022 | 10.2342 | 13.2671 |
| Njaah Memorial Hospital | Lamurde | 31053783 | 02/15/1/1/2/0053 | 10.2559 | 13.2532 |
| Bajaule Primary Health Clinic | Mugulbu | 72559023 | 02/15/1/1/1/0004 | 10.1779 | 13.2235 |
| Chakamaje Primary Health Clinic | Mugulbu | 43896052 | 02/15/1/1/1/0007 | 10.2017 | 13.2536 |
| Girji Primary Health Clinic | Mugulbu | 36918096 | 02/15/1/1/1/0050 | 10.1919 | 13.2592 |
| Muda Primary Healthcare Centre | Mugulbu | 85461718 | 02/15/1/1/1/0026 | 10.1946 | 13.2388 |
| Mugulbu Primary Healthcare Centre | Mugulbu | 35967543 | 02/15/1/1/1/0028 | 10.2000 | 13.2234 |
| Yadafa Health Clinic | Mugulbu | 36488570 | 02/15/1/1/1/0038 | 10.2118 | 13.1905 |
| Al-heri Clinic | Nasarawo | 27373949 | 02/15/1/1/2/0051 | 10.2630 | 13.2632 |
| Al-umma Nursing Home | Nasarawo | 68383162 | 02/15/1/1/2/0054 | 10.2626 | 13.2737 |
| Mubi General Hospital | Nasarawo | 39963337 | 02/15/1/2/1/0001 | 10.2636 | 13.2700 |
| Nakowa Clinic | Nasarawo | 14133391 | 02/15/1/1/2/0055 | 10.2614 | 13.2753 |
| Nassarawo Primary Healthcare Centre | Nasarawo | 33732623 | 02/15/1/1/1/0030 | 10.2477 | 13.2824 |
| WuroBulude Health Clinic | Nasarawo | 69238097 | 02/15/1/1/1/0036 | 10.2612 | 13.2697 |

*Source: Adamawa State Primary Health Care Development Agency, 2020.*

**RECOMMENDATION**

Based on the result obtained from the research, the following recommendations are made:
There is need to support community participation, collaboration and integration in the malaria control programs in all stages and decentralization of malaria control operations.

It would be imperative to continuously educate the people on good environmental management, the need for proper sanitation and the importance of using the conventional method for control of malaria fever. Government should set sanction against dumping of refuse in an unauthorized area especially the water bodies which served as mosquito breeding ground. Land fillings should be practices in order to avoid stagnant water in the environment.

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