# 10th International Symposium & Exhibition on Geoinformation 2011 (ISG 2011) and ISPRS 2011

"Seamless Innovative Geospatial Solutions"

## Programme & Abstract

**27-29 September 2011,**
**Shah Alam Convention Centre, Selangor, Malaysia**

Organized by:

UNIVERSITI TEKNOLOGI MARA

International Symposium & Exhibition on ISG Geoinformation

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10th International Symposium & Exhibition on Geoinformation (ISG 2011) & ISPRS Commission II/5 & II/7 Conference

# ISG & ISPRS 2011

**"Seamless Innovative Geospatial Solutions"**

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Universiti Teknologi MARA (UiTM)

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## EDDY ACTIVITIES IN THE SOUTH CHINA SEA DURING MONSOON SEASON DERIVED BY MULTI-MISSION SATELLITE ALTIMETRY DATA

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Generation of eddy field in the South China Sea (SCS) can be studied globally and continuous manner using satellite altimetry data. This study concern with the eddy activities during monsoon season by using seasonally averaged sea level anomaly in the periods of eight years (year 2000-year 2008) from multi-mission satellite altimetry; TOPEX, ERS-2, JASON-1 and ENVISAT. Eddy patterns are mapped into four seasons; Southwest Monsoon being from June to September, first inter-monsoon on October, Northeast Monsoon from November to March, and second inter-monsoon on April. The sea level anomaly data have been derived and processed using Radar Altimeter Database System (RADS). Standard data retrieval and reduction such as electromagnetic bias, ionosperic, dry and wet tropospheric, solid earth tide and loading tide correction were made by applying specific models provided in RADS. Cross track analysis and crossover adjustment were performed in altimeter data processing. This study also intends to investigate the correlation between sea surface temperature and wind stress on eddy activities and the data were derived from Moderate Resolution Imaging Spectroradiometer (MODIS) and Quick Scatterometer (QuickSCAT) mission respectively. It clearly can be found that the wind stress and sea surface temperature play an important role in the generation of the eddy at South China Sea.

**Keywords:** *Eddy field, South China Sea, Altimetry Data, RADS, QuickSCAT, MODIS*

## AN ANALYSIS OF THE VARIATION OF OCCURRENCE OF MENINGOCOCCAL MENINGITIS IN KADUNA STATE OF NIGERIA

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The aim of this study is to describe the variation of the occurrence of meningococcal meningitis within the different months of the year for each of the twenty three local government of Kaduna state of Nigeria, and for a five year period. All the recorded cases of the occurrence of the meningococcal meningitis for the five year period was collected from the Health departments of each of the local government and also from the Kaduna state epidemiology unit. Descriptive statistics was used to show the variations of the occurrence on a bar chart and coefficient of variation was also determined. The results show that the occurrence was more in the early part of the year (January to May), the peak period is between March and April. The coefficient of variation shows that except in a few of the LGAs including Zaria (28.04%), Kudan (30%), Soba (36.49%), Kaduna North (39.52%), Makarfi (43.6%), high variability of well over 50% are recorded in the local government areas. The occurrence of Meningococcal meningitis is much more severe in first five months of the year. Except for few local governments, there is a lot of variation in the occurrence of the disease.

**Keywords:** *Meningococcal Meningitis, Local Government*

# VARIATION OF THE OCCURRENCE OF MENINGOCOCCAL MENINGITIS IN KADUNA STATE BETWEEN THE PERIOD OF 1999 TO 2003

By

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## Abstract

Meningococcal meningitis disease is a contagious disease caused by the meningococcus (Neisseria meningitides), a gram-negative bacterium. Meningitis epidemics can occur in any part of the world, but the largest occur mainly in the semi-arid areas of sub-saharan Africa, known as the African Meningitis belt. The aim of this study is to describe the variation of the occurrence of meningococcal meningitis within the different months of the year for each of the twenty three local government of Kaduna state of Nigeria, and for a five year period. All the recorded cases of the occurrence of the meningococcal meningitis for the five year period was collected from the Health departments of each of the local government and also from the Kaduna state epidemiology unit. Descriptive statistics was used to show the variations of the occurrence on a bar chart and coefficient of variation was also determined. The results show that the occurrence was more in the early part of the year (January to May), the peak period is between March and April. The coefficient of variation shows that except in a few of the LGAs including Zaria (28.04%), Kudan (30%), Soba (36.49%), Kaduna North (39.52%), Makarfi (43.6%), high variability of well over 50% are recorded in the local government areas. The occurrence of Meningococcal meningitis is much more severe in first five months of the year. Except for few local governments, there is a lot of variation in the occurrence of the disease.

**Meningococcal meningitis**

Meningococcal meningitis is an infection of the meninges, which is the membrane that covers the brain and spinal cord like a sheath (Variane et.al, 1997). It can be caused by a variety of germs, both viral and bacterial. The most dangerous form however, is caused by the bacterium *Neisseria meningitides*, commonly called the meningococcal meningitis. This bacterium is significant because it is highly virulent for the individuals it affects and because unlike most other causes of meningitis, it has the potential to cause epidemics (Medecine Sans Frontieres, 2002).

Meningococcal meningitis occurs in two distinct patterns, endemic and epidemic, (Fermon and Variane 2000). In most countries of the world there is a sporadic case from time to time, which means that the meningococcal germ is endemic there at low levels. However there is an area that spans sub-Saharan Africa called the meningitis belt where large epidemics occur regularly, affecting many thousands of people (Medecine Sans Frontieres, 2002). The so-called meningitis belt of tropical Africa lies between 5 and 15 north of the equator and characterized by

annual rainfall between 300 and 1100mm (Lucas and Gilles, 1984). The meningitis belt is a flat area with little or no natural barrier such as large barriers such as large rivers or mountain to stop movements of people or the disease (Peltola, 1983). Fig1 shows the map of the West Africa meningitis belt.

**Statement of the Problem**

Kaduna state falls within Africa's meningitis belt. In spite of the nearly annual occurrences of this disease, governments do not seem to be winning the battle posed by epidemic. Most often, outbreaks take governments unaware despite the fact the period in which the disease is frequent is very well known. Little or no effort is made to check the spread until there is an outbreak. It is only during epidemics that hurried interventions such as providing vaccines to areas that are under the attack are made. Thus, actions are usually taken when it is already too late and many lives have been lost. Part of the problem is that the spread pattern of the disease is poorly understood.

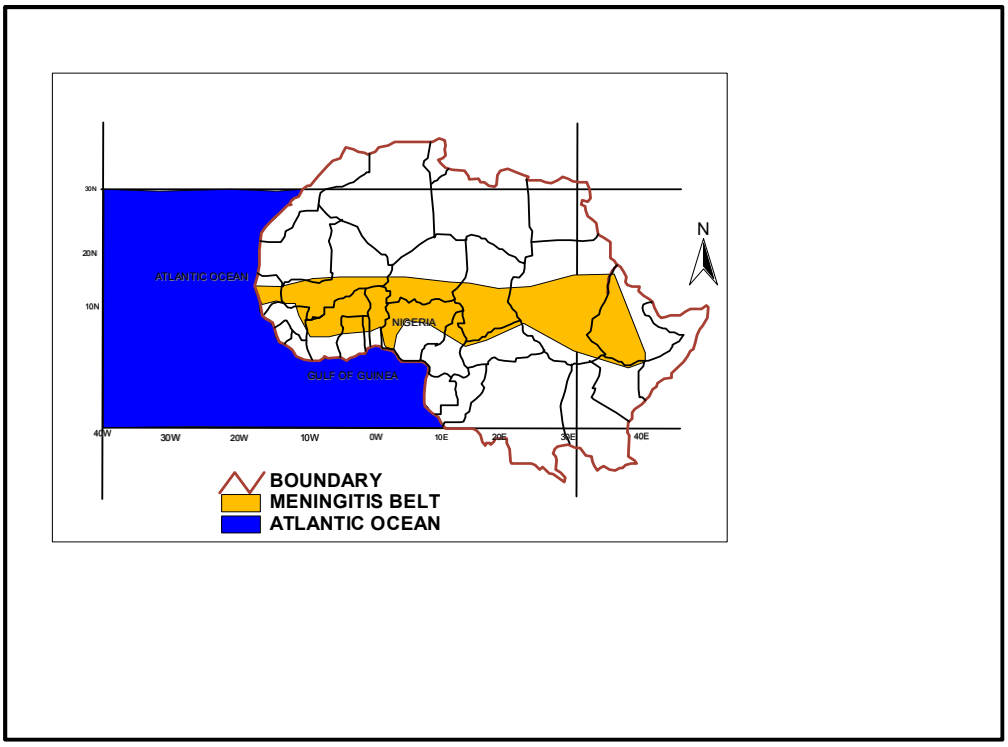
Variations in weather elements like temperature, humidity, and rainfall have effect on the occurrence and severity of the epidemics. For example, a study carried out by Moles (2003) shows that high temperatures and low humidity influence the spread of meningitis. It appears also that socio- economic factors affect the occurrence and intensity of the outbreaks. People in the middle and upper strata of the society, are rarely affected by the disease.

In order to be able to maintain firm control over the disease, there is need to have a clearer understanding of the dynamics of the outbreak of the disease in terms of the trends and spread pattern.

Methodology

Secondary type of data sets was used in this study:

i. Meningococcal meningitis occurrence data from 1999-2003 from each of the twenty-three Local government, Health Departments and the Epidemiology unit of the Ministry of Health Kaduna. The data collected was based on the population of the local governments.
ii. Population figures for the twenty three local government of Kaduna state, it was obtained from the National Population Commission Abuja.
iii.




Source: UCAR, (2009)

Fig 1: Map of West Africa Showing the Meningitis Belt

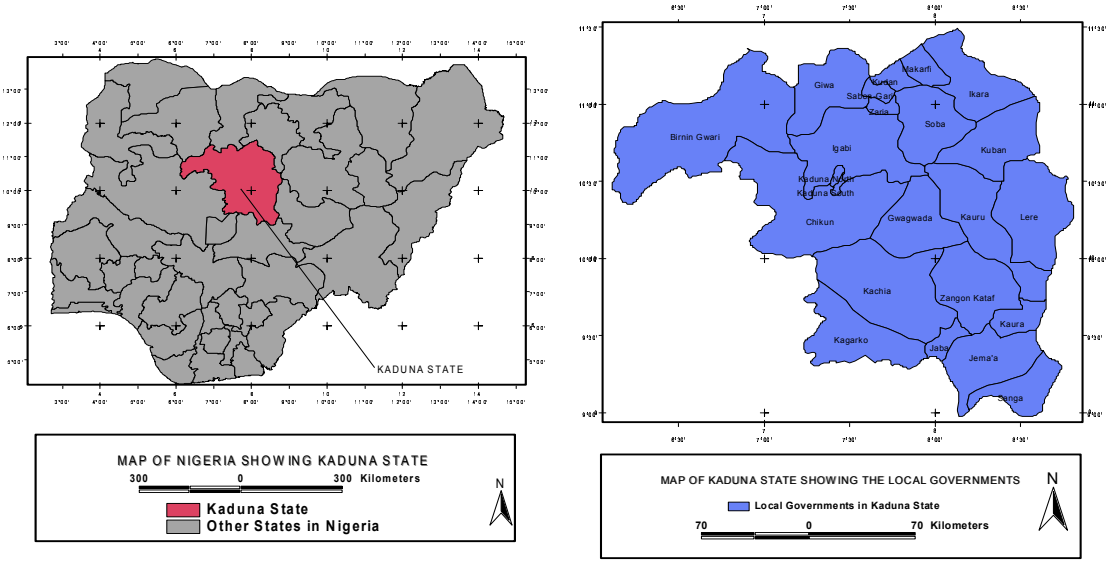



Fig 2: Source: Ministry of Surveys, Abuja (2010)
Map of Nigeria showing Kaduna State

**Data Analysis.**

The descriptive statistics were applied using Microsoft Excel and Statistical Package for the Social Sciences (SPSS) so as to calculate the means, standard deviation and the coefficient of variation for the data set. The Meningococcal meningitis data was further explored using the trend analysis in order to evaluate the dominant trend in the occurrence of the disease

Charts were used to describe the level and trend of the occurrences of Meningococcal meningitis occurrence for each of the months January to June, 1999 to 2003. There is no occurrence of the disease from the month of July to December that is why there is a sharp decline in the month of June till the January of another year.

## Results

**Variability of Occurrences of Meningitis in the Local Government Areas**

Table 1. Shows the summary statistics including percent coefficient of variation of occurrences of Meningococcal meningitis in the State. The percent coefficient of variation is important in evaluating consistency in the pattern of occurrence of outbreaks from year to year. Coefficients of variation give indications of how much variations exist within the five-year period in each LGA in terms of the reported incidences of meningitis.

Except in a few of the LGAs including Zaria (28.04%), Kudan (30%), Soba (36.49%), Kaduna North (39.52%), Makarfi (43.6%), high variability of well over 50% are recorded in the local government areas. The variability is more than 100% in more than a third of the LGAs. These large values of coefficients imply that in general, large differences exist from one year to the other in the reported cases of *M. meningitis*. From the point of view of management, past sufficient resources must be provided for fighting the epidemics as incidences can be high in any year.

**Table 1 Summary Statistics on the occurrences of Meningitis in Kaduna State for the five years**

| Local Government Area | Mean | Standard Deviation | % Coefficient of Variation |
|---|---|---|---|
| LERE | 4.2 | 4.76 | 113.44 |
| ZARIA | 14.4 | 4.04 | 28.04 |
| ZANGO KATA | 5 | 6.93 | 138.56 |
| BIRNIN GWARI | 3.6 | 5.13 | 142.45 |
| SANGA | 1 | 2.24 | 223.61 |
| SABON GARI | 18 | 9.19 | 51.07 |
| GIWA | 13 | 7.38 | 56.79 |
| KAJURU | 3.2 | 4.87 | 152.13 |
| IGABI | 8.6 | 8.14 | 94.68 |
| IKARA | 5 | 7.07 | 141.42 |
| JABA | 5.2 | 5.17 | 99.37 |

| | | | |
|---|---|---|---|
| **KADUNA NORTH** | 11.4 | 4.51 | 39.52 |
| **KACHIA** | 1.4 | 3.13 | 223.61 |
| **SOBA** | 11.2 | 4.09 | 36.49 |
| **CHIKUN** | 2.4 | 3.36 | 140.06 |
| **MAKARFI** | 22 | 9.59 | 43.6 |
| **KADUNA SOUTH** | 6 | 4.18 | 69.72 |
| **JEMA'A** | 6.4 | 6.35 | 99.19 |
| **KUDAN** | 19.4 | 5.94 | 30.63 |
| **KAURU** | 3.6 | 5.13 | 142.45 |
| **KAGARKO** | 4.8 | 4.76 | 99.26 |
| **KAURA** | 7.2 | 7.66 | 106.41 |

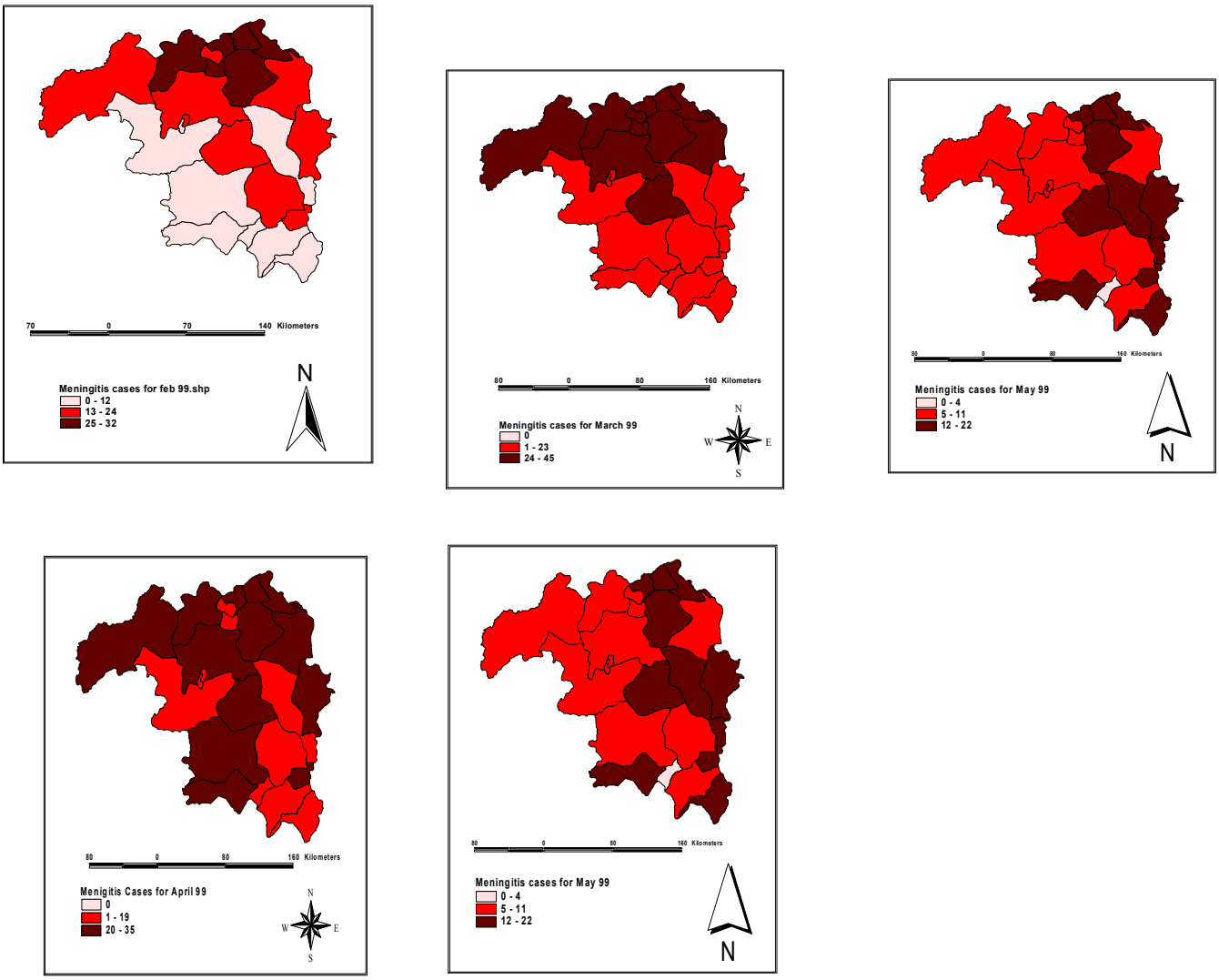



**Fig. 3** Spatial Pattern of meningitis Occurrence in Kaduna state from January1999 to May 1999

**Spatial pattern of *M. meningitis* occurrence in 1999**

The maps in figure 3 Shows the spatial pattern and intensity of the occurrences of meningitis from the months of January through May 1999 in Kaduna state. The maps were generated from the database of GIS. In the month of January, only five LGAs – Makarfi, Kudan, Zaria, and Kaura have high occurrences of the disease which has the thickest red colour. The remaining LGAs recorded generally low occurrences. In the month of March also, LGAs like Birnin Gwari, Giwa, Makarfi, Zaria, Soba, Ikara, Kubau, and Igabi, have high occurrences. The situation is different in April when all LGAs record medium to high incidences of *M. meningitis* outbreaks. The higher occurrences are recorded in northern part of the state which is usually hotter than the southern parts.

**Annual trends in the occurrence of Meningococcal meningitis in Kaduna State by Local Government Areas (1999-2003)**

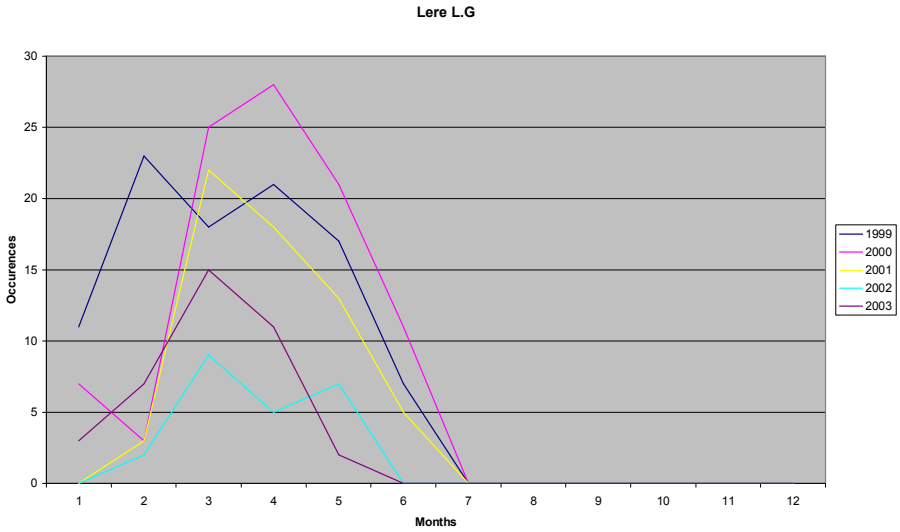



Fig.1. Trend in the occurrence meningococcal meningitis in Lere LGA of Kaduna State, 1999-2003

Figure 1. to Figure 23. Show the annual trends in the occurrence of meningitis for each of the twenty three local government areas (LGAs) in Kaduna state. The trends in the five years depicted by the polygons are differentiated by colours as shown in the key.

Fig. 1: shows the trend in Lere LGA between 1999 to 2003. In general, incidences of meningococcal meningitis in the LGA start from about the month of January peaking most commonly in March. Among those five years the greatest occurrence was recorded in 2000 with the peak coming in April. Occurrences drop sharply from the peak period around March/April, coming to zero in June/July. Thus in the five-year period for which there are data sets, the first half of the year, which is normally the dry part of the year for the state, is the ***meningitis*** season**.** This agrees with what is the literature with respect to the timing of occurrence meningitis epidemics.

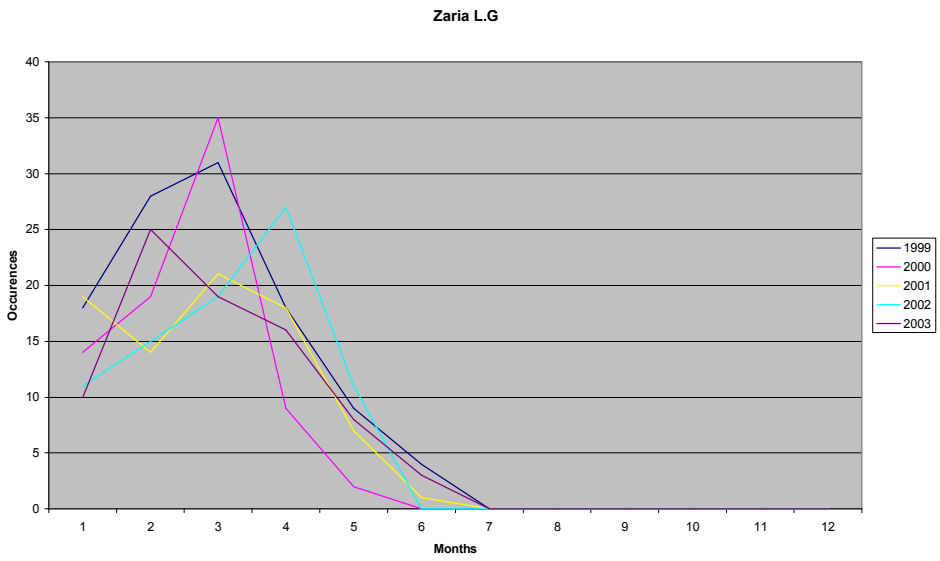



Fig. 2 Trends in the occurrence of meningitis in Zaria LGA between 1999 to 2003.

The trend for Zaria LGA is shown in Figure 4.1.2. Like in Lere LGA, the peak of occurrence is commonly in March. However, in 1999, the peak was in February and in 2002 it was in April. As in Lere LGA, occurrence drop to zero between in June/July.


Fig. 3 Trends in the occurrence of meningitis in Zangon Kataf LGA between 1999 to 2003.

**Pattern of meningitis occurrence in the other local governments between 1999 to 2003.**

The annual trends in most of the other LGAs (Figure 4.1.3 to 4.1.23 are generally similar to the ones described for Lere, Zaria and Zangon Kataf local government. Onset of the meningitis season is commonly February with a peak around March/April and a drop to zero in |June/July. Some LGAs however have patterns that deviate somewhat significantly from the general pattern. For example, in Kajuru LGA (Figure 4.1.8), the peak periods came up in four different months during the five-year period. This may suggest that it can be difficult to define with certainty the

month of the year when the occurrence may reach its peak although it is fairly established that peaks are reached between February and May.

In Kaduna North and Kaduna South LGAs (Figure 4.1.11 and Figure 4.1.17), there are occurrences of meningitis virtually throughout the year in two of the five years although the peak periods still fall around March/April. This is also a significant trend because it suggests that outbreaks of meningitis could occur in any part of the year although occurrence is minimal in the second half of the year i.e. July to December. In Soba (Figure 4.1.14), Chikun (Figure 4.1.14) and Makarfi (Figure 4.1.15), there are occurrences between October and December after a break between July and October. This again points to the possibility of having outbreaks during any month of the year. The isolation of the peak period of the rainy season in these local government areas is also significant. It underscores the fact that outbreaks are extremely unlikely during the period of heavy rains.

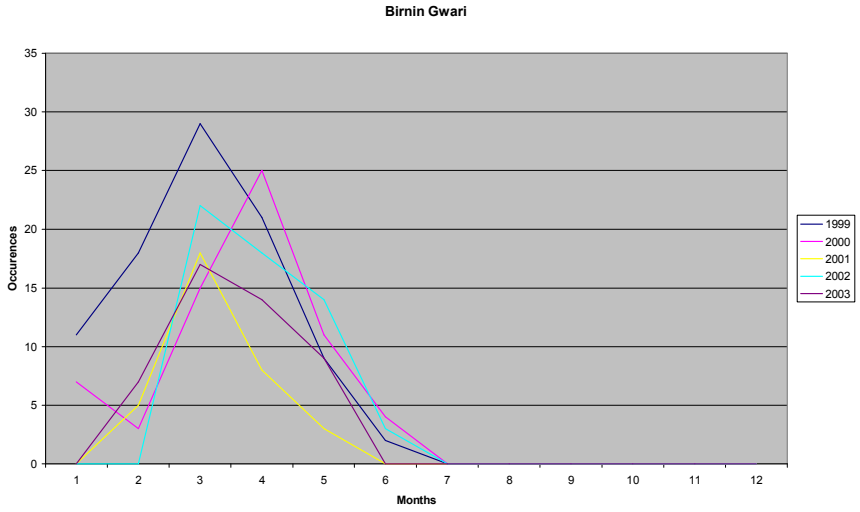



Fig. 4 Annual trends in the occurrence of meningitis in Birnin Gwari LGA (1999 to 2003).


Fig. 5 Annual trends in the occurrence of meningitis in Sanga LGA (1999 to 2003).

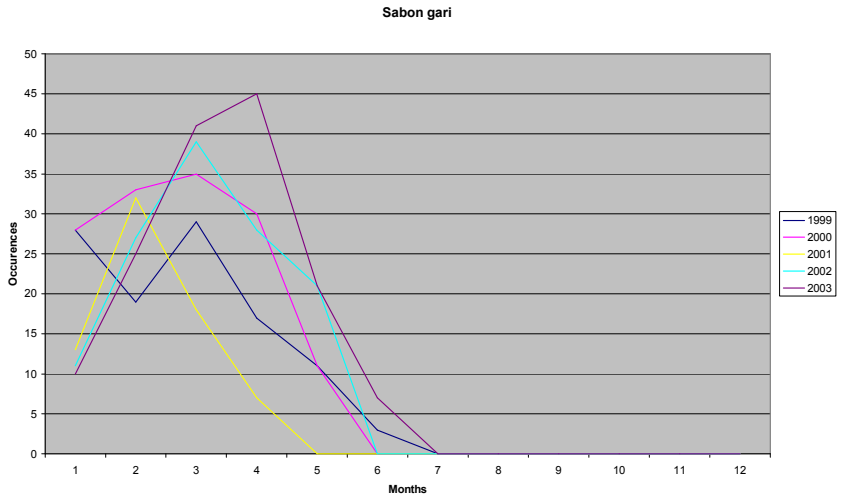



Fig. 6 Annual trends in the occurrence of meningitis in Sabon Gari LGA (1999 to 2003).

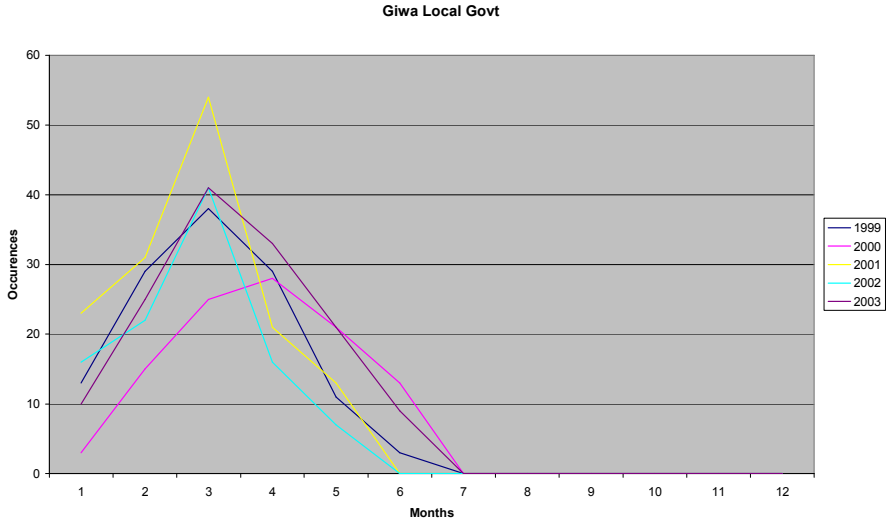



Fig. 7 Annual trends in the occurrence of meningitis in Giwa LGA (1999 to 2003).

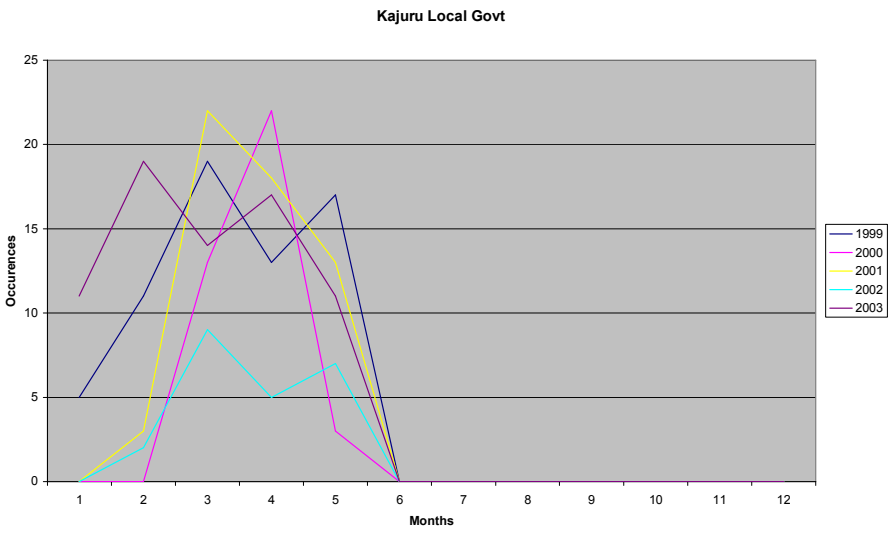



Fig. 8 Annual trends in the occurrence of meningitis in Kajuru LGA (1999 to 2003).

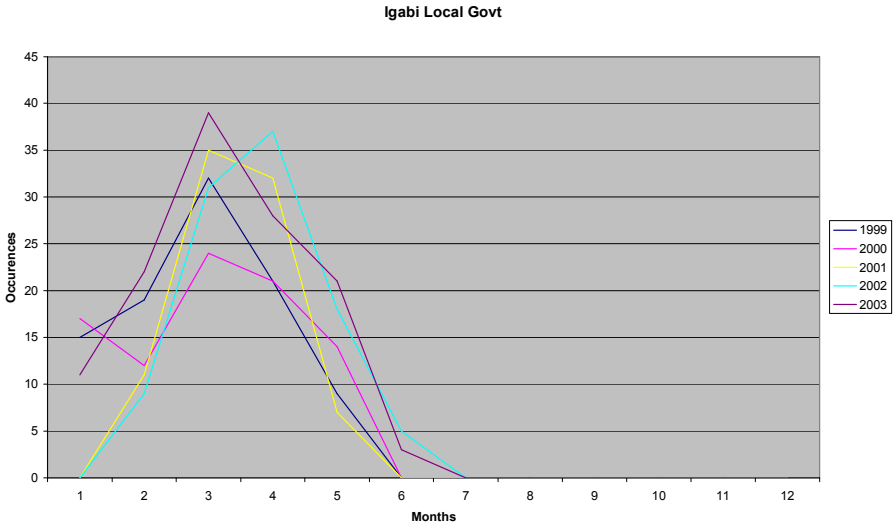



Fig. 9 Annual trends in the occurrence of meningitis in Igabi LGA (1999 to 2003).

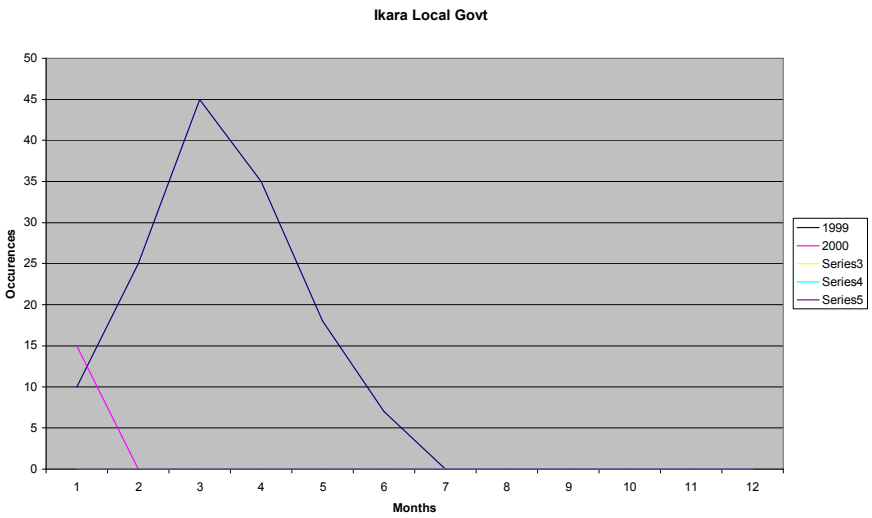



Fig. 10 Annual trends in the occurrence of meningitis in Ikara LGA (1999 to 2003).

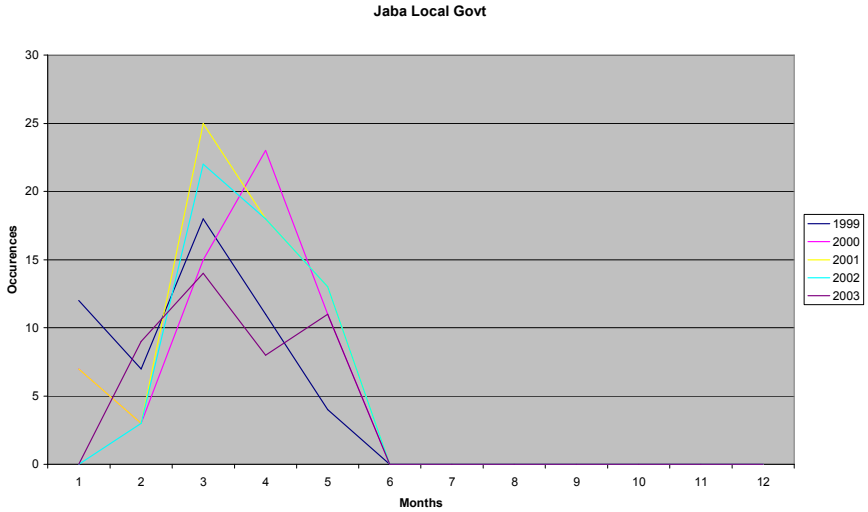



Fig. 11 Annual trends in the occurrence of meningitis in Jaba LGA (1999 to 2003).

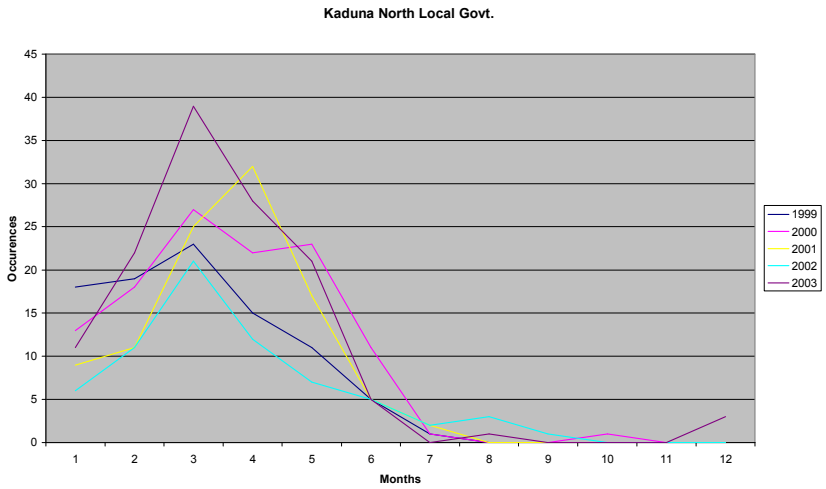



Fig. 12 Annual trends in the occurrence of meningitis in Kaduna North LGA (1999 to 2003).

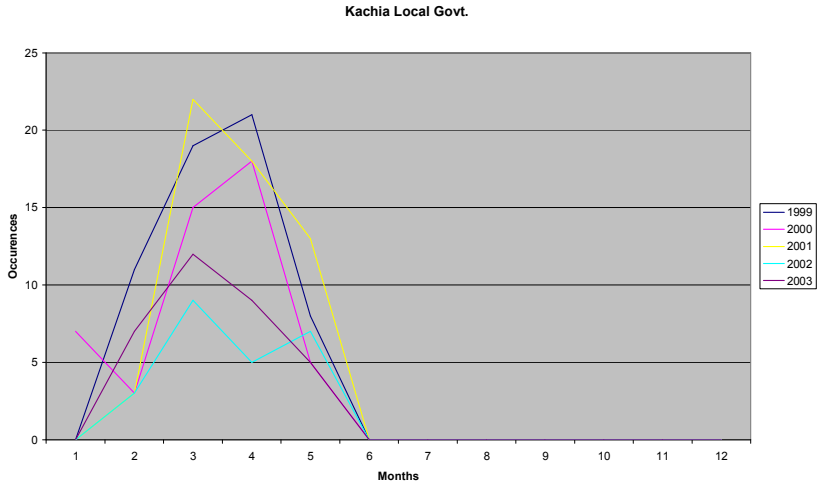



Fig. 13 Annual trends in the occurrence of meningitis in Kachia LGA (1999 to 2003).

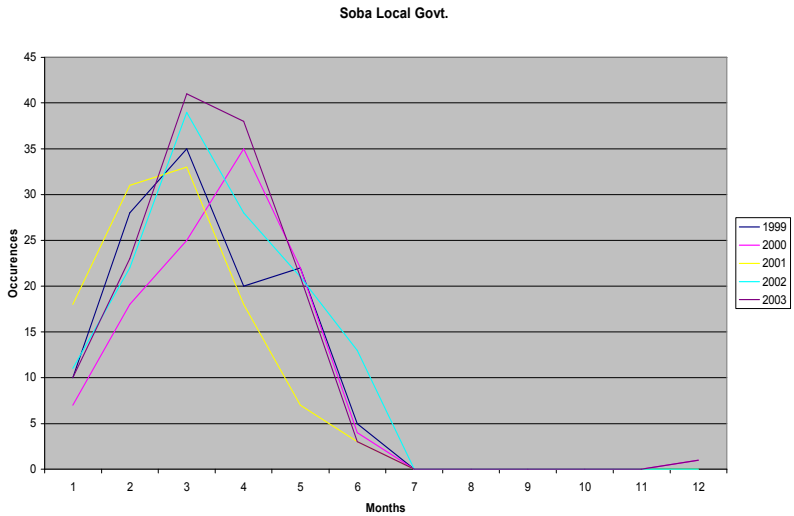



Fig. 14 Annual trends in the occurrence of meningitis in Soba LGA (1999 to 2003).


Fig. 15 Annual trends in the occurrence of meningitis in Chukun LGA (1999 to 2003).

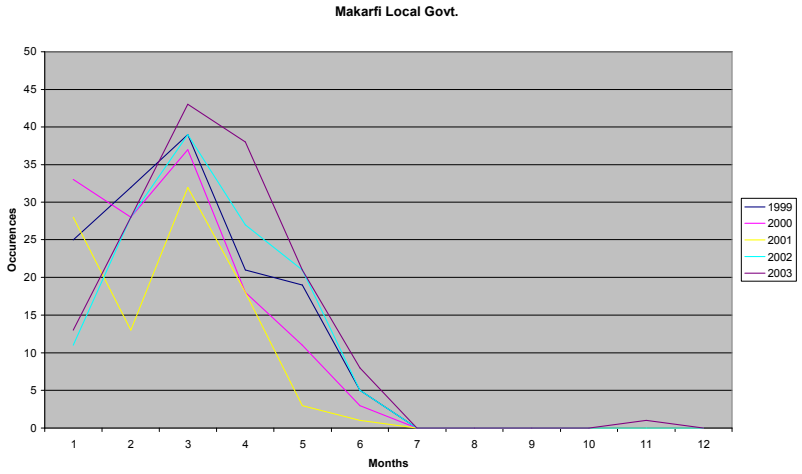



Fig. 16 Annual trends in the occurrence of meningitis in Makarfi LGA (1999 to 2003).

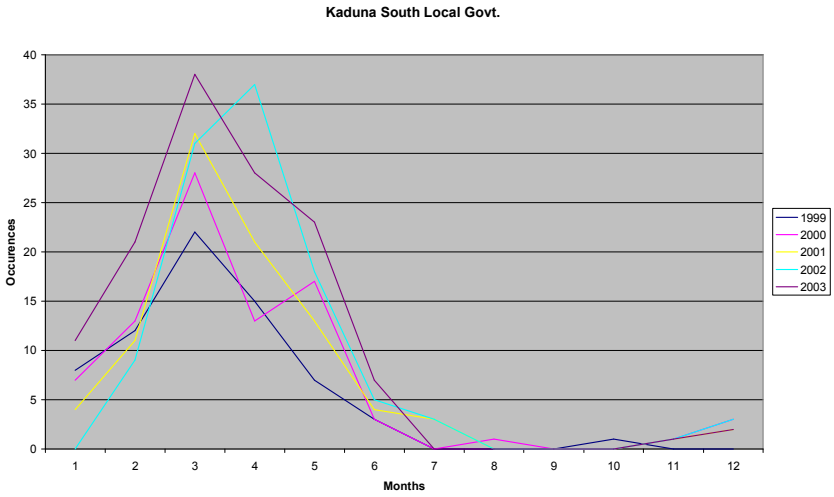



Fig. 17 Annual trends in the occurrence of meningitis in Kaduna South LGA (1999 to 2003).

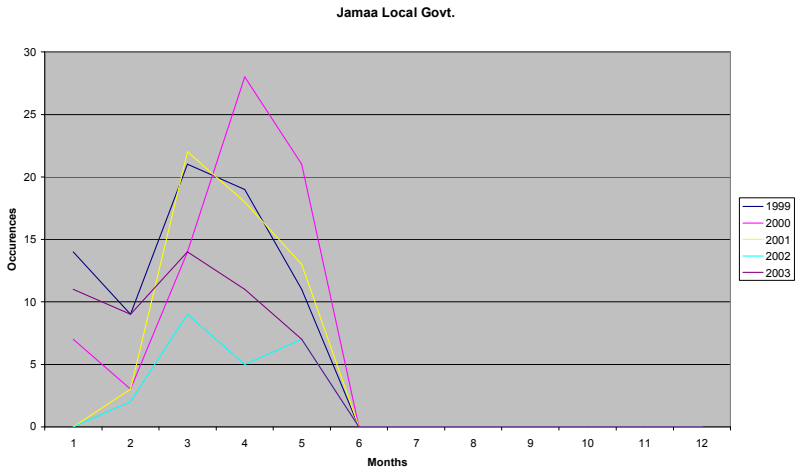



Fig. 18 Annual trends in the occurrence of meningitis in Jama'a LGA (1999 to 2003).

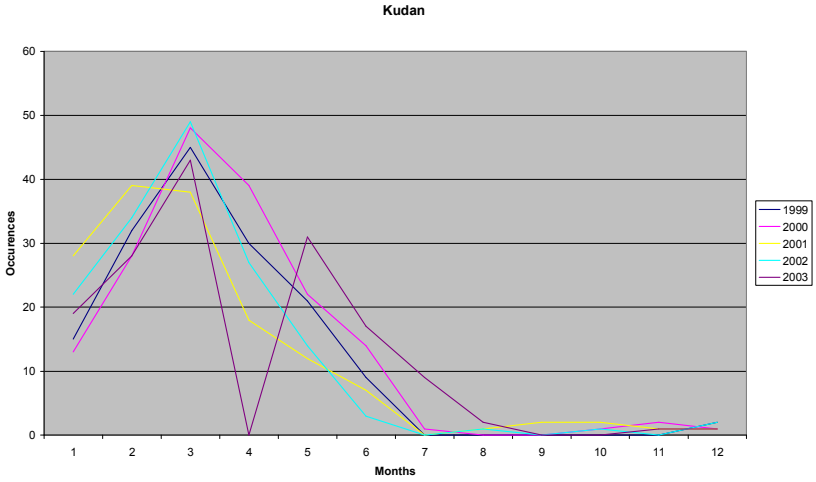



Fig. 19 Annual trends in the occurrence of meningitis in Kudan LGA (1999 to 2003).

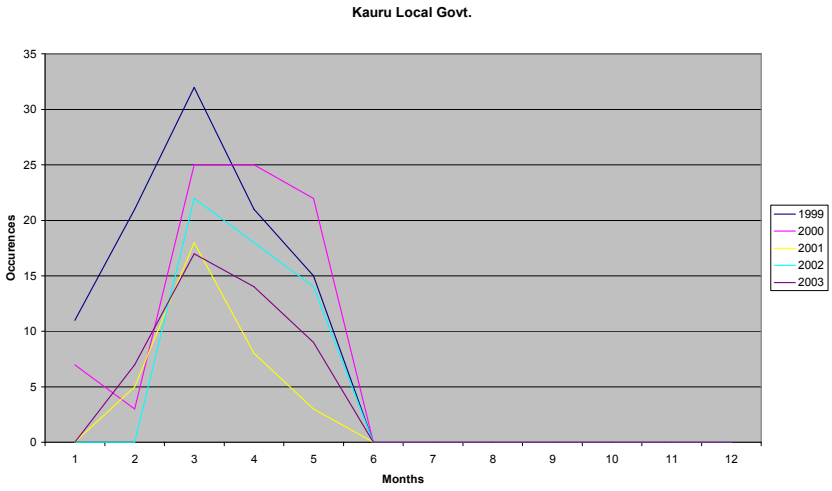



Fig. 20 Annual trends in the occurrence of meningitis in Kauru LGA (1999 to 2003).

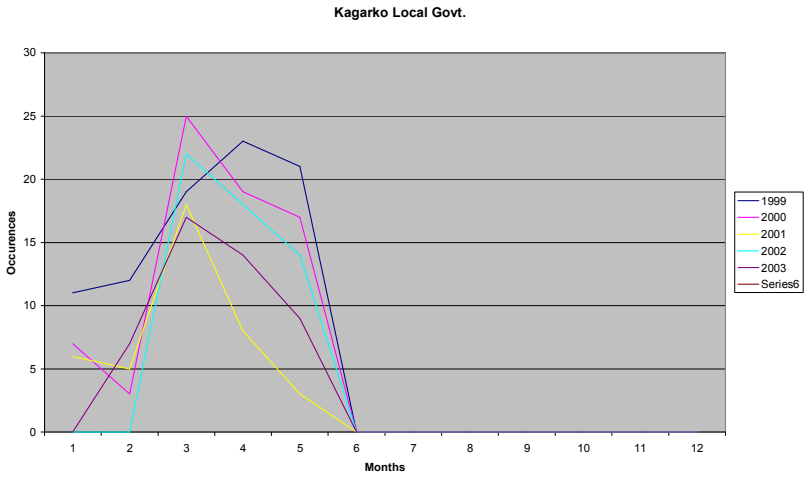



Fig.21 Annual trends in the occurrence of meningitis in Kagarko LGA (1999 to 2003).


Fig. 22 Annual trends in the occurrence of meningitis in Kaura LGA (1999 to 2003).

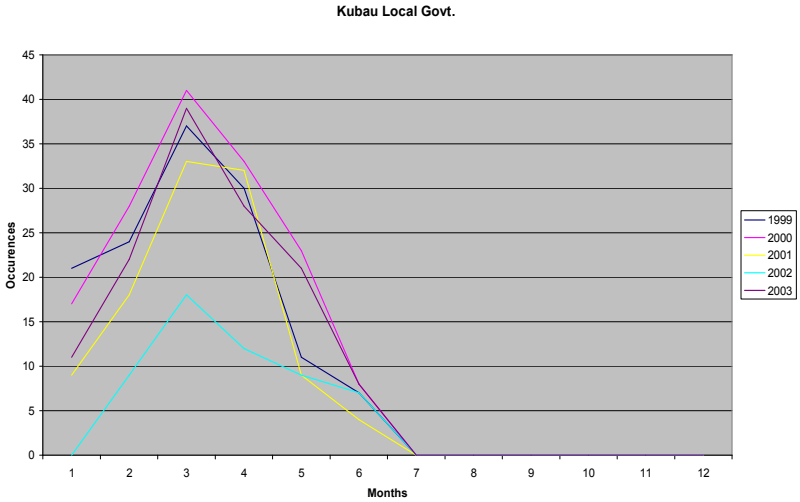



Fig. 23 Annual trends in the occurrence of meningitis in Kubau LGA (1999 to 2003).

## Conclusion

The results of the analysis show that the occurrences of the disease was more severe in Local Government Areas such as Zaria, Giwa, Sabon gari, Ikara, Kubau, Kaduna north and Makarfi, Kaduna south, Soba, and Kudan which are located to the northern part of the state. The intensities of occurrences also vary with the months of the year. The months of February, March and April are shown to have higher occurrences of the disease across the state. In some years there are high occurrences of Meningococcal meningitis in some of the LGAs in the southern part of the State. However, the severity are generally not as high as those but not as frequent as that of LGAs listed above, that is why there is a very high variation of occurrence within these years of the study in the LGAs located at Southern part of the State.

This study has confirmed the significance of statistical analytic tools in epidemiology (Umaru, 2006). Apart from allowing the experts and decision makers appreciate the trend patterns of the diseases; they also enable them to query the database for various scenarios. Government, in particular, need to invest resources in the development of capabilities in order to effectively manage outbreaks of diseases.

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