EFFECT OF WEATHER ON THE OCCURRENCE OF SOME COMMON DISEASES IN ZARIA.

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JUNE, 2011.

DECLARATION

I declare that the work in the thesis entitled: "Effect of weather on the occurrence of some common diseases in Zaria" has been performed by me in the Department of Geography under the supervision of Dr. O.F Ati and Prof. E.O Iguisi. The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this thesis report was previously presented for another degree or diploma at any university.

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CERTIFICATION

This thesis entitled EFFECT OF WEATHER ON THE OCCURRENCE OF SOME COMMON DISEASES IN ZARIA by Osadare Ruth Oluwatoyin meets the regulations governing the award of the degree of M.Sc Geography of Ahmadu Bello University, and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This research work is dedicated to the Almighty God, who rules in the affairs of men. What he says come to pass and whatsoever he does is forever. To Him alone is all the glory. And to my father Major P.A. Oludare for his kind support.

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ABSTRACT

Medical and Meteorological data for ten years were used to study the effect of weather on the occurrence of some common diseases such as malaria, typhoid, meningitis, measles, pneumonia, diarrhea and asthma in Zaria. The results show that malaria is the most rampant having the highest number of occurrence in all the hospitals. Typhoid occurred throughout the year but higher during the rainy season in some hospitals. Measles and meningitis were more common during the hot periods. Asthma, pneumonia and diarrhea did not show seasonal pattern of occurrence. Analysis show that the diseases have significant relationship with some of the meteorological elements but these correlations vary in strength. Malaria, typhoid, measles, asthma and diarrhea had a very strong correlation with relative humidity. Meningitis and asthma had strong correlation with temperature. While only asthma had a strong correlation with rainfall. With this it was easier to identify the weather element that influences the frequency of occurrence of a particular disease more than the others.

CHAPTER ONE: INTRODUCTION

1.1 BACKGROUND TO THE STUDY

In spite of the achievements of the medical sciences through modern technology, the health of the human population is still influenced to a great extent by weather and climate (Akinbobola and Omotosho, 2004). Weather and health are two vital elements of nature that affect daily living (Whitney, 2009). Climate affects health in a number of ways. These effects may be direct as with heat stress, or indirect, as with infectious diseases such as malaria and meningitis (CHRR, 2008; Griffiths, 1976).

Climate change, which refers to any significant change in the measures of climate, such as temperature, precipitation, wind and other weather patterns that last for a decade or longer, is a significant and emerging threat to public health. Many important diseases are highly sensitive to changing temperatures and precipitation. These include common vector – borne diseases such as malaria and dengue fever as well as other major killers such as malnutrition and diarrhea (WHO, 2007).

Hippocrates (350BC), cited by Campbell-Ledrum and Corvalan (2008), says that, "*Whoever wishes to investigate medicine properly, should proceed thus: in the first place to consider the seasons of the year,*

and what effects each of them produces for they are not at all alike, but differ much from themselves in regard to their changes. Then the winds, the hot and the cold, especially such as are common to all countries and then such as are peculiar to each locality. In the same manner, when one comes into a city to which he is a stranger, he ought to consider its situation, how it lies as to the winds and the rising of the sun; for its influence is not the same whether it lies to the north or the south, to the rising or to the setting sun". This he said to describe the extent of the relationship between human health and the weather of a particular environment.

It is now widely recognized that there are four major health determinants namely; human biology, environment, lifestyle and medical care. Human biology for example greatly influences susceptibility to illness. It includes gender, age, and those variables which are genetically inherited. The environment within which an individual can exert slightly more influence, particularly through his/her mobility includes numerous aspects of the physical milieu, such as altitude, climate, chemical composition of the soil and quality of drinking water. The social environment or life style, for example includes population density, housing design and construction, and agriculture and industrial processes and

pollutants. Biological components like viruses, bacteria, pollen and fungal spores greatly influence human health also. Indeed, the incidence of disease varies geographically at scales from international to local. Clearly, geographers can make a major contribution to reducing suffering and increasing longevity if they are able to establish causal links between specific diseases and the environment (Foster, 1992).

All populations will be affected by a changing climate and weather, but the initial health risks vary greatly, depending on where and how people live. The major diseases that are most sensitive to weather are more serious with people living in poverty (WHO, 2008). The importance of determining the role of weather on human health and well-being cannot be overemphasized. It has been demonstrated to be associated with changes in birth rates, sperm counts, outbreaks of pneumonia, influenza and bronchitis (Kalkstein and Valimont, 2008).

The close relationship between climate, environment and infectious diseases in the developing world is well established. For example, the importance of rainfall and drought in the occurrence of malaria, the influence of the dry season on epidemic meningococcal disease in the sub-saharan African "meningitis belt" and the importance of warm ocean

waters in driving cholera occurrence in the Ganges River Delta and elsewhere in Asia are well described (Greer *et al.*, 2008).

The Director General of the World Health Organization (WHO) gave this report on World Health Day (WHD. 2008) that human beings are being exposed continually to the effects of climate sensitive diseases which kills in millions. She said that malnutrition causes over 3.5 million deaths per years, diarrhea kills over 1.8 million and malaria kills almost 1 million per year.

Scott-Evans (2007), for example, noted that some people have symptoms that worsen with cold weather while others suffer more in hot weather. He observed that people with imbalances that reflect environmental energies such as heat, cold or dampness often have symptoms that worsen when the weather is similar to their internal imbalance. The average body temperature of man is made up of both his surface temperature and his rectal temperature which is the temperature at which the human body functions most efficiently. When the average body temperature is too low (internal cold) or too high (internal heat) then, there is an internal imbalance. Those with internal heat have symptoms that worsen in hot weather and feel better in cold weather, while those with

internal cold will have symptoms that worsen in cold weather and feel better in hot weather.

Banzer (2009) insist that the effect of changes in the weather on our health is undeniable. She justified this fact by describing how weather affects the mood and activities of man like being depressed and weak on a cloudy day, and being very active on a sunny day. She also said that a rheumatoid arthritis patient will have more pains during rainy days because of the effect of atmospheric pressure on their health.

Kallkstein and Valimont (2008), also trace the larger increases of mortality to hot weather extremes which brought about several illnesses. He said humidity leads to excessive dehydration of nasal passages and the upper respiratory tract during winter and increases the chances of microbial and viral infections.

A study carried out by Climate and Health Resource Room (CHRR, 2008) on climate and malaria in Africa showed that where malaria is not adequately controlled, its distribution and seasonality are closely related to seasonal characteristics of the weather. And when there are cases of anomalies such as rainfall anomalies, malaria which is seasonally endemic becomes epidemic in warm semi arid regions of Africa. They also carried

out a study on climate and meningitis in Africa and the study showed that epidemics of meningitis occur in the sahel region of Africa during the dry season. They typically coincide with period of very low humidity and dusty conditions and disappear with the onset of the rains.

Also, Akinbobola and Omotosho (2004) carried out a research on the relationship between meteorological variables and the occurrence of malaria, measles, chicken pox, meningitis and pneumonia in Ikeja, Akure and Kaduna (Nigeria) and their results showed that there is a relationship between the diseases and the seasons. It shows that malaria and pneumonia are associated with the rainy season while measles, chicken pox and meningitis are common during the hot periods.

Adefolalu (1984) also carried out a research that investigated how temperature relates with respiratory diseases in northern Nigeria and he discovered that the diseases thrives more when the temperature is very low.

It is obvious from these studies that among several factors that could be responsible for the occurrence of common diseases in any environment, the weather of such a place could be a major factor since its

effects could be felt either directly or indirectly. But the extent of its impact can vary from place to place.

1.2 RESEARCH PROBLEM

Researchers have taken various approaches to the study of the relationship between weather and the occurrence of diseases globally. Kaplan (2009) carried out a research that delved into the effects of weather patterns on headache as well as investigating whether or not patients could predict their own sensitivity to weather, and which weather patterns were most significant. Interestingly, of the migraine sufferers affected by weather, it was clear that they were sensitive to a combination of temperature and humidity changes. The study findings demonstrate that there is a relationship between weather and migraine.

Malek (2008) showed that high humidity can aggravate arthritis and a warm wind may bring on a migraine. But he emphasized that the effect of temperature on human health is more compared to the two weather elements he studied (humidity and air pressure). CHRR (2008), also carried out studies on the occurrences of some diseases (malaria and meningitis), in Africa and their results showed that most of the diseases are highly seasonal. Oshaji (2000) studied the effect of weather in the

distribution of some diseases in Zaria and discovered that there is a relationship between temperature extremes and cerebro-spinal meningitis (CSM). His result also showed that CSM was the most common disease among others (malaria, cholera, catarrh and cough) which he studied within the period of his study.

Ogbaji (2006) studied the role of temperature in the distribution of malaria in Zaria. His result showed that there is a positive relationship between temperature extremes and the prevalence of malaria. December to February recorded less cases of malaria while March to May recorded more cases.

Ilemona (1983) carried out a research on the occurrence of pneumonia among children below the age of 5 years in Zaria. He established that the occurrence of this disease widely depends on the variability of weather. The colder months recorded more cases of the disease. Bukhari (2009) studied temperature and rainfall variability and the outbreak of meningitis and measles in Zaria L.G.A. He observed that there is a significant relationship between temperature and the outbreak of CSM. Measles showed a negative relationship with rainfall while CSM has no significant relationship with rainfall.

Based on this backdrop, this study was further focused to consider some of the above diseases and a few others. Diseases like Typhoid, Asthma, Measles, Diarrhea, Malaria, Meningitis and Pneumonia were considered and the effect of rainfall, temperature and relative humidity on the diseases was examined. It will help to know which element triggers off the incidence of a particular disease at a given time. This will clearly bring out some of the diseases that are weather sensitive and it can give information about preventive strategies such as trigger avoidance, vaccinations and primary health care for individuals. Emphasis has been on high temperature influencing the occurrence of malaria and meningitis, and low temperature influencing that of pneumonia in Zaria. Is the trend still the same? Is temperature the only weather element among these three that will trigger off such diseases? Which weather element(s) will trigger off any of these seven diseases?

1.3 AIM AND OBJECTIVES

1.3.1 AIM

The aim of this study is to examine the relationship between rainfall, temperature and relative humidity of Zaria and the occurrence of some common diseases.

1.3.2 OBJECTIVES

1. To characterize the weather induced diseases from the study.
2. To establish the trend of their occurrence using ten years data.
3. To examine the relationship between the diseases and the weather elements chosen for this study

1.4 HYPOTHESES

1. There is no significant relationship between rainfall and the occurrence of diseases in Zaria.
2. There is no significant relationship between temperature and the occurrence of diseases in Zaria.
3. There is no significant relationship between relative humidity and the occurrence of diseases in Zaria
4. There is no significant difference among the various studied hospitals in Zaria on the frequency of occurrence of these diseases.

1.5 SCOPE OF THE STUDY

This study is intended to cover some selected hospitals in the two LGAs of greater Zaria. These are:

- Sabon Gari and
- Zaria L.G.A.

The hospitals are sixteen in number from which six hospitals were selected based on their spatial spread within the study area and the number of years they have existed, since the record must cover a period of 10 years (1999-2008). The selected hospitals are:

1. Hajia Gambo Sawaba General Hospital, Kofar Gayan, Zaria City.(Zaria L.G.A)
2. St. Luke's Anglican Hospital Wusasa (Zaria L.G.A).
3. Afuwa Specialist Hospital Tudun Wada (Zaria L.G.A).
4. Limi Hospital and Maternity, Hanwa (Sabon gari L.G.A).
5. A. B. U. Sickbay Main Campus, Samaru (Sabon gari L.G.A)
6. Mayfair Hospital and Maternity Sabon Gari (Sabon gari L.G.A).

The diseases that were considered are: Malaria, Typhoid, Measles, Meningitis, Asthma, Pneumonia, and Diarrhea because these diseases are among the common diseases in Zaria.

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CHAPTER TWO: LITERATURE REVIEW

2.0. INTRODUCTION

The close relationship between weather, the environment and infectious diseases in the developing world has been established by researchers. There is a profound connection between the natural world (physical environment) and the human economy, there can be no sustained economic development without a healthy natural environment. In turn, human well-being and health depend fundamentally upon the goods and services provided by the natural world and the human economy (McMichael *et al*, 1998).

Hence, these researchers have attempted to explore this important aspect of human life: health and how the weather of a particular region could be a major determinant of the state of health of the people. Some of these effects are positive while others are negative, some are direct and some indirect. These will clearly present the pattern of relation that existed between these two variables.

2.1. DIRECT EFFECTS OF WEATHER ON HEALTH

Beniston (2002) when describing the possible impacts of climate change on human health said that in the coming decades, humankind is

likely to be subjected to the impacts of rapid environmental change triggered, at least in part, as a result of human activities. According to him, while the balance between human and their resource – base has always been delicate, the accelerated changes resulting from industrialization and significant global population increases over the last century have resulted in definite and sometimes irreversible damage and loss of resources. He further stated that there are numerous side effects of environmental change that can impact upon health and well being. They may affect the geographical distribution and extent of propagation of vector-borne diseases as well as the equilibrium between a number of other infectious and non-infectious diseases.

Luber and Prudent (2009) described global temperature increase due to the effect of the urban "built" environment as a major cause of Urban Heat Island (UHI). The UHI can add 2 – 10°F to ambient air temperature. It absorbs heat during the day and radiates it out at night, raising nighttime minimum temperatures, which have been epidemiologically linked to excess mortality (U.S Environmental Protection Agency, 2006).

Heat wave is another major health problem. In 2003, it was estimated to have killed 29,817 to 30,617 people in Europe through heat

stroke, exacerbated cardiovascular and respiratory diseases, (Haines *et al*, 2006). A large portion of these deaths occurred among the elderly and socially isolated. These category of the population are more susceptible to extreme heat. Increased frequency of intense rainfall has also been associated with an increasing severity of floods, landslide, debris, and mudflows. This has already been witnessed in parts of Bangladesh, Nepal, and India. Increases in sea surface temperature have caused an increase in tropical cyclone intensity leading to an increase in the height of storm surges (Luber and Prudent, 2009)

Patz et al (2000) described the direct health impacts of natural disasters as mostly injury and death while secondary health effects may also occur, this may involve changes in ecological systems and public health infrastructures, such as bacterial proliferation and the availability of safe drinking water.

They also discovered that epidemiologic studies found that exposure to particulate matter can aggravate existing respiratory and cardiovascular disease, alter the body's defense systems against foreign materials, damage lung tissue and may cause cancer and premature death. According to their discoveries, health effects of exposures to carbon monoxide, sulfur dioxide, and nitrogen dioxide can include visual

impairment, reduced work capacity, aggravation of existing cardiovascular diseases, effects on breathing, respiratory illness, lung irritation, and alterations in the lung's defense systems.

Human-induced climate change is now compromising the sustainability of human development on the planet, because it threatens the ecological support systems on which human life depends as well as human health and wellbeing, the continuing improvement of which should be the very goal of the development process itself (Martens *et al*, 1997).

2.2 INDIRECT EFFECTS OF WEATHER ON HEALTH

Greer *et al* (2008) discovered that large water-borne disease outbreaks have been linked to extreme precipitation events. Water-borne pathogens include viral, bacterial and protozoan agents of gastroenteritis and pneumonic pathogens such as Legionella species. Many of these pathogens are also important causes of food-borne illness. Most cases of water and food-borne gastroenteritis exhibit a distinct summer time pattern of occurrence. The association between warmer temperatures and diseases suggest that rates of water-borne and food-borne illness are likely to increase with rising temperatures. They also discovered that the incidence of pneumonic infections and melioidosis, is also likely to be

affected by weather (rainy and humid weather). Many respiratory pathogens including influenza, respiratory syncytial virus and streptococcus pneumonia, exhibit winter seasonality that is often attributed to seasonal changes in temperature or population behavior.

Ayoade(1988) investigated the water and health situation on a global basis and discovered that 400million cases of gastro-enteritis occurs yearly, Schistosomiasis 200 million cases every year, Malaria 160 million cases every year and Onchocerciasis 20-40 million cases every year. Some 5 million people are estimated to die every year from such diseases as cholera, typhoid, diarrhea, dysentery, malaria and intestinal worm infection.

The occurrence of vector-borne diseases such as malaria is determined by the abundance of vectors and intermediate and reservoir hosts, the prevalence of disease-causing parasites and pathogens suitably adapted to the vectors, and the human or animal hosts and their resilience in the face of the disease. Local climatic conditions, especially temperature and moisture, are also determinant factors for the establishment and reproduction of the Anopheles mosquito (Beniston, 2002).

In the United States, food borne diseases are estimated to cause 76 million cases of illness, microbiologic agents in water (e.g. viruses, bacteria and protozoa) can contaminate food. Direct weather associations have been documented for water borne disease agent. Also, diseases transmitted between humans by blood-feeding arthropods (e.g. insects, ticks and mites), such as plague, typhus, malaria, yellow fever and dengue fever were once common in the United States and in Europe (Patz *et al*, 2000).

Sutherst (2004), describe the effects of temperature increase as being responsible for faster vector and pathogen development, and that the increased frequency of extreme rainfall event has altered the pattern of breeding that occurs with increased flooding.

2.3 WEATHER ELEMENTS INVOLVED

Ati (2002) describe temperature as the degree of sensible heat or cold within the atmosphere. He described rainfall, as liquid precipitation in the form of drops of diameter greater than 0.5mm while relative humidity, as the ratio of the observed humidity mixing ratio to that which would saturate the air at the same temperature. Thus, the elements involved are rainfall, temperature and relative humidity.

2.3.1 TEMPERATURE

The concept of thermoreception is involved in temperature sensation, thermal comfort and thermoregulation of the body. Thermoreception is a process in which different levels of heat energy (temperature) are detected by living things. Thermal comfort and temperature sensation can be separated psychologically and physiologically. Temperature sensation is directed towards an objective world, while thermal comfort refers to the subjective state of the observer. Temperature sensation is verbalized by either warm or cold while thermal comfort uses the term pleasant or unpleasant (Hensel, 1979).

Gonzalez (1979) describes health as an important criterion in any selection of the environment. He said survival to heat or cold stress often plays a more important role than preference of an optimal comfort zone.

2.3.2 HUMIDITY

Humidity affects thermal comfort indirectly by altering the rate of evaporation of sweat in warm environments. The fraction of the body surface wet with perspiration, necessary to maintain the evaporative cooling for temperature regulation is a measure of the strain indirectly

caused by humidity. In cold environments low humidity may cause discomfort from dehydration of the skin surface and membrane of eye, nose and throat (Gagge, 1979; Kalkstein and Valimont, 2008).

2.3.3 RAINFALL

Apart from the effects of rainfall on temperature and humidity, that is, reduction in the intensity of sensible heat when it rains and increase in humidity, it also affects crop production which could mean malnutrition with little amount of rainfall or abundance of food with adequate rainfall, this also determines the state of well-being of a person. Also, the rain might provide breeding sites for vector-borne diseases. Extreme rainfall events could mean flooding in some cases which leads to injury, destruction of life and properties (Geer *et al*, 2008).

2.4 THE DISEASES INVOVLED

2.4.1 MENINGOCOCCAL MENINGITIS

Meningococcal meningitis or cerebro-spinal meningitis is an acute communicable disease caused by "*N. Meningitidis*". It usually begins with intense headache, vomiting and stiff neck, and progresses to comma within a few hours (Park, 1997). There are two major types of meningitis. Werner (1977) described one type as the viral meningitis. He said it is

characterized by fever, headache, vomiting, hyperesthesia, myalgia and stiffness of the neck. It is a common syndrome caused by diverse infectious agents.

Hoeprich (1977), describe the other as acute Bacterial Meningitis. He reports that it is an inflammary disease of the central nervous system caused by the growth of bacteria in and adjacent to the leptomeninges. The infecting bacteria usually reach the leptomeninges by the bloodstream. Occasionally however, infection extends to the meninges directly from other intracranial foci, or results from traumatic inoculation of extradural bacteria. Its spread may be exceedingly rapid.

2.4.1.1 Mode of Transmission

The disease spreads mainly by droplet infection. The portal of entry is the nasophraynx.

2.4.1.2 Incubation period

Usually 3 to 4 days, but may vary from 2 to 10 days.

2.4.1.3 Environmental Factors

The seasonal variation of the disease is well established, outbreaks occur more frequently in the dry and cold months of the year.

important predisposing factor. The incidence is also greater among groups living under poor housing conditions.

2.4.2 DIARRHEA

Diarrhoea is defined as the passage of loose, liquid or watery stools. These liquid stools are usually passed more than three times a day. However, it is the recent change in consistency and character of stools rather than the number of stools that is more important (Park, 1997).

2.4.2.2 Mode of Transmission

The disease is primarily transmitted by the faecal-oral route. It could be water-borne, food-borne, or direct transmission via the finger or dirt ingested by the children.

2.4.2.3 Environmental Factor

Distinct seasonal patterns of diarrhea occur in many geographical areas. In tropical areas, rotavirus diarrhea occurs throughout the year, increasing in frequency during the drier, cool months, whereas bacterial diarrheas peak during the warmer, rainy season.

2.4.3 TYPHOID FEVER

Typhoid fever is the result of systemic infection mainly by "*S. typhi*" found only in man. The disease is clinically characterized by a typical continuous fever for 3 to 4 weeks, relative bradycardia with involvement of lymphoid tissues and considerable constitutional symptoms. The disease may occur sporadically, epidemically or endemically (Hornick, 1977).

2.4.3.1 Mode of Transmission

Typhoid fever is transmitted via the faecal-oral route or urine-oral routes. This may take place directly through soiled hands contaminated with faeces or urine of cases or carriers, or indirectly by the ingestion of contaminated water, milk or food, or through flies (Kalamullah, 2002).

2.4.3.2 Incubation Period

It is usually 10-14 days, but it may be seen as short as 3 days or as long as three weeks depending upon the dose of the bacilli ingested.

2.4.3.3 Environmental factors

Typhoid fevers are observed all through the year. However, the peak incidence is reported during July – September. This period coincides with the rainy season and an increase in fly population.

2.4.4 PNEUMONIA

Pneumonia is an acute respiratory infection that affects the lower respiratory tract. It implies an acute inflammatory process involving the alveolar walls and spaces of the lung parenchyma. A wide range of bacteria and respiratory viruses are responsible for it. The two common types are the "lobar pneumonia" and "Broncho pneumonia" (Ilemona, 1983).

2.4.4.1 Mode of Transmission

All the causative organisms are normally transmitted by direct contact with the carrier.

2.4.4.2 Environmental factors

Many risk factors have been identified. They include not only the climatic condition but also the housing, level of industrialization and socio-economic development and poor nutrition.

Asthma is a respiratory disease in which spasm and constriction of the bronchial passages and swelling of their mucous lining cause obstruction of breathing. Its symptoms include coughing, wheezing and shortness of breath, and in some cases dry cough may be the only symptom (Encarta Dictionary, 2008).There are two types:

1. The intrinsic asthma: This is non-allergic and may occur due to respiratory infections and emotional up sets.
2. The extrinsic asthma: This occurs often due to allergy like dust, animal feathers, moulds and pollen.

The extrinsic asthma is majorly triggered by allergies such as pollen, smoke, dust, etc. while the intrinsic asthma could be due to some internal imbalances in the body such as in the blood, black bile, yellow bile and phlegm (Medicinenet, 2010).

2.4.6 MEASLES

Measles is a highly contagious, serious disease caused by a virus in the paramyxovirus family. The virus normally grows in cells that line the back of the throat and lungs. Measles is most common in school-age children with outbreaks occurring in winter and spring (Healthscout Network, 2010; WHO, 2009).

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2.4.6.1 Symptoms

The onset is gradual with rhinitis, drowsiness, loss of appetite, gradual elevation of temperature for the first two days. Koplik's spots usually appear on the inner cheek opposite the molars on the second or third day. On the fourth day, rash appears on the face and upper neck, and spread in 3 days to other parts of the body (WHO, 2009).

2.4.6.2 Mode of Transmission

The highly contagious virus is spread by coughing and sneezing, close personal contact or direct contact with infected nasal or throat secretions. The virus remains active and contagious in the air or on infected surfaces for up to two hours. It can be transmitted by an infected person from four days prior to the onset of the rash to four days after the rash erupts (Kidshealth, 2010).

2.4.7 MALARIA

Malaria is one of the most common infectious diseases of man worldwide, causing much morbidity and significant mortality. Four species of plasmodium infect man; "*plasmodium falciparum*", "*plasmodium vivax*", "*plasmodium ovale*" and "*plasmodium malariae*". Of these, "*plasmodium*

falciparum" most often causes serious morbidity and extensive mortality, and it is highly resistant to anti malaria drugs (Miller, 1977).

WHO (2007), in showing pattern of the disease, discovered that in areas where malaria is endemic, the disease usually occurs in a fairly stable and predictable seasonal pattern. While elsewhere, the disease may occur sporadically or at a low level, leaving non-immune populations vulnerable to explosive epidemics of the disease.

2.4.7.1 Mode of Transmission

a. Vector transmission: Malaria is transmitted by the bite of certain species of infected, female, anopheline mosquitoes. A single infected vector, during her life time, may infect several persons. The mosquito is not infective unless the sporozoites are present in its salivary glands.

b. Direct transmission: Malaria may be induced accidentally by hypodermic intramuscular and intravenous injections of blood or plasma. Blood transfusion poses a problem because the parasites keep their infective activity during at least 14 days in blood bottles stored at 4°C.

c. Congenital Transmission: congenital infection of the newborn from an infected mother may also occur (Park, 1997).

2.4.7.2 Incubation Period

The length of time between the infective mosquito bite and the first appearance of clinical signs is usually not less than 10 days. The duration of the incubation period varies with the species of the parasite, and in natural infections this is 12 (9-14) days for falciparum malaria, 14 (8-17) days for vivax malaria, 28 (18-40) days for quartan malaria and 17 (16-18) days for ovale malaria (Park,1997).

2.4.7.3 Environmental factors

Geographic position and climatic conditions had been long favorable to the transmission of malaria. For example in India malaria has been recognized as a seasonal disease with maximum prevalence between July and November. Also temperature affects the life cycle of the malaria parasite.

The optimum temperature for the development of the malaria parasite in the insect vector is between 20°C to 30°C. The parasites cease to undergo development in the mosquito if the mean temperature is below

16°C. Temperatures higher than 30°C are lethal to the parasites (Park, 1997).

The atmospheric humidity has a direct effect on the length of life of the mosquito. A relative humidity of 60 percent is considered necessary for mosquitoes to live their normal span of life. When the relative humidity is high, mosquitoes are more active and they feed more voraciously. If the humidity is low, mosquitoes do not live long. Rainfall in general provides opportunities for the breeding of mosquitoes and may give rise to epidemics of malaria. However, heavy rains may flush out the breeding places. (Luber and prudent, 2009 ; Patz *et al*, 2000).

2.5 EFFECT OF WEATHER ON SOME DISEASES

Kaiser (2010) describes a relationship between weather and the occurrence of headaches and migraine. He observed that period of either low temperature and humidity or high temperature and humidity can set off a migraine attack in susceptible sufferers or bring on headache for most patients.

Matthews (2005), confirm some kinds of weather effects on health, such as aching joints occurring when the temperature is low. Extremely

high temperature leads to heat stroke while extremely low temperature causes hypothermia. A thunderstorm could trigger off an asthma attack.

Science Daily (1998) reported that scientists are discovering more about the intricate relationship between global weather patterns and infectious diseases. It says that seasonality of many human diseases has long been recognized, but it is only recently that this aspect has become a major study in infectious disease research.

Coleman (2010) outlined the results of some researches on weather and health, and reports that Asthma was identified with the onset of thunderstorm, cold with heart attack, labor with tornadoes while seasonal affective disorder leads to fatigue and depression.

My Weather and Health Forecast (2010) gave a report that the Ragweed Season (August to December) is usually a season where ragweed plant could produce one billion pollen grains. Therefore, allergic patients and asthma patients in the areas where ragweed is common (Northeast, South and Midwest), suffer more in this season.

Ericsson (2010) reports that cold air can trigger asthma because it can increase the blood pressure which will affect the heart. He also stated that an asthmatic attack takes place when something affects the lungs.

Extremes of heat and humidity can trigger asthma attacks because heat increases the metabolic rate and body temperature. This makes the body use more energy and oxygen. The need for more oxygen means faster or deeper breathing which is a problem for asthmatics. Extreme humidity makes it difficult to lower body temperature. The body will then have to work harder and longer, again increasing the need for oxygen.

Beniston (2002) reported that the infection rate for malaria is an exponential function of temperature. Small increases in temperature can lead to a sharp reduction in the number of days of incubation. He also said that increases in temperature and rainfall would most probably allow malaria vectors to survive in areas immediately surrounding their current distribution limits.

Center for Disease Control and Prevention (CDC, 2008), when describing the health effects of weather remarked that increased temperatures has a range of effects from mild heat rashes to deadly heat stroke. It can aggravate chronic cardiovascular and respiratory diseases. Droughts can also result in shortages of clean water and may concentrate contaminants that negatively affect the chemistry of surface waters in some areas. Drought may also strain agricultural productivity and could

result in increased food prices and food shortages, this may also lead to malnutrition.

CHRR (2008) observed that epidemics of meningitis occur in Sahel region of Africa in the dry season. They coincide with periods of very low humidity and dusty conditions, which disappear with the onset of the rains, suggesting that there is a relationship between these weather elements and the occurrence of the disease.

Oduyebo (1999) discovered from a study that the incidence and prevalence of meningitis coincides with periods of high temperature. This and other factors (housing type) contributed to the spread of the disease in his study area.

Bukhari (2009) in his study on the temperature and rainfall variability and outbreak of meningitis and measles observed that high temperature was responsible for meningitis incidences while measles showed a negative relationship with rainfall, only a few occurrences were recorded during the rainy season.

2.6 RELATIONSHIP WITH OTHER ENVIRONMENTAL FACTORS

Scot-Evans (2007), reports that it is helpful to understand how different external environments can influence the internal environment of our bodies.

2.6.1 HOUSING CONDITION

BetterHealth Channel (2010) described the pattern of relationship that occurs between the home environment where people live and their health condition. Certain diseases like asthma, meningitis and pneumonia are influenced by the nature of the home environment where the patients live.

Griffiths (1976) described four major aspects to consider climatologically when building a house for living. These are: thermal considerations, ventilation and wind pressure, day lighting factors, and precipitation or dampness aspects. These factors all contribute to the well being of the people and the structure. The indoor climate is also considered which also influences their physiological comfort.

Duncan (1996), when writing on environmental health principles remarked that the potential presence of diseases of all types in either urban or rural areas is a feature of life in human settlement. He further reports that eleven "health principles of housing" were defined by a WHO

consultation on housing; the implications for health. The principles were stated in the context of socio-economic development and with particular emphasis on the health risks of the urban and rural poor living pattern.

2.6.2 FOOD

Food, its method of preparation or cooking can be affected by temperature, humidity, sunlight and pressure. Dietary habits are similarly influenced by weather. Humidity can spoil some dry foods if not well protected, sunlight destroys vitamin C especially in liquid form and in vegetables, fruit juices and milk. People eat certain food based on weather condition to either keep warm or cold. These affects the nutritional value of the food ingested and could lead to malnutrition or imbalance diet which could make people susceptible to diseases (CDC, 2008; Griffiths, 1976).

2.6.3 SANITATION

Sanitation has been a major treat to health especially in places where little attention is given to it. Most vector-borne diseases find breeding home in stagnant water this is very common in rainy season. Personal hygiene also helps to prevent direct contact with some bacteria and virus that could be detrimental to health (Griffiths, 1976).

[illegible]

Thus, planning for the protection of human health from the potential impacts of global climate change requires a much improved understanding of the disease-inducing mechanisms involved, possible synergetic effects, and vulnerability of populations (Martens *et al*, 1997).

CHAPTER THREE: STUDY AREA AND METHODOLOGY

3.1.0 THE STUDY AREA

This study was carried out in Zaria Local Government Area and Sabon Gari Local Government of Zaria.

3.1.1 LOCATION OF ZARIA

Zaria is located on a plateau at a height of about 670 meters above sea level, in the central part of northern Nigeria and more than 644Kilometers away from the atlantic Ocean. (Ogbaji,2006).

3.1.2 CLIMATE AND WEATHER OF ZARIA

Zaria ($11^{0}3^{1}$N, $7^{0}42^{1}$E) possesses a tropical continental climate. It lies within a region which has a tropical savanna climate with distinct wet and dry seasons. According to Thornwaite's moisture index, the climate of Zaria is the dry sub-humid type. The annual rhythm of weather in Zaria follows the annual march of the surface position of the ITD over Nigeria it is approximately from WNW to ESE. It reaches its northernmost and southernmost positions August and January respectively. The gross features of rainfall patterns in this region, as in other part of the country are usually in association with what is often called the Inter Tropical

Discontinuity (ITD) (Nicholson, 1981; Kanote, 1984; Hayward and Oguntoyinbo, 1987; Oladipo,1993). The movement of the ITD North-wards across the country between January and August, and its retreat from the southern fringe of the sahara desert after August, causes much of Nigeria to experience seasonal rainfall. (Olaniran and sumner, 1989; Olaniran, 2002; Ojo et al, 2001).

The ITD itself is the boundary at the ground level between the dry Tropical continental (cT) air of northern origin and the cool, moist Tropical martime (mT) air of southern origin. These two air masses pass through and are responsible for the seasonal changes in Zaria. Sticky hot weather condition prevails during the northward movement of the ITD because of small diurnal temperature range, high relative humidity with little or scanty showers of rainfall. While the southward movement is associated with dry and cold weather condition because of great diurnal temperature range and low relative humidity with no rainfall (Ogbaji, 2006).

On the basis of these two air masses and their subsequent weather, the year in Zaria is divided into four seasons (DURP,1979)

- Dry season "*harmattan*", November to February.
- Hot season, March to April.

- Thunderstorms and Rain season, May to June.
- Wet season, July to October. (DURP, 1979).

October usually marks the end of the wet season and the beginning of dry season. While April marks the onset of the rain and the end of the hot season. With the onset of the wet season the daily maximum temperature drops, and the diurnal range of temperature becomes low. July and August in Zaria are the months of mildest weather. (Oshaji, 2000)

The diurnal range of temperatures during this period varies from about 9.4^{0}C to 6.7^{0}C. The mean daily maximum temperature is about 26.7^{0}C to 28.9^{0}C. Cloudiness reaches a maximum in August and consequently the hours of sunshine are least. The average duration of sunshine in August varies from three to six hours. The relative humidity is very high in August about 70-80 percent (Hore, 1970).

The beginning of the dry season is marked by an abrupt drop in the moisture content of the surface air and a change in the direction of the surface winds. Relative humidity drops from 60-65 percent in October to about 25-30 percent in November. Daily minimum temperatures drop more rapidly than the maximum. Consequently the diurnal range of temperatures increases rapidly. The sky is mostly clear in November

which permits longer hours of sunshine. In early November, mornings and nights become cooler and pleasant. Dust haze begins to appear and increases in frequency as the '*harmattan*' wind is being introduced. In December to January, the thickness of this haze and dust layer of the '*harmattan*' rarely exceeds a height of 1,524 meters. Sometimes visibility becomes very poor (Hore,1970).

3.1.3 VEGETATION OF ZARIA

Zaria lies within the northern Guinea savannah type which implies that it has a woodland vegetation type. Through the clearing of vegetation for cultivation, firewood, as well as overgrazing the natural or climatic vegetation of Zaria have been changed to that of derived savannah type which is characterized by shrubs, stems and trees along with some tuft covers and some clusters of trees along river course (Alkali, 2009).

3.1.4 GEOLOGY OF ZARIA

Zaria is underlaned by three groups of rock all of which belong to the precambrian basement complex of Nigeria. These groups of rock include:

a. Gneiss of variable composition, which include granite rocks gegmatite or schists, which have been thoroughly weathered at

to low infiltration. This concurrently causes pollution of rivers and other environmental problems to the people. (Niniola, 1999).

3.1.6 ECONOMIC ACTIVITIES IN ZARIA

Based on Ray (1970)'s report, the major activities include agriculture, a little bit of manufacturing, trade/commerce and military activities. The dominant activities in Zaria are military and academic activities both western and eastern oriented, this attracted the present population. This is evident in the presence of primary, secondary, Islamic and higher institutions of learning scattered around the town.

various depths and are found to form most of the superficial materials which are generally called drift.

b. Quartz, schist and quartzite which form a narrow bed of low rounded hill and valley topography.

c. Gneiss or porphyritic granites are characterized by inselbergs of different shapes and sizes, these are often referred to as the older granite. They cover a small area with largest outcrop forming the kufena group of inselbergs.(Alkali,2009)

3.3.5 SOIL OF ZARIA

Zaria soil is grouped to be among the leached ferruginous tropical soils. Most of the soil is 30-40% rich in clay, which have the ability to retain moisture. They are inherently rather poor that they cannot sustain much food production to meet the ever increasing population of Zaria. This is why most of the available food of Zaria are chemically infected because of the use of fertilizer.

Also, most of its soil forms a hard surface cap under the impact of heavy rain in all and scanty vegetation cover which enhances surface run off due

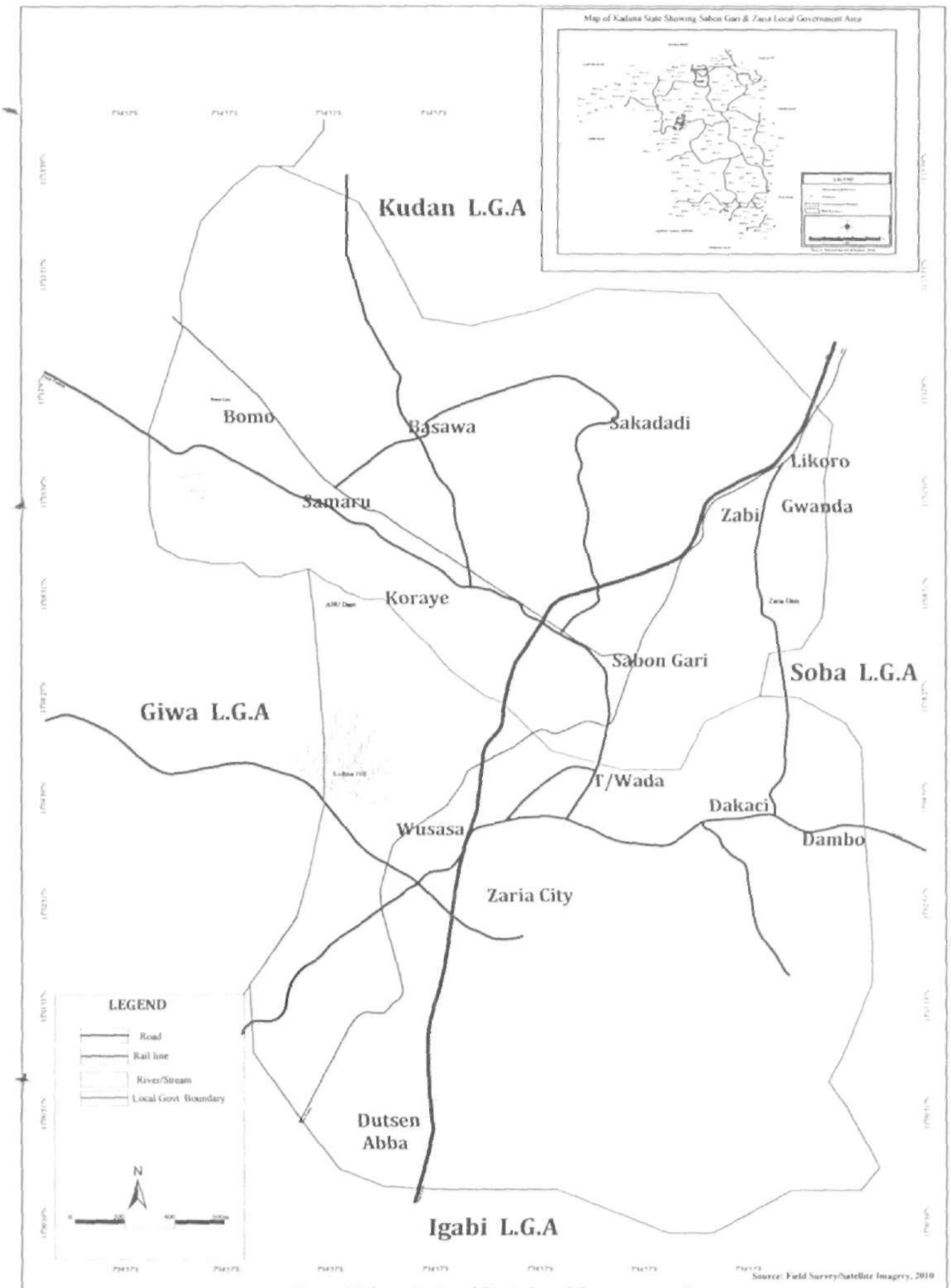


Fig 3.1: Map of Sabon Gari and Zaria Local Government Areas

METHODOLOGY

This essentially deals with the methods employed to carry out this research work. It includes the type of data required, their sources, the method of data collection and the methods of data analysis.

3.2.1 TYPES AND SOURCES OF DATA COLLECTED

Monthly data of temperature (Minimum and maximum), rainfall and relative humidity for 10years in Zaria were collected from the Nigerian college of Aviation Technology, Zaria. Medical records of the diseases: malaria, typhoid, cerebro-spinal meningitis, measles, asthma, pneumonia and diarrhea were obtained from six hospitals using purposive sampling method based on their spatial spread within the study area and the duration of their existence, if up to 10years. The diseases are among the common diseases in Zaria.

Zaria is made up of two Local Government Areas (L.G.A) they are: Sabon-Gari L.G.A and Zaria L.G.A. Health care facilities in each L.G.A include:

A. Zaria L.G.A

1. Hajia Gambo Sawaba General Hospital, Kofar Gayan Zaria City.

2. St Luke's Anglican Hospital, Wusasa.

3. Afuwa Specialist Hospital, Tudun Wada.

4. Muslim Specialist Hospital, Tukur-Tukur.

5. Anna kitch Medical Centre, Wusasa.

6. Marhaba Clinic, Tudun Wada.

7. Sauki Clinic, Tudun Wada.

8. Zaria Clinic and Maternity, Tudun Wada.

Including Local Government clinics in most wards and primary health care centre

B. Sabon- Gari L.G.A

1. Major Ibrahim Abdullahi Memorial Hospital Sabon-Gari

2. Limi Hospital and Maternity, Hanwa.

3. A.B.U Sickbay Mini Campus Samaru.

4. Mayfair Hospital and Maternity, Sabon-Gari.

5. Ladiya Hospital, Sabon-Gari.

6. Salama Hospital, Hanwa.

7. Aviation Clinic.

8. 3MRS Depot N.A

Including Local Government clinics in most wards and primary health care centres.

Three hospitals were selected from each local government area using purposive sampling method and also considering their spatial spread in the two areas. The hospitals selected are those that have existed for more than ten years and have available records. They are:

Zaria L.G.A

1. Hajia Gambo Sawaba General Hospital,Kofar Gayan Zaria City.
2. St Luke's Anglican Hospital, Wusasa.
3. Afuwa Specialist Hospital, Tudun Wada.

Sabon-Gari L.G.A

1. Limi Hospital and Maternity,Hanwa.
2. Mayfair Hospital and Maternity, Sabon-Gari.
3. A.B.U Sickbay Main Campus Samaru.

3.2.2 TECHNIQUES OF DATA COLLECTION

3.2.2.1 Collection of Meteorological Data.

The data was collected from the climatological unit of the Nigerian college of Aviation Technology, Zaria by selecting from their records the three (3) weather elements required for this work which are: Rainfall, Temperature and Relative Humidity. The records for each were taken monthly for the period of 10 years (1999-2008).

3.2.2.2 Collection of Medical Records

The medical records were obtained from the following hospitals; Hajia Gambo Sawaba General Hospital, Kofar Gayan, Zaria City; St Luke's Anglican Hospital Wusasa; Afuwa Specialist Hospital Tudun Wada; Limi Hospital and Maternity Hanwa; A.B.U. Sickbay Main Campus Samaru; Mayfair Hospital and Maternity Sabon-Gari. Each of the above named Hospitals have existed for up to 10 years and have the records of patients treated between 1999-2008, therefore these records were collected by taking the frequency of occurrence of each of these diseases monthly for the period of time in question.

3.3 DATA PRESENTATION AND ANALYSES

This was done using both inferential and descriptive statistics.

3.3.1 Presentation of Data

This was done using the descriptive method. All the data collected were presented in tabular from. The Mean Temperature for each month and Mean Relative Humidity for each month were calculated and also presented.

Also, the relationship between each disease and the meteorological variables were presented using line graphs. The diseases are the dependent variable while the weather elements are the independent variables.

Adewoye (2004) remarked that charts are used for comparing the sizes of figures giving a visual indication of the fluctuation in the chart.

3.3.2 Data Analyses

Nwosu (1997) reported that correlation analysis is usually used to measure the degree of relationship that exists between two variables of interest. This statistic was used to assess relationship between weather (rainfall, temperature and relative humidity) of Zaria and the occurrence of diseases.

The Product Moment Correlation Coefficient was used. The formula is given below:

$$r = \frac{n\sum xy - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2}} -$$

Where

r = Product Moment Correlation Coefficient /x and y values of the two variable.

n = number of occurrence /frequency of occurrence

$\sum x$ = sum of x

$\sum y$ = sum of y

$\sum y^2$ = sum of y^2

$\sum xy$ = sum of xy

$\sum x^2$ = sum of x^2

Also according to Ebdon (1977), analysis of variance is used to find out whether there is more variation between a given sample than within them. This was used to test for significant difference in the frequency of the occurrence of the diseases among the hospitals studied in zaria.

To calculate the analysis of variance, first two estimates of the variance are made, i.e the within samples variance estimate and the between samples variance estimate. The formula is given below:

The within samples variance estimate is given by:

$$Ó^2W = \frac{\sum^K \sum^n (x^- - X)^2}{N-K}$$

The between samples variance Estimate is given by:

$$Ó^2 B = \frac{\sum^K \bar{n}(X^- - X_G)^2}{K-I}$$

$$F \text{ ratio} = \frac{\text{Larger Variance Estimate}}{\text{Smaller Variance Estimate}}$$

Where

K = Number of Sample

N = total frequency

$\underline{N}$ = Frequency of each role

X_G = Grand Mean

$\bar{X}$ = Mean

$Ó^2B$ = between sample variable estimate

$Ó^2W$ = within sample variable estimate.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.0 INTRODUCTION

This chapter presents the results of the study on effects of weather on the occurrence of some common disease in Zaria. Based on the hypotheses given, the analysis was done and the following results were obtained.

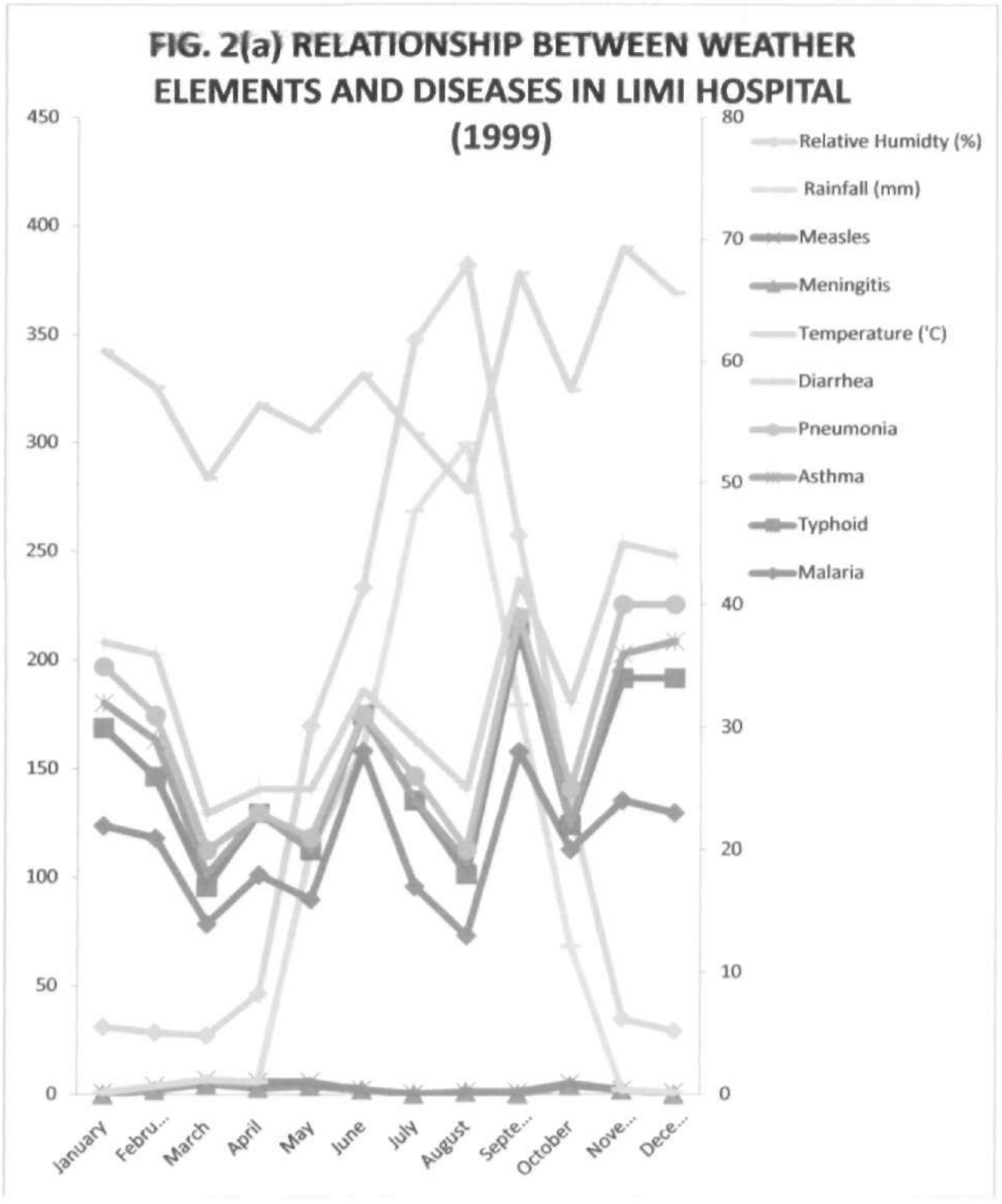
4.1 DATA ON TEMPERATURE, RAINFALL AND RELATIVE HUMIDITY

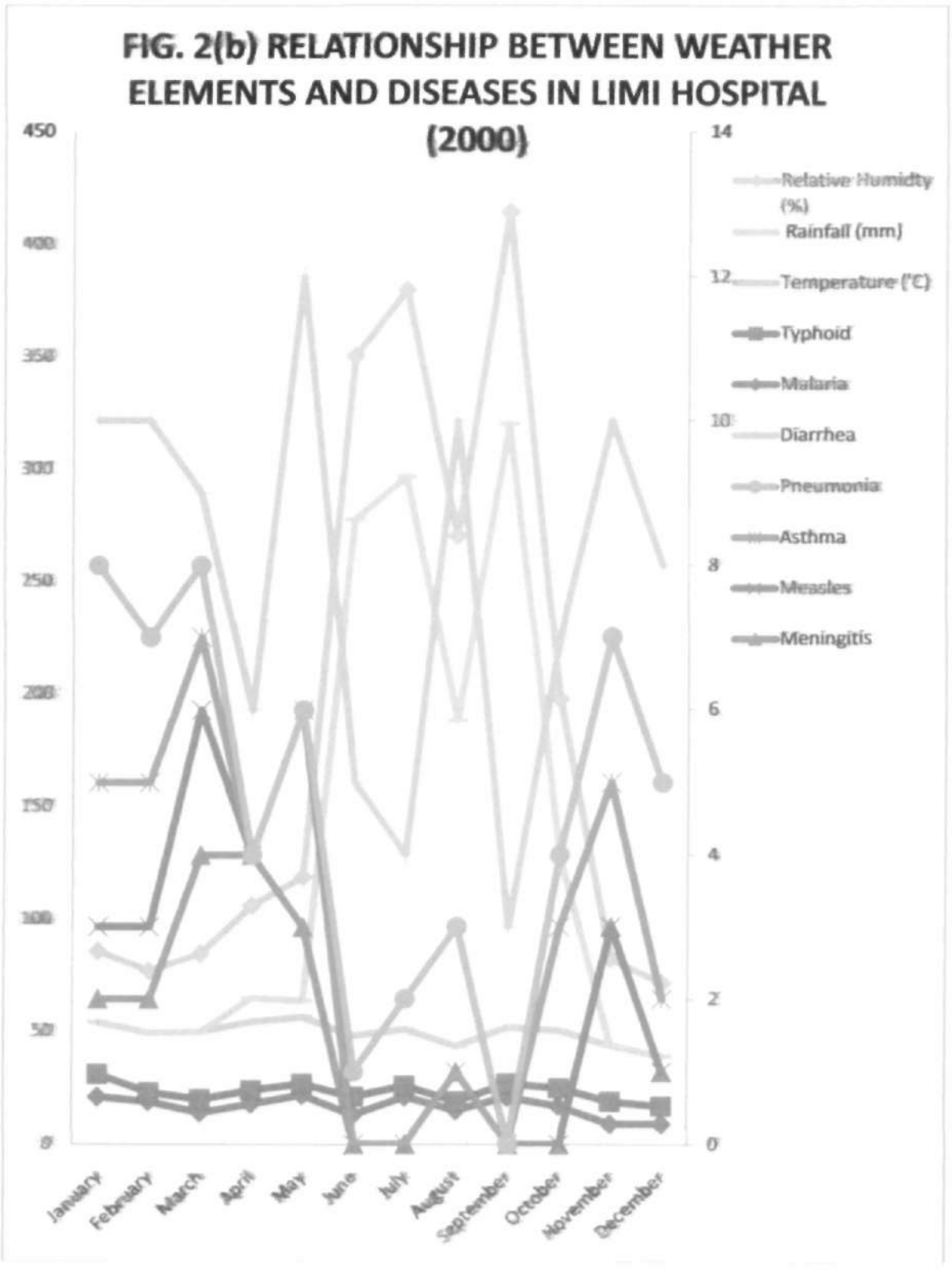
From the results given in table 4.1, it is observed that the rainfall pattern is highly seasonal with onset in April, its climax is usually around July/August and it ends early October. Relative Humidity also begins to increase as the rain increases and it is usually at its peak in August, after which it begins to decrease. It is lowest around February/March when the weather is usually hot and dry. Temperature also has seasonal variation. Maximum and minimum temperature is highest in April and lowest in August because of the high Relative Humidity in August. The temperature range is high between November and February and lowest around July/August. The Mean Temperature is lowest in December/January.

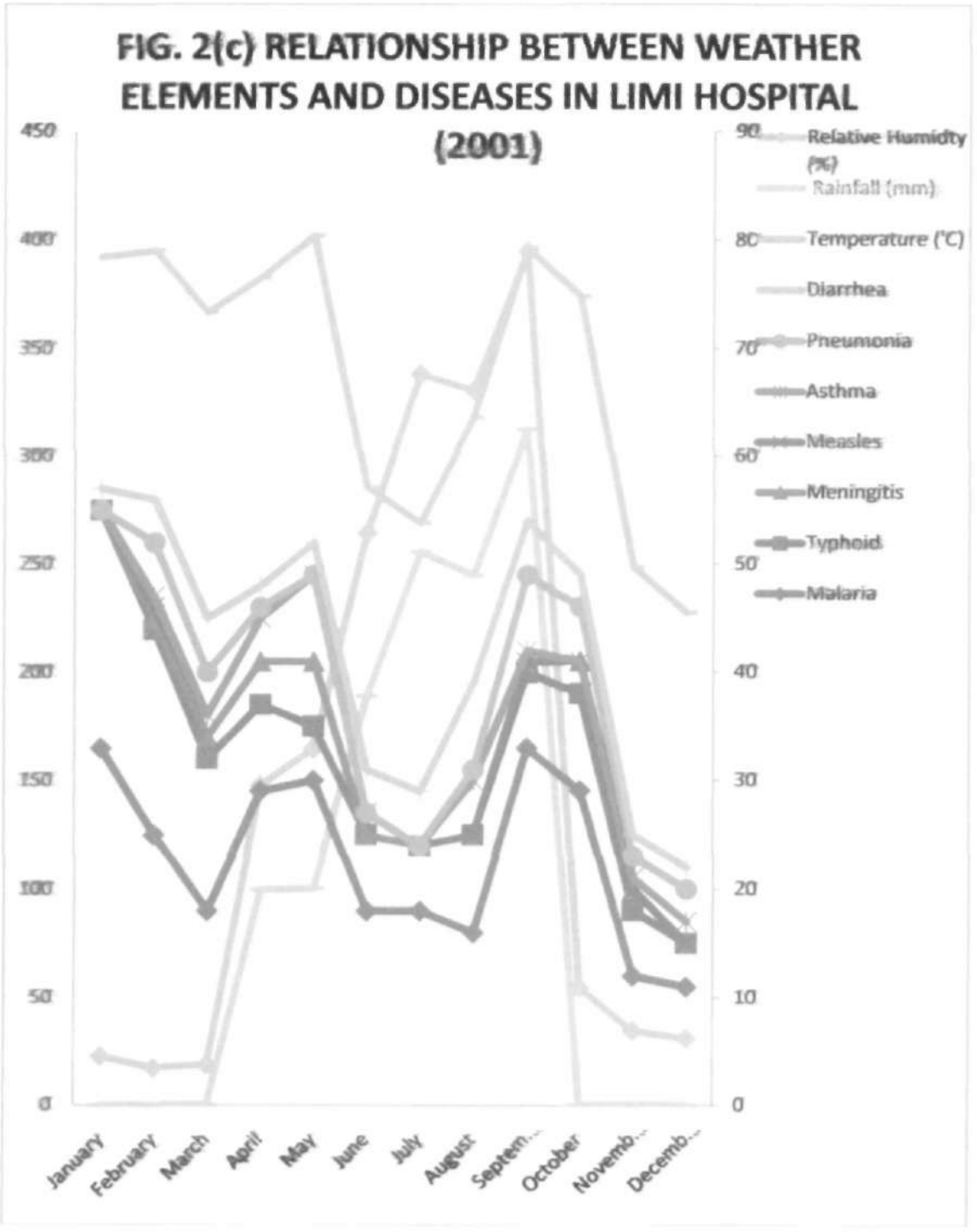
4.2 DATA ON THE DISEASES

The medical records from the hospitals showed that malaria had the highest frequency of occurrence among other diseases recorded.

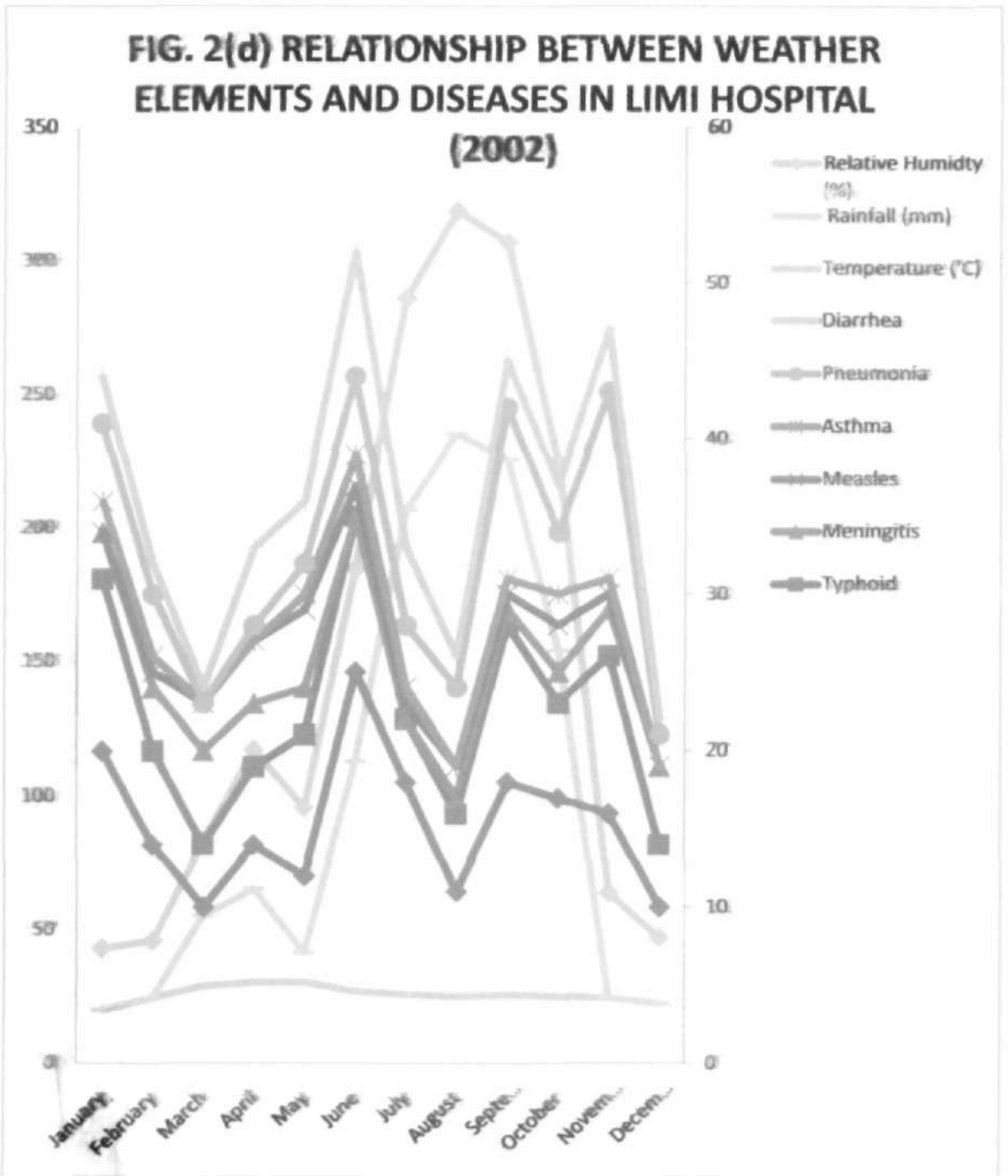
In Limi hospital, the occurrence of all these diseases was established. (Table 4.2.1, Fig. 2) Cases of malaria and typhoid were recorded every month of the year while diarrhea was recorded almost throughout the months of the year. Meningitis and measles showed a seasonal pattern of occurrence while asthma and pneumonia did not. The graphs show clearly the pattern of relationship that occurred between the weather elements and the diseases in Limi Hospital. Secondary axis was created for the graph to avoid overlapping of the different lines represented in the line graph which have relatively small values and may be pressed down.

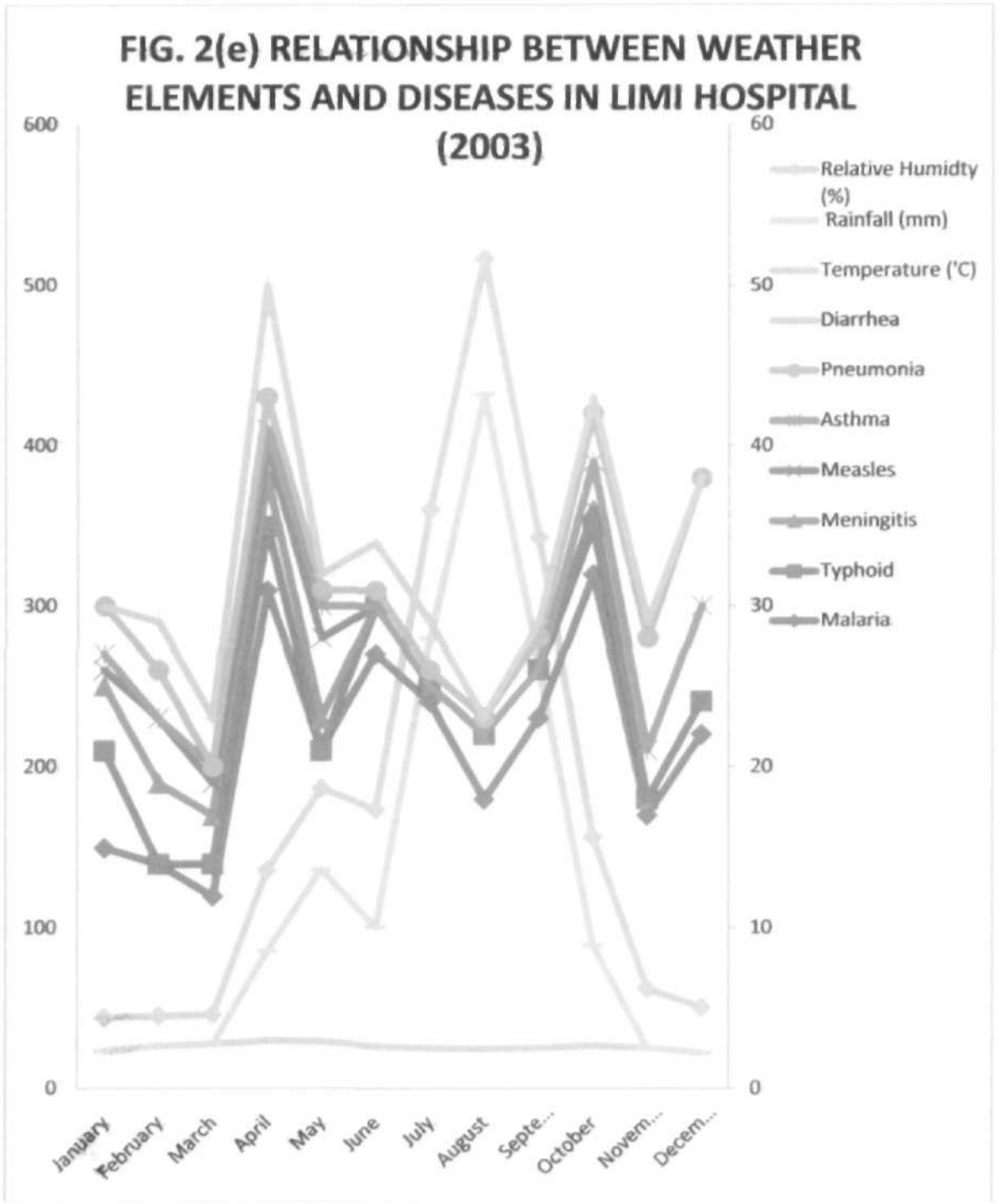

FIG. 2(a) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN LIMI HOSPITAL (1999)
450
400
350
300
250
200
150
100
50
0
80
70
60
50
40
30
20
10
0
Relative Humidty (%)
Rainfall (mm)
Measles
Meningitis
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Typhoid
Malaria
January
Febru...
March
April
May
June
July
August
Septe...
October
Nove...
Dece...

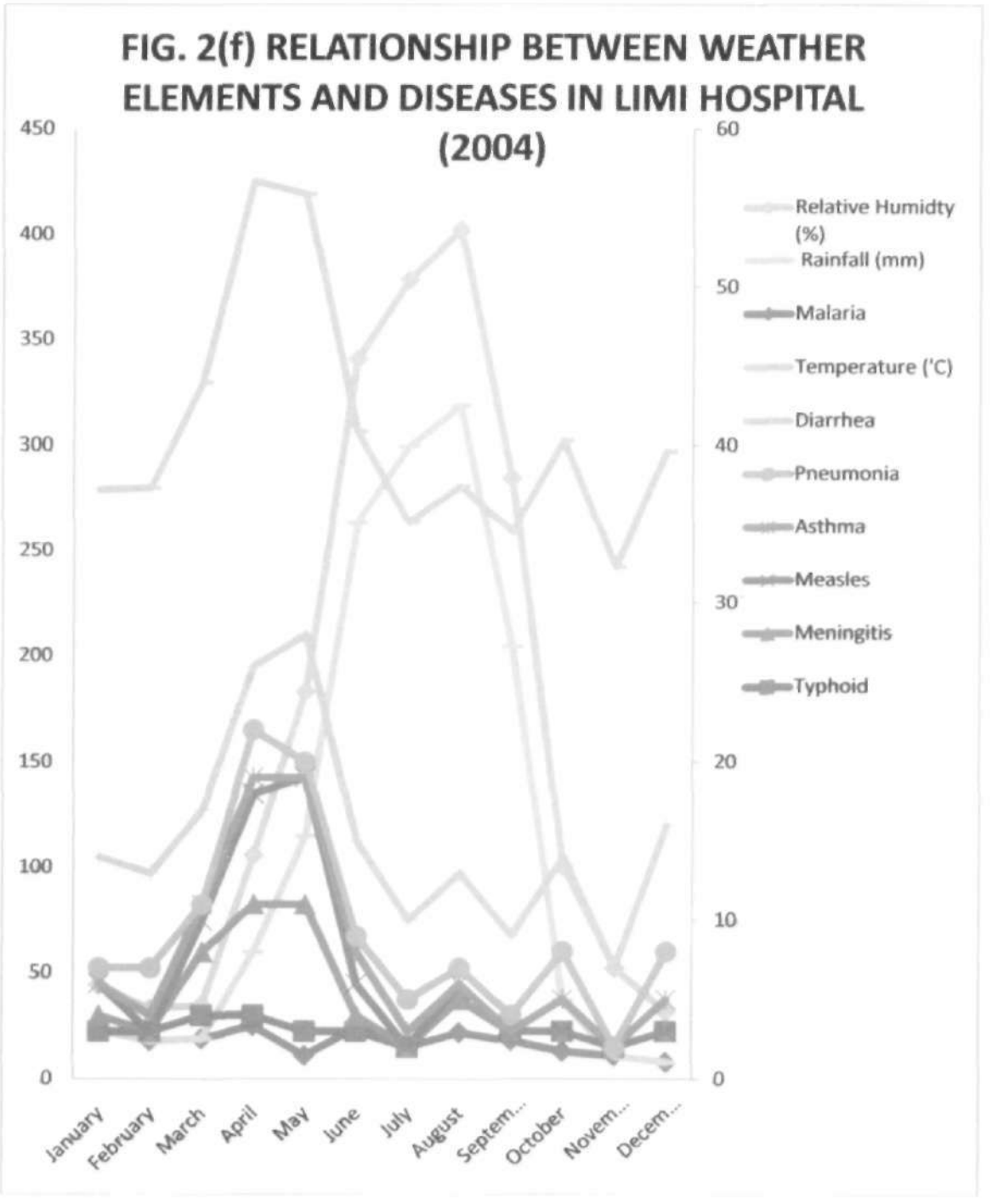

FIG. 2(b) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN LIMI HOSPITAL (2000)
450
400
350
300
250
200
150
100
50
0
14
12
10
8
6
4
2
0
Relative Humidty (%)
Rainfall (mm)
Temperature (°C)
Typhoid
Malaria
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
January
February
March
April
May
June
July
August
September
October
November
December

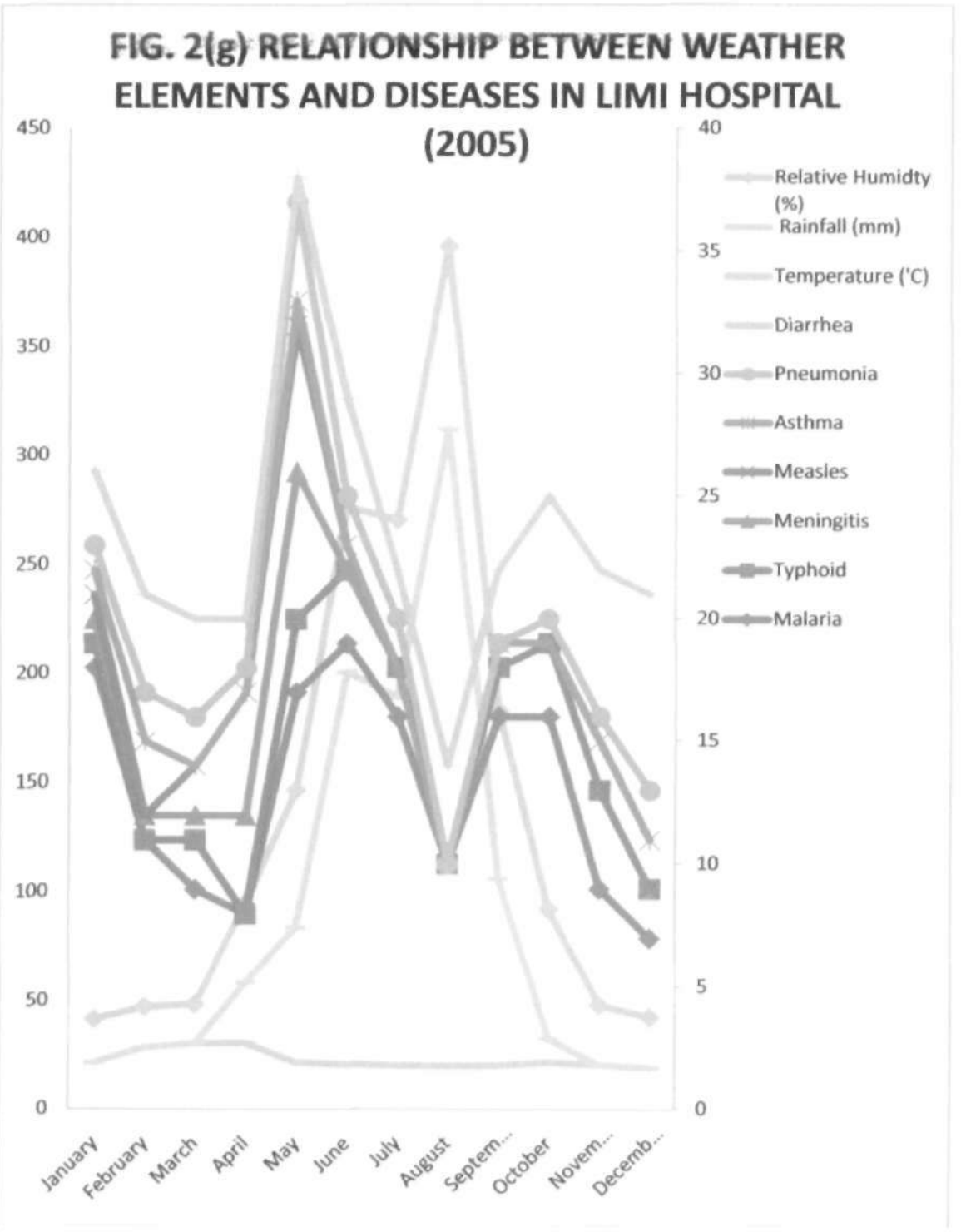


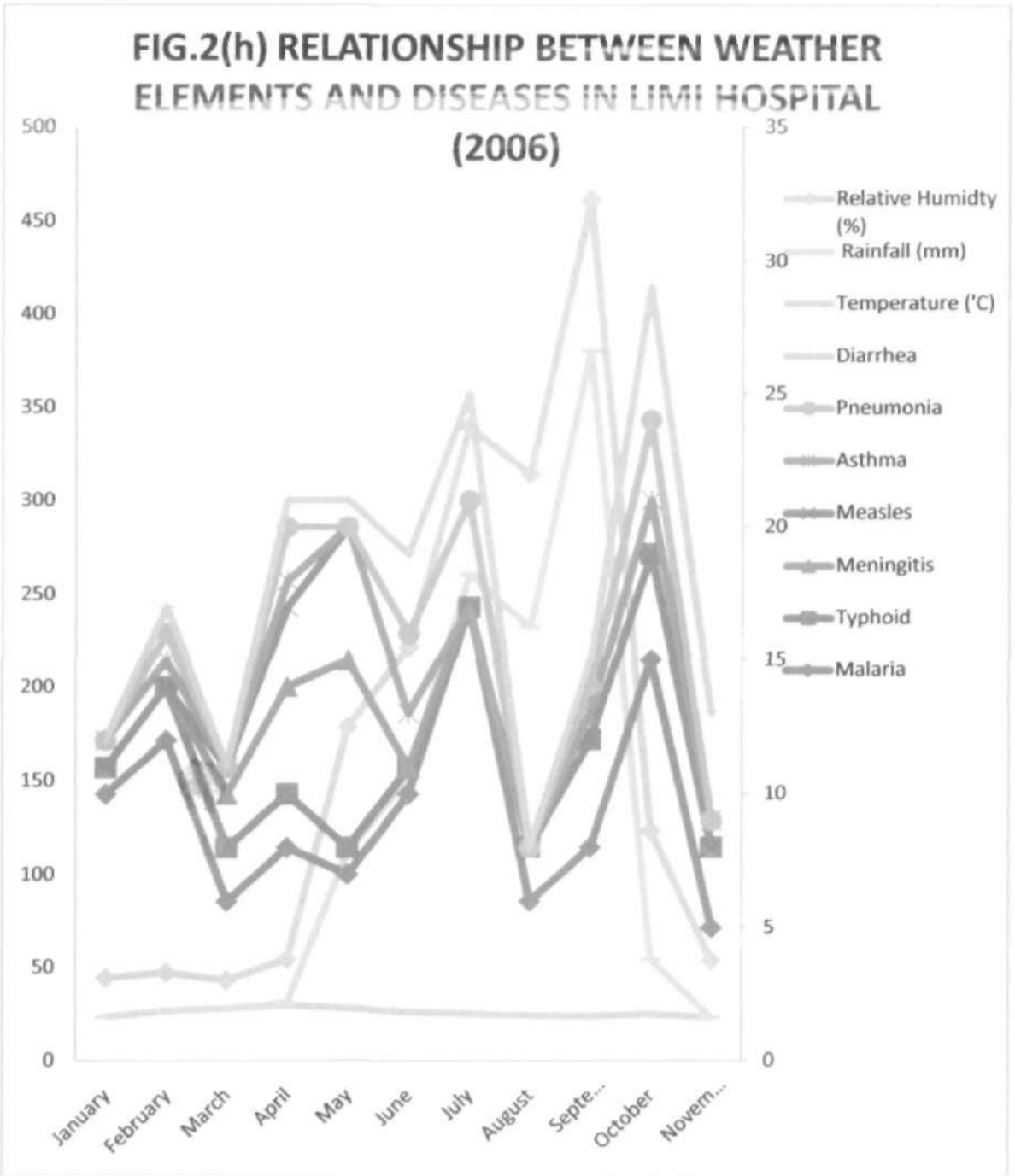
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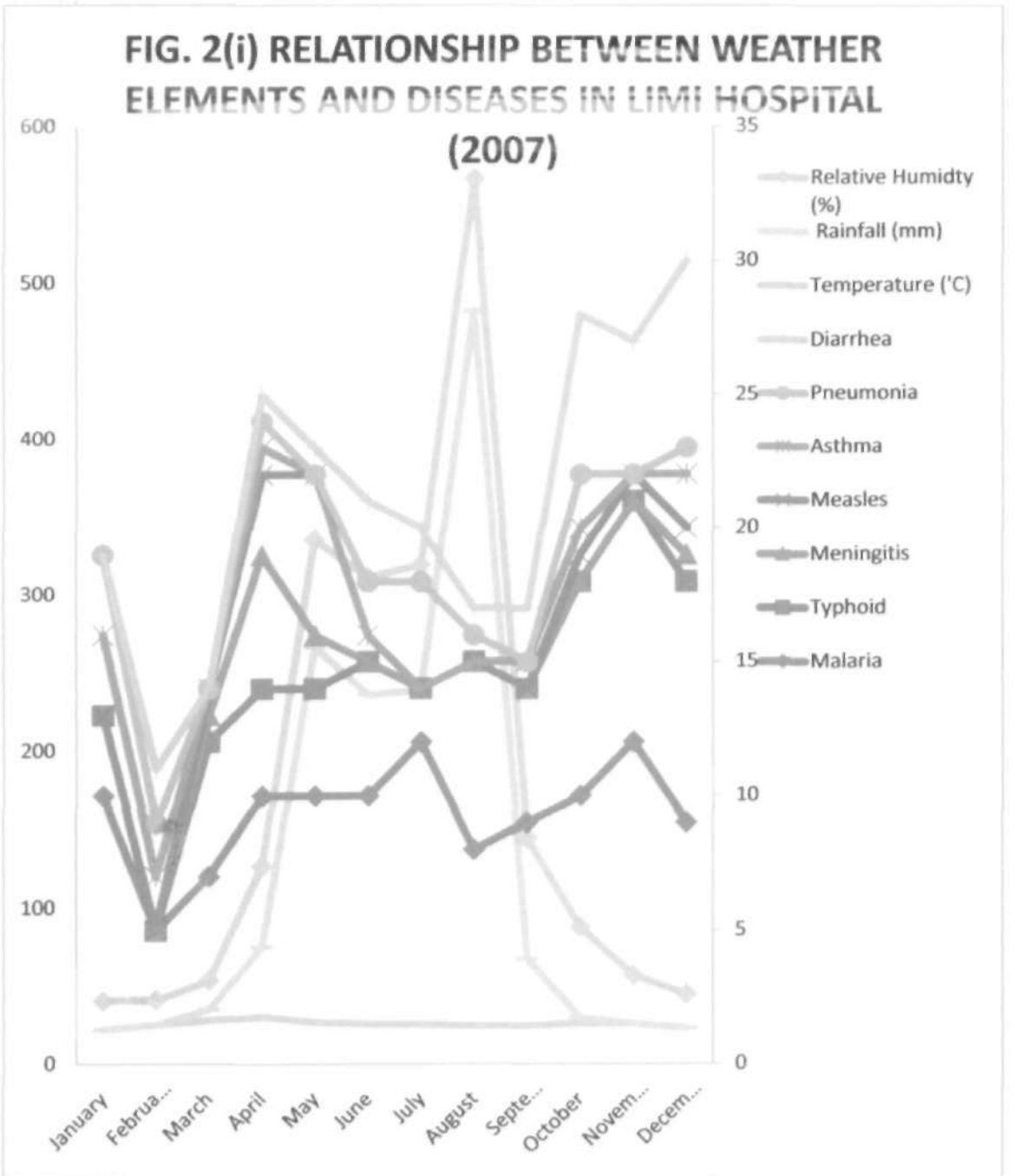

FIG. 2(d) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN LIMI HOSPITAL (2002)
350
300
250
200
150
100
50
0
60
50
40
30
20
10
0
Relative Humidty (%)
Rainfall (mm)
Temperature (°C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
January
February
March
April
May
June
July
August
Septe...
October
Novem...
Decem...

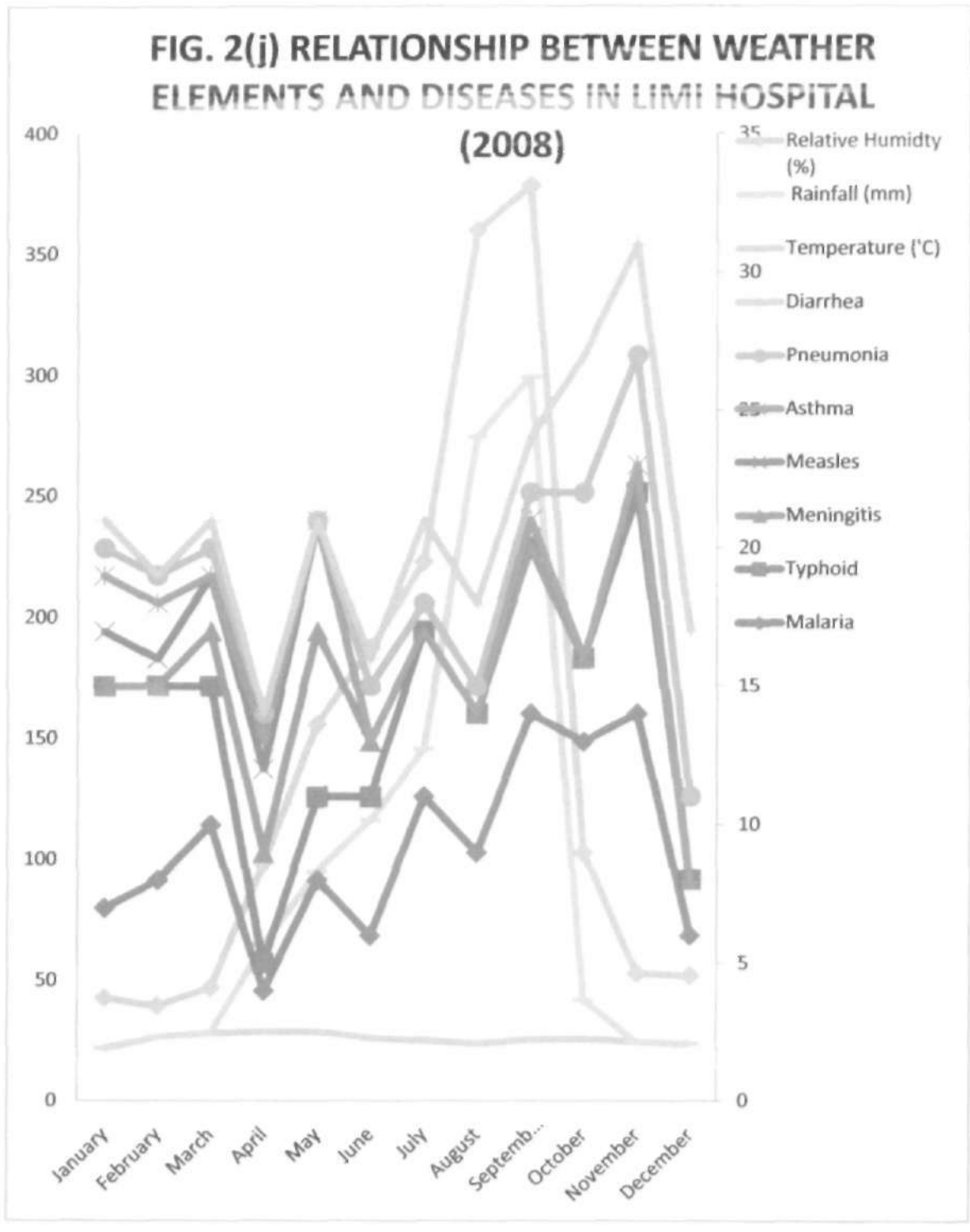

FIG. 2(e) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN LIMI HOSPITAL (2003)
600
500
400
300
200
100
0
60
50
40
30
20
10
0
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
January
February
March
April
May
June
July
August
Septe...
October
Novem...
Decem...


FIG. 2(f) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN LIMI HOSPITAL (2004)
450
400
350
300
250
200
150
100
50
0
60
50
40
30
20
10
0
Relative Humidty (%)
Rainfall (mm)
Malaria
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
January
February
March
April
May
June
July
August
Septem...
October
Novem...
Decem...

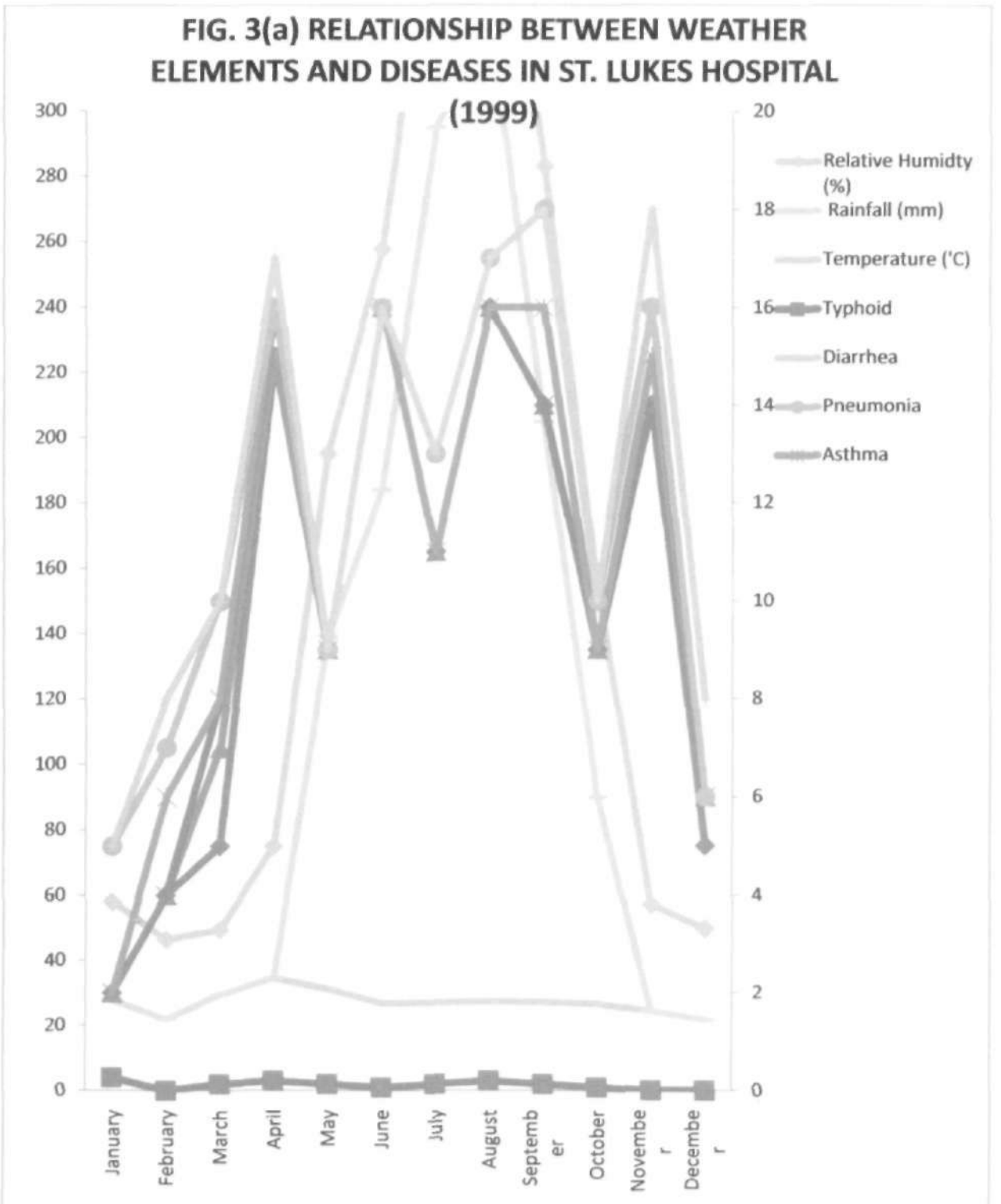

FIG. 2(g) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN LIMI HOSPITAL (2005)
450
400
350
300
250
200
150
100
50
0
40
35
30
25
20
15
10
5
0
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
January
February
March
April
May
June
July
August
Septem...
October
Novem...
Decemb...


FIG.2(h) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN LIMI HOSPITAL (2006)
500
450
400
350
300
250
200
150
100
50
0
35
30
25
20
15
10
5
0
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
January
February
March
April
May
June
July
August
Septe...
October
Novem...


FIG. 2(i) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN LIMI HOSPITAL (2007)
600
500
400
300
200
100
0
35
30
25
20
15
10
5
0
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
January
Februa...
March
April
May
June
July
August
Septe...
October
Novem...
Decem...


FIG. 2(j) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN LIMI HOSPITAL (2008)
400
350
300
250
200
150
100
50
0
35
30
25
20
15
10
5
0
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
January
February
March
April
May
June
July
August
Septemb...
October
November
December

St Luke's hospital also established the occurrence of all the diseases. Malaria cases occurred throughout the months of the year while typhoid did not. Cases of meningitis, measles and asthma were few occurring only in some months. From 2003-2008 cases of pneumonia and diarrhea occurred almost through the months of the years. (Table 4.2.2, Fig. 3) The graphs showing the pattern of the relationship between the weather elements and the diseases in St Luke's Hospital was also presented with some values on the secondary axis as well.


FIG. 3(a) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN ST. LUKES HOSPITAL (1999)
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
20
18
16
14
12
10
8
6
4
2
0
Relative Humidty (%)
Rainfall (mm)
Temperature (°C)
Typhoid
Diarrhea
Pneumonia
Asthma
January
February
March
April
May
June
July
August
Septemb er
October
Novembe r
Decembe r

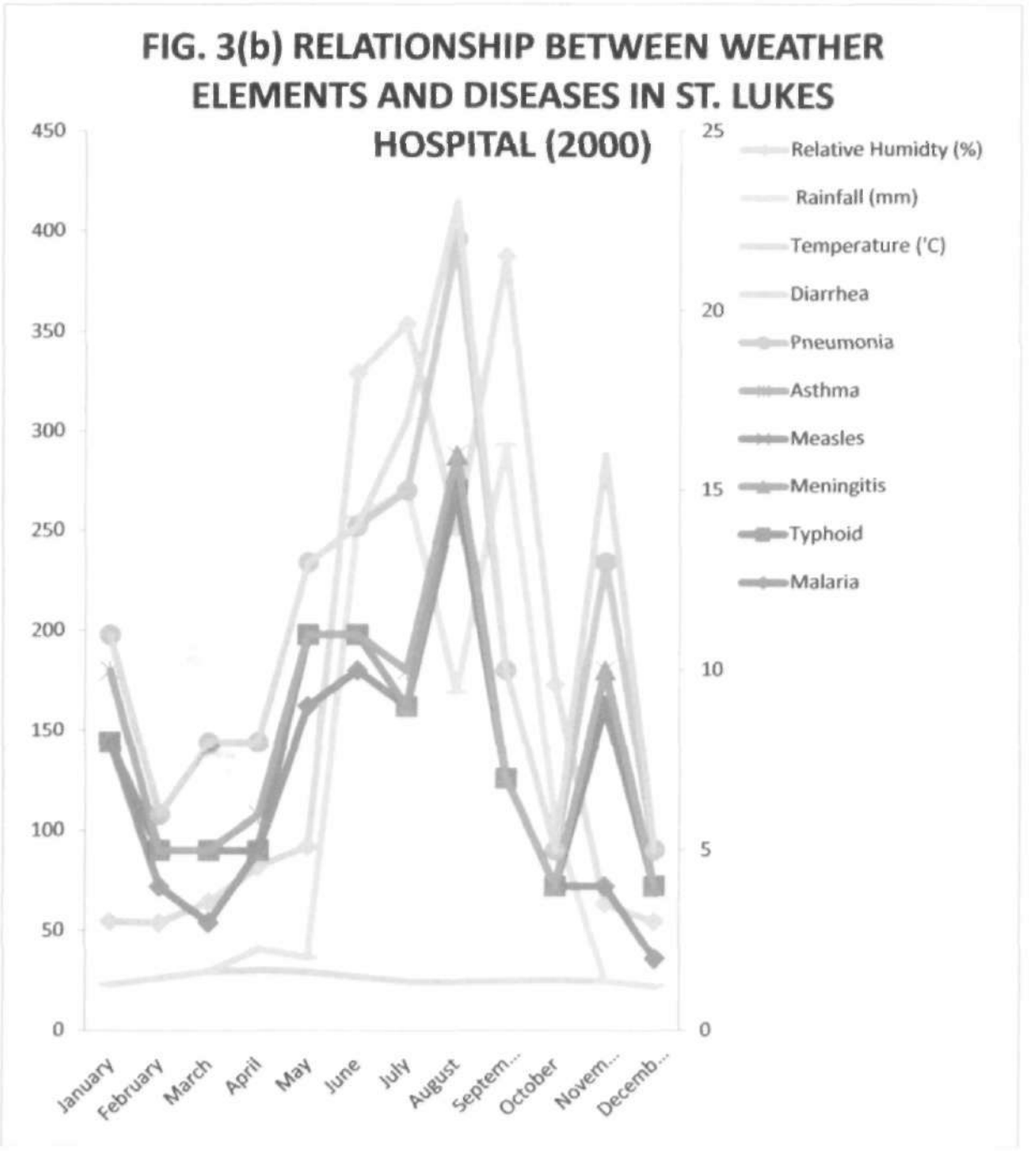
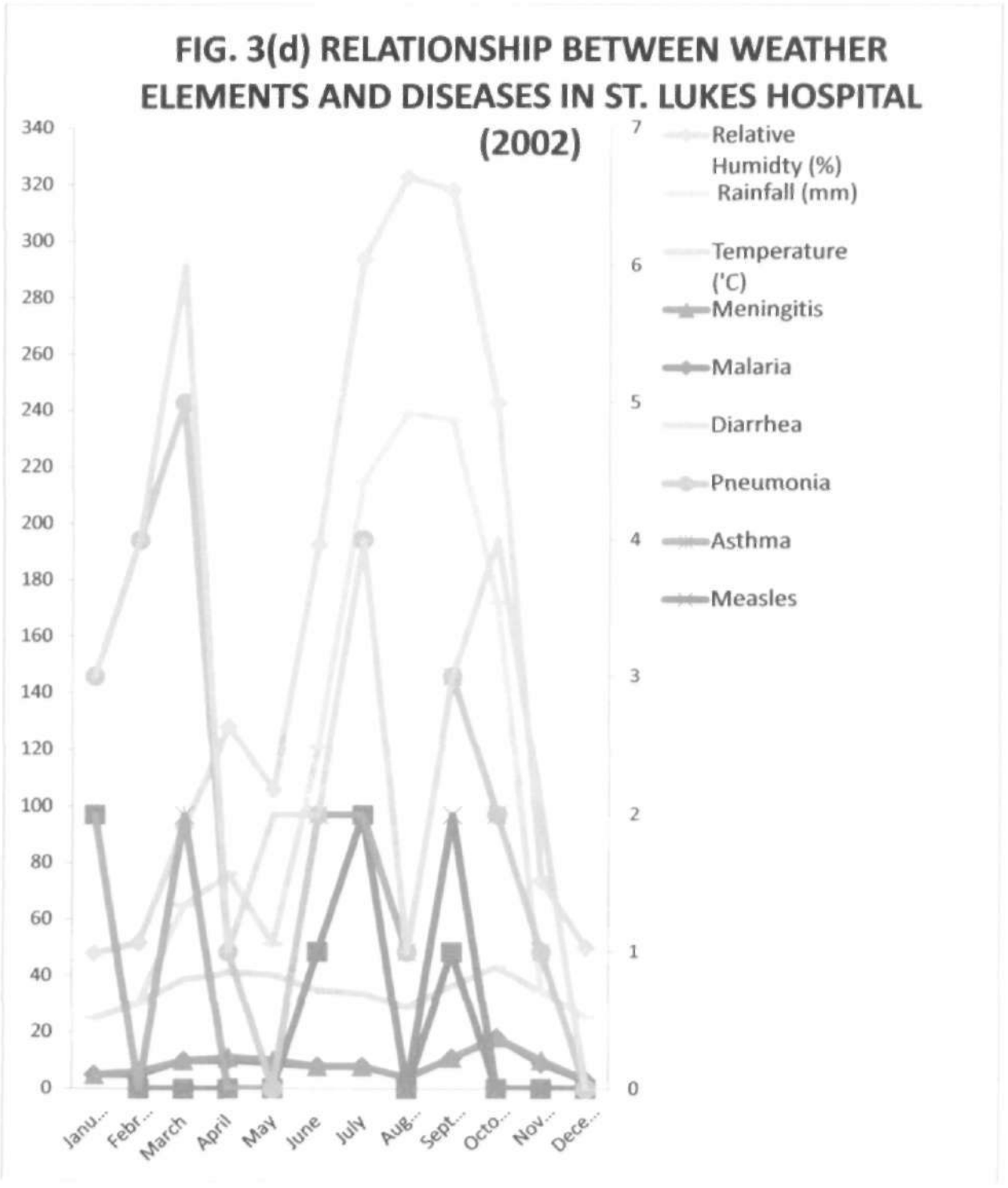
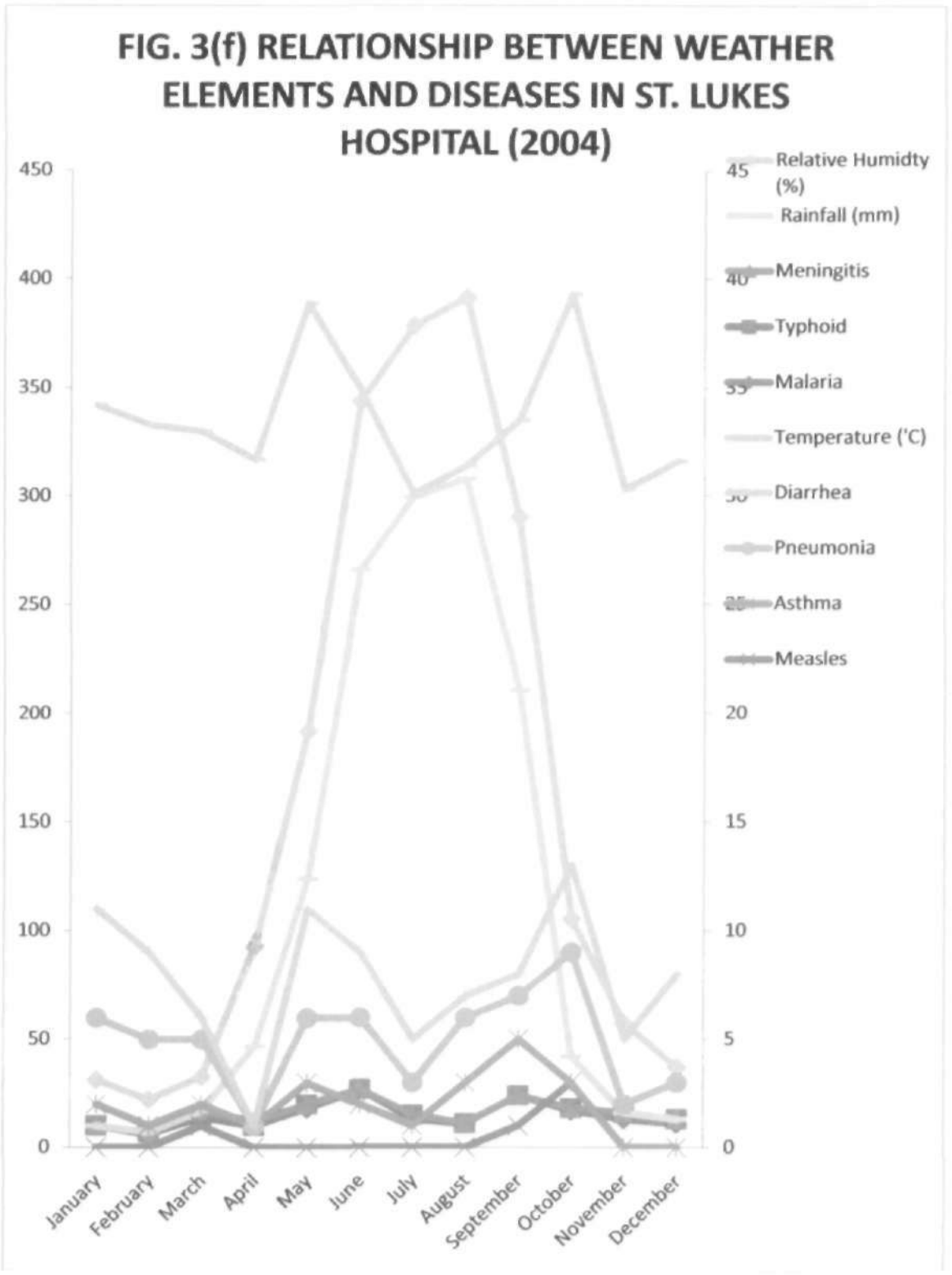
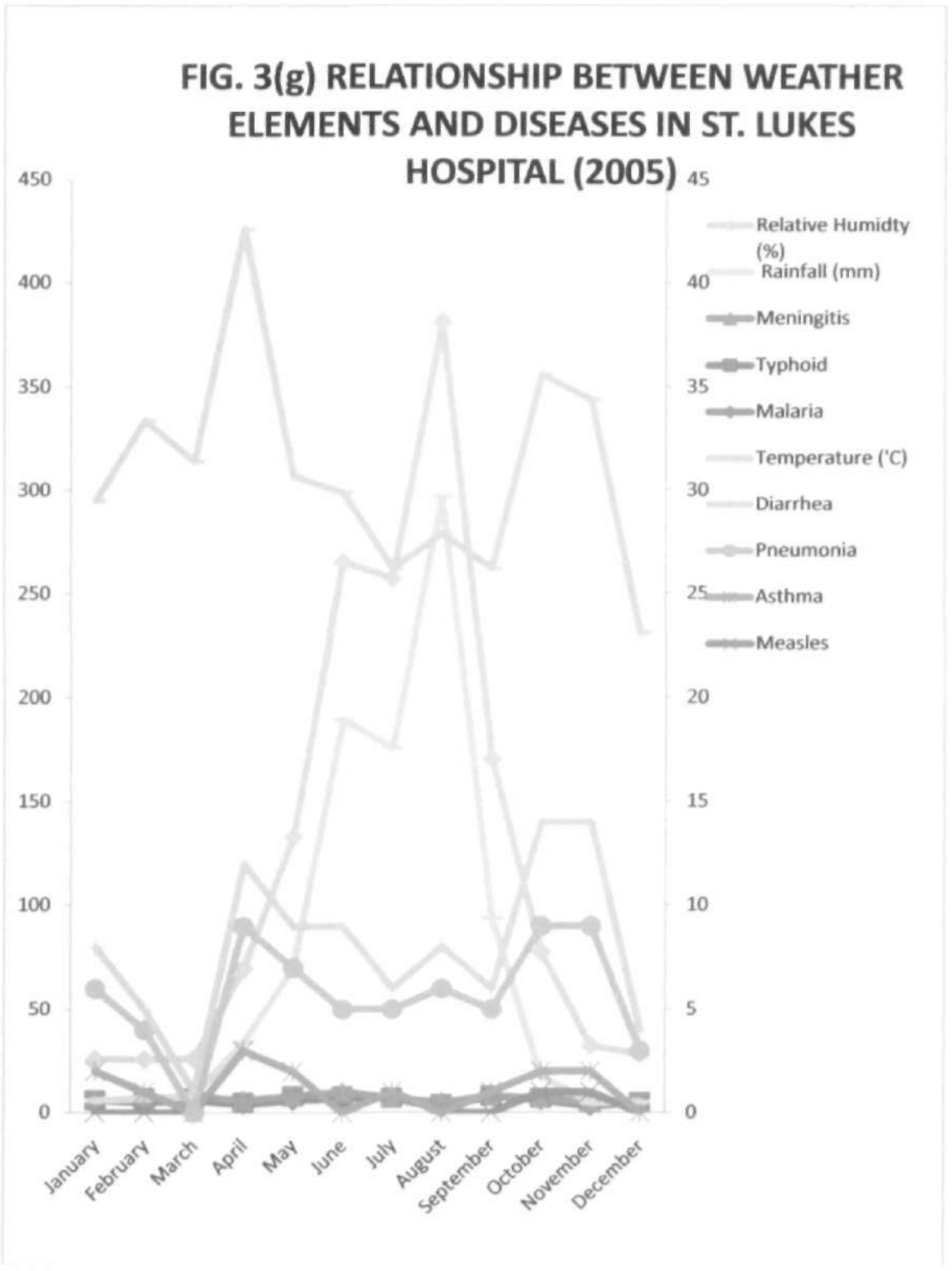
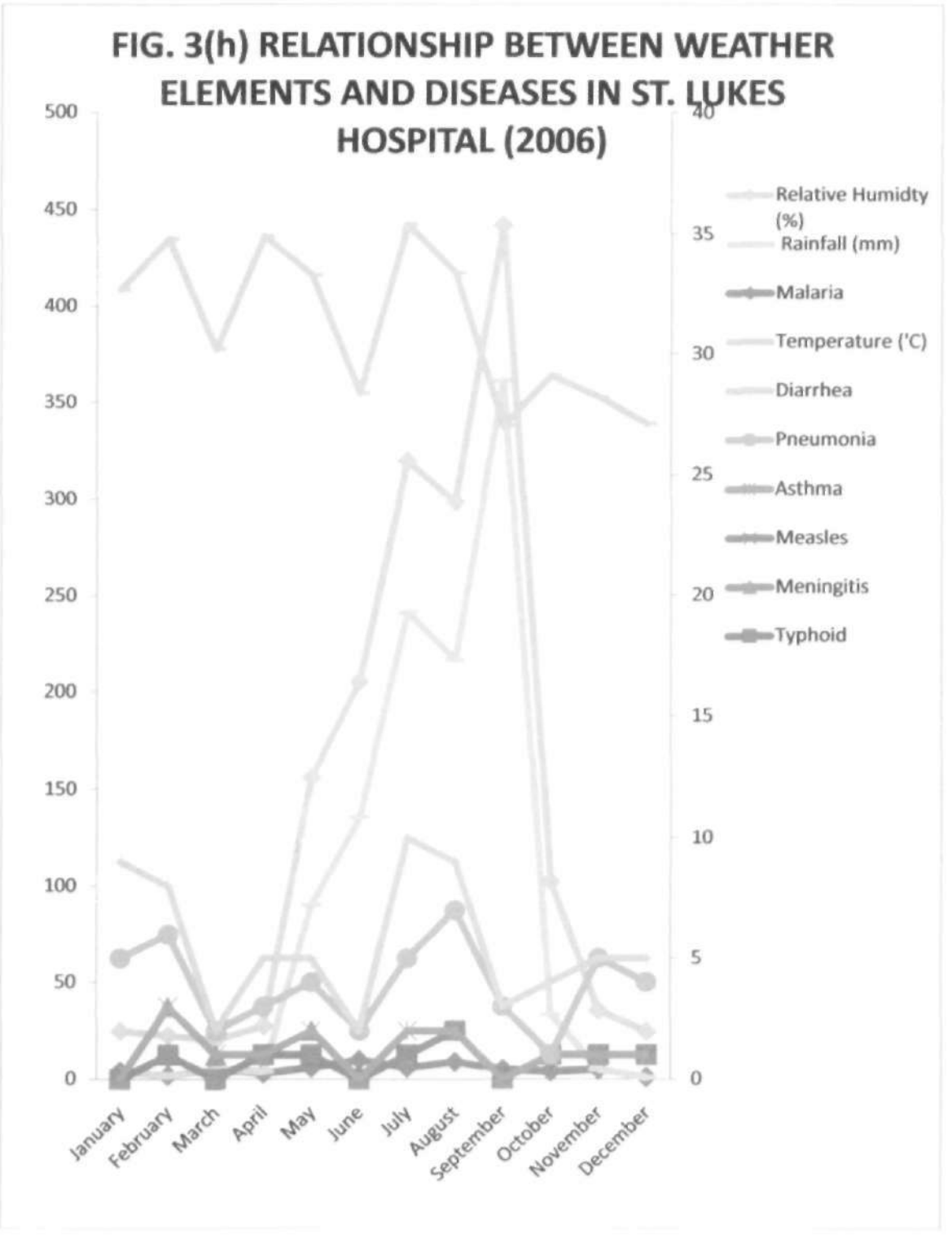

FIG. 3(b) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN ST. LUKES HOSPITAL (2000)
450
400
350
300
250
200
150
100
50
0
25
20
15
10
5
0
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
January
February
March
April
May
June
July
August
Septem...
October
Novem...
Decemb...

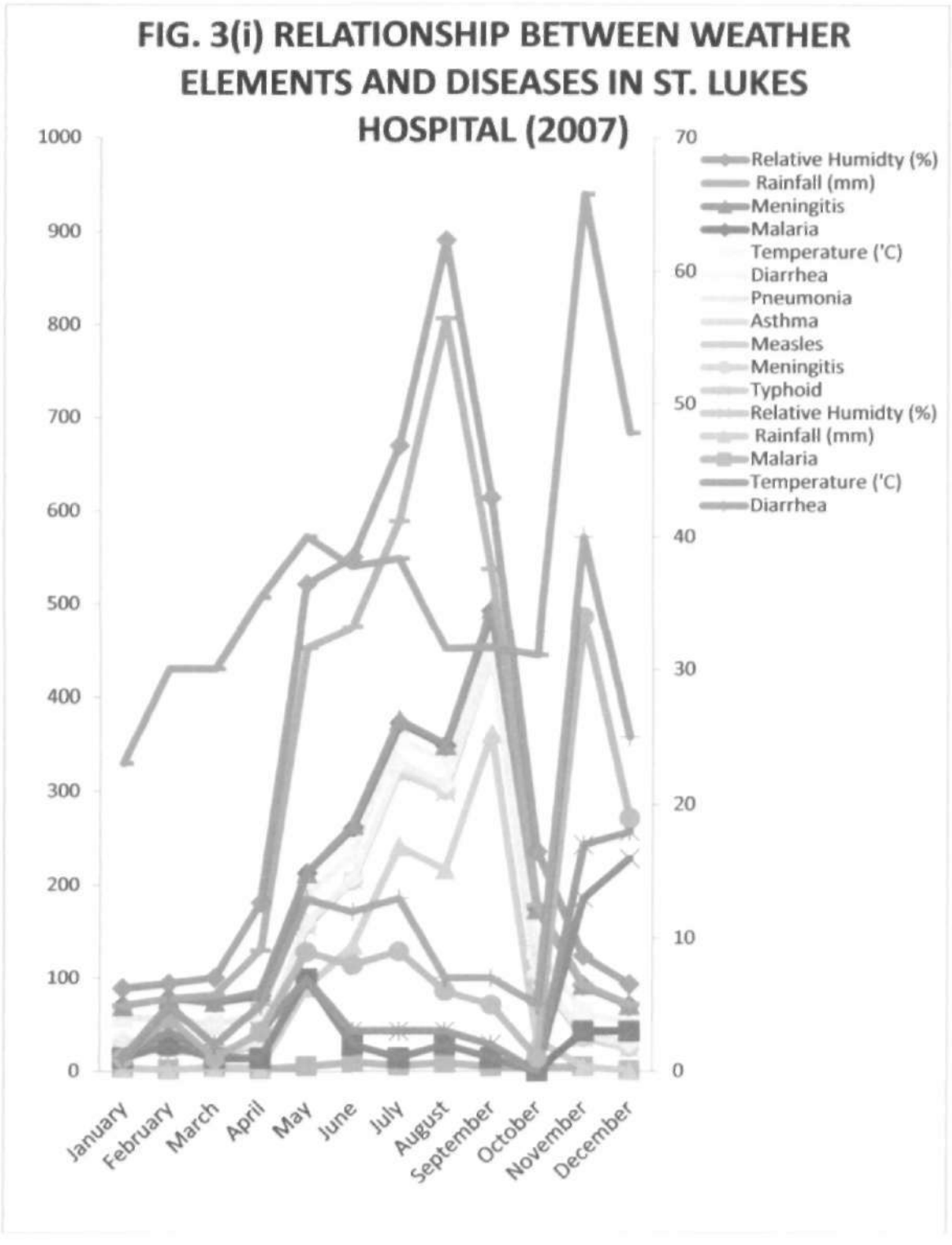

FIG. 3(c) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN ST. LUKES HOSPITAL (2001)
460
440
420
400
380
360
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
35
30
25
20
15
10
5
0
Relative Humidty (%)
Rainfall (mm)
Temperature (°C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
January
February
March
April
May
June
July
August
Septem...
October
Novem...
Decem...

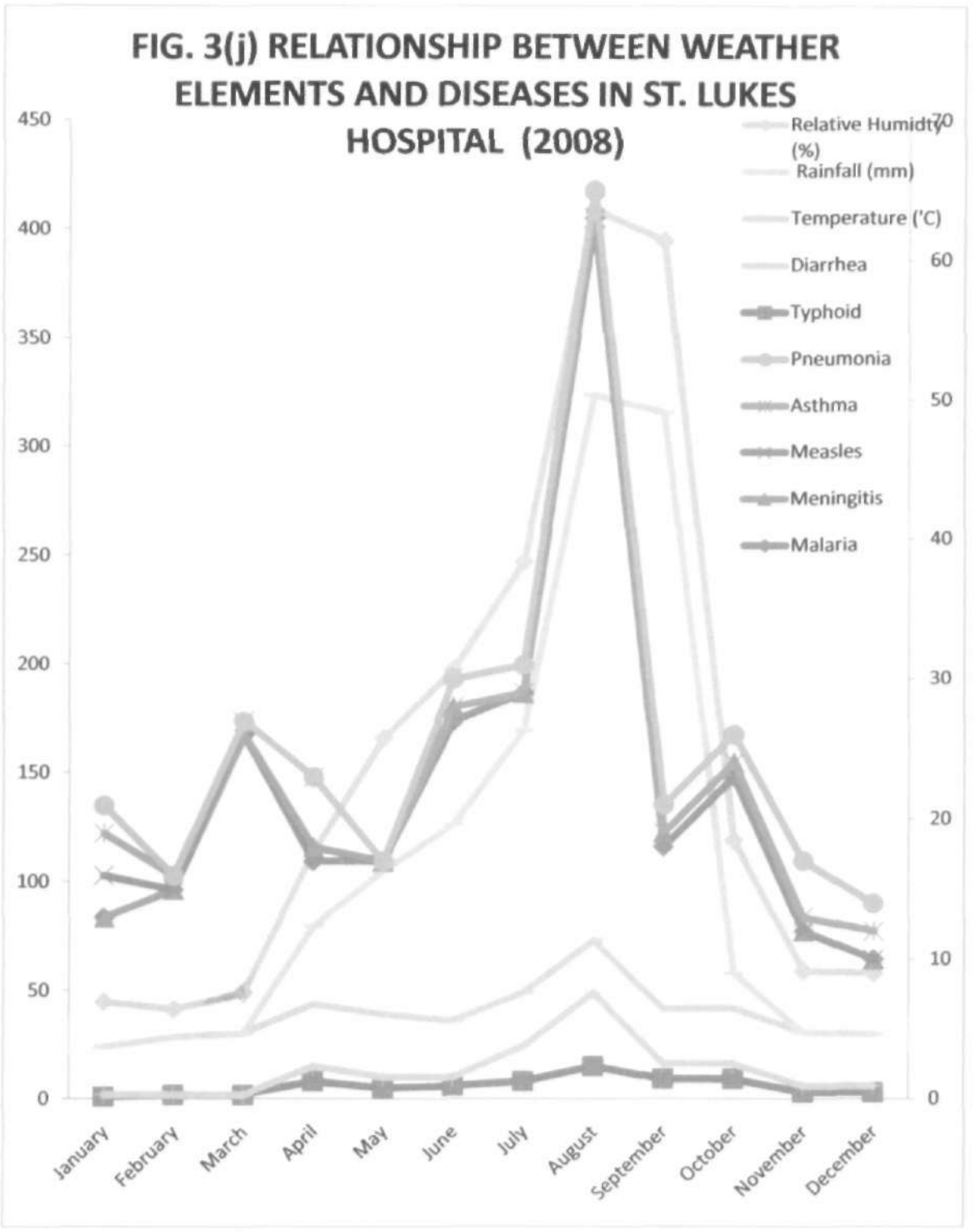

FIG. 3(d) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN ST. LUKES HOSPITAL (2002)
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
7
6
5
4
3
2
1
0
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Meningitis
Malaria
Diarrhea
Pneumonia
Asthma
Measles
Janu...
Febr...
March
April
May
June
July
Aug...
Sept...
Octo...
Nov...
Dece...


FIG. 3(f) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN ST. LUKES HOSPITAL (2004)
450
400
350
300
250
200
150
100
50
0
45
40
35
30
25
20
15
10
5
0
Relative Humidty (%)
Rainfall (mm)
Meningitis
Typhoid
Malaria
Temperature (°C)
Diarrhea
Pneumonia
Asthma
Measles
January
February
March
April
May
June
July
August
September
October
November
December

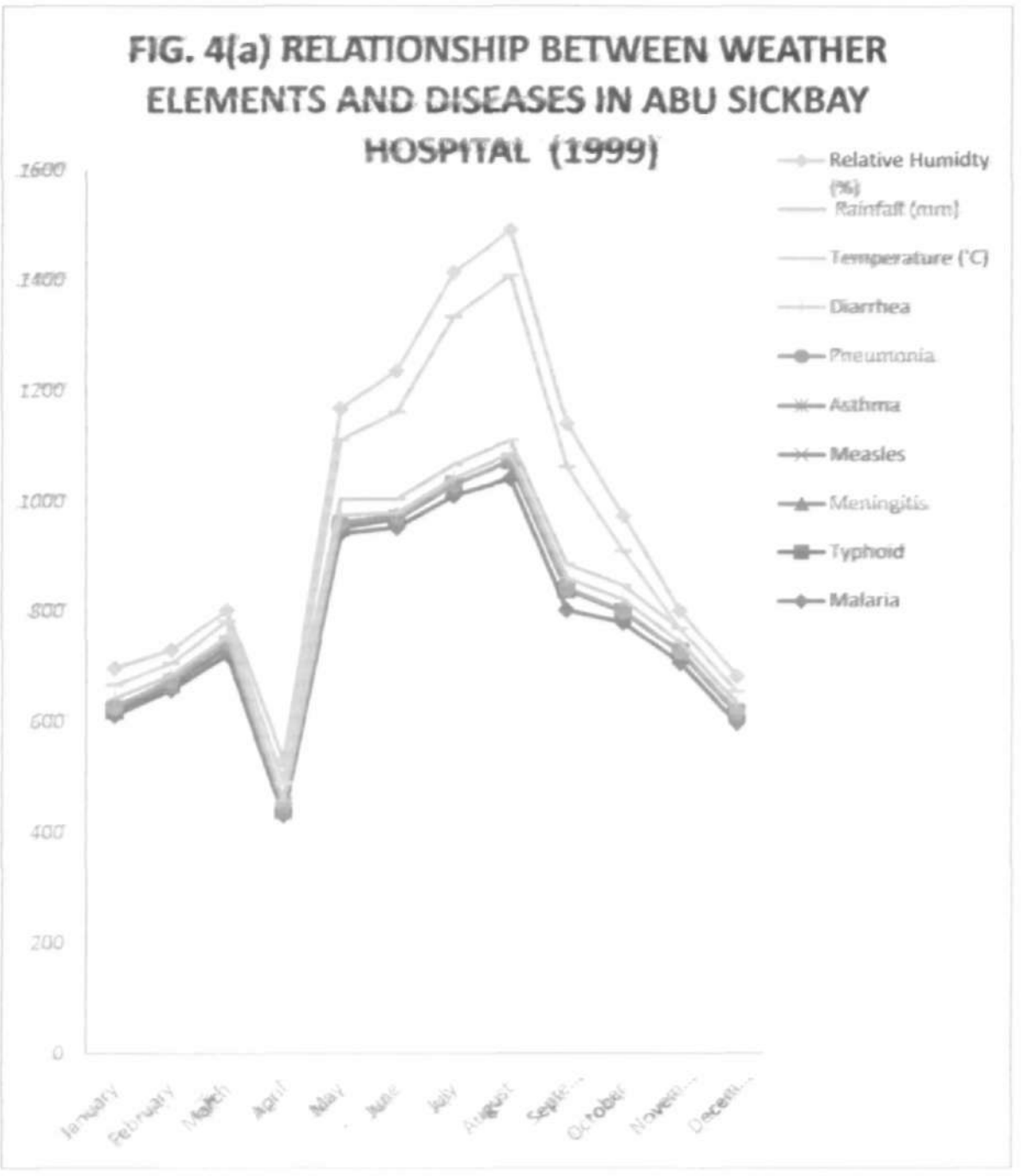

FIG. 3(g) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN ST. LUKES HOSPITAL (2005)
450
400
350
300
250
200
150
100
50
0
45
40
35
30
25
20
15
10
5
0
Relative Humidty (%)
Rainfall (mm)
Meningitis
Typhoid
Malaria
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
January
February
March
April
May
June
July
August
September
October
November
December

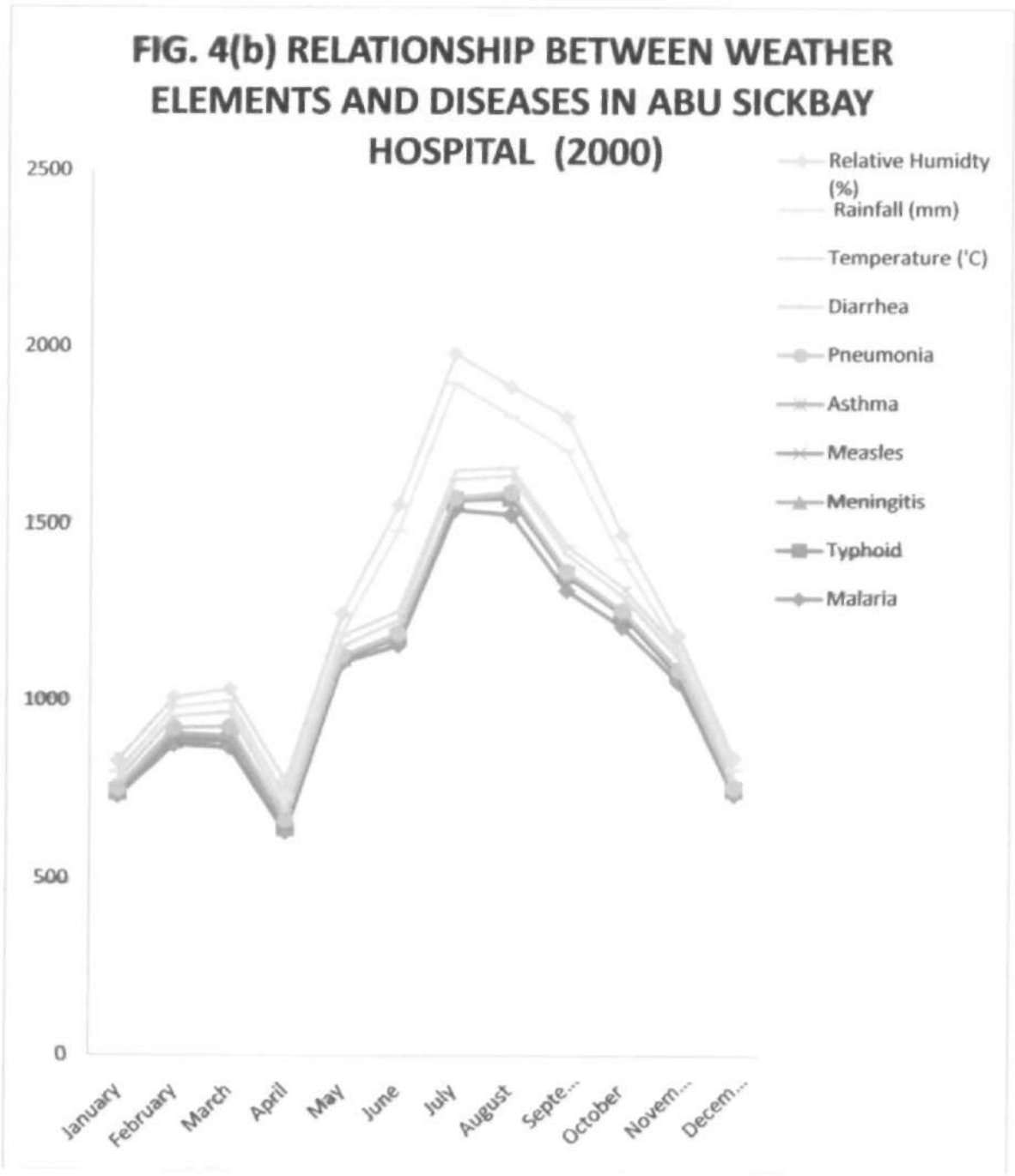

FIG. 3(h) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN ST. LUKES HOSPITAL (2006)
500
450
400
350
300
250
200
150
100
50
0
40
35
30
25
20
15
10
5
0
Relative Humidty (%)
Rainfall (mm)
Malaria
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
January
February
March
April
May
June
July
August
September
October
November
December

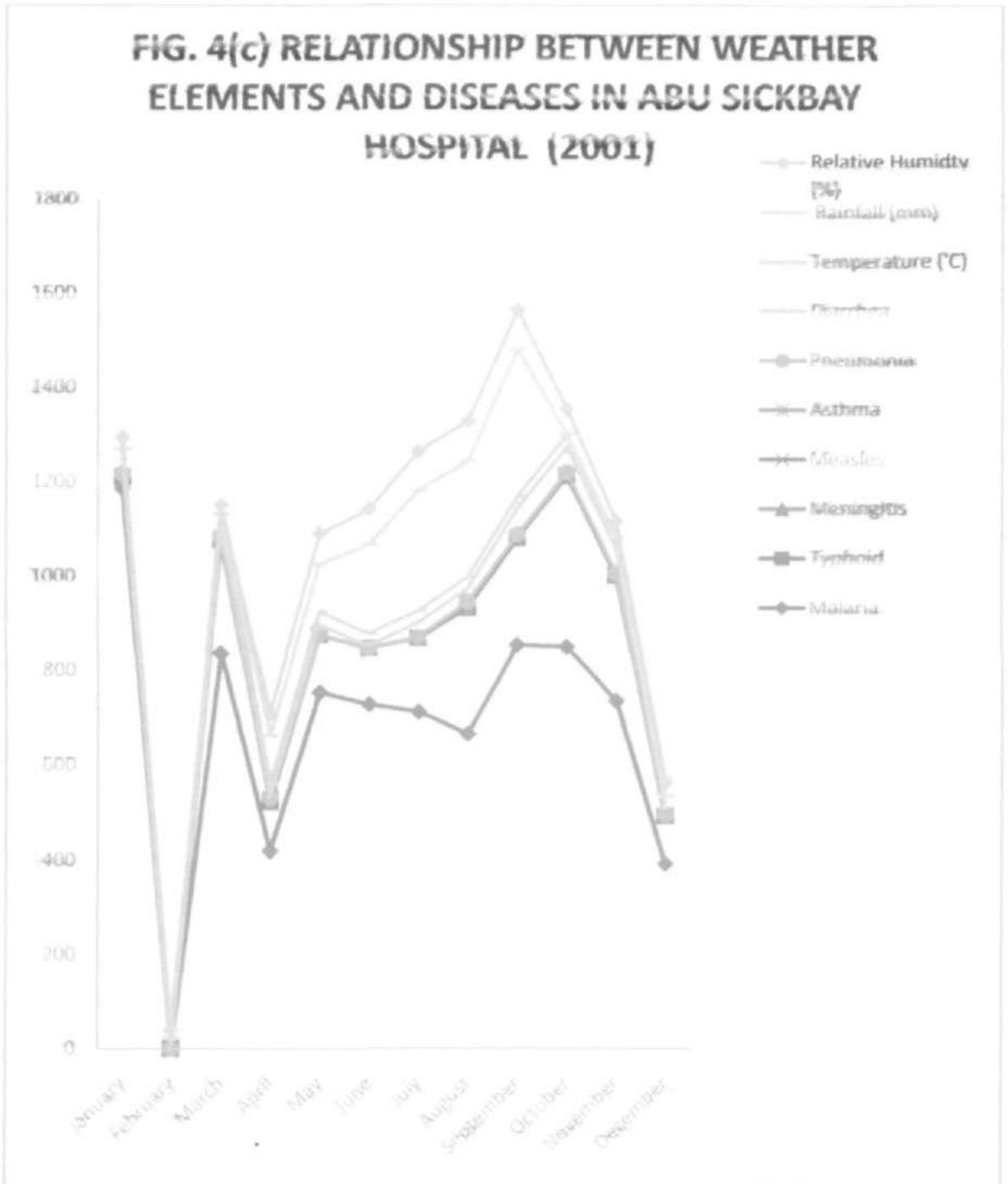

FIG. 3(i) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN ST. LUKES HOSPITAL (2007)
1000
900
800
700
600
500
400
300
200
100
0
70
60
50
40
30
20
10
0
Relative Humidty (%)
Rainfall (mm)
Meningitis
Malaria
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Relative Humidty (%)
Rainfall (mm)
Malaria
Temperature ('C)
Diarrhea
January
February
March
April
May
June
July
August
September
October
November
December

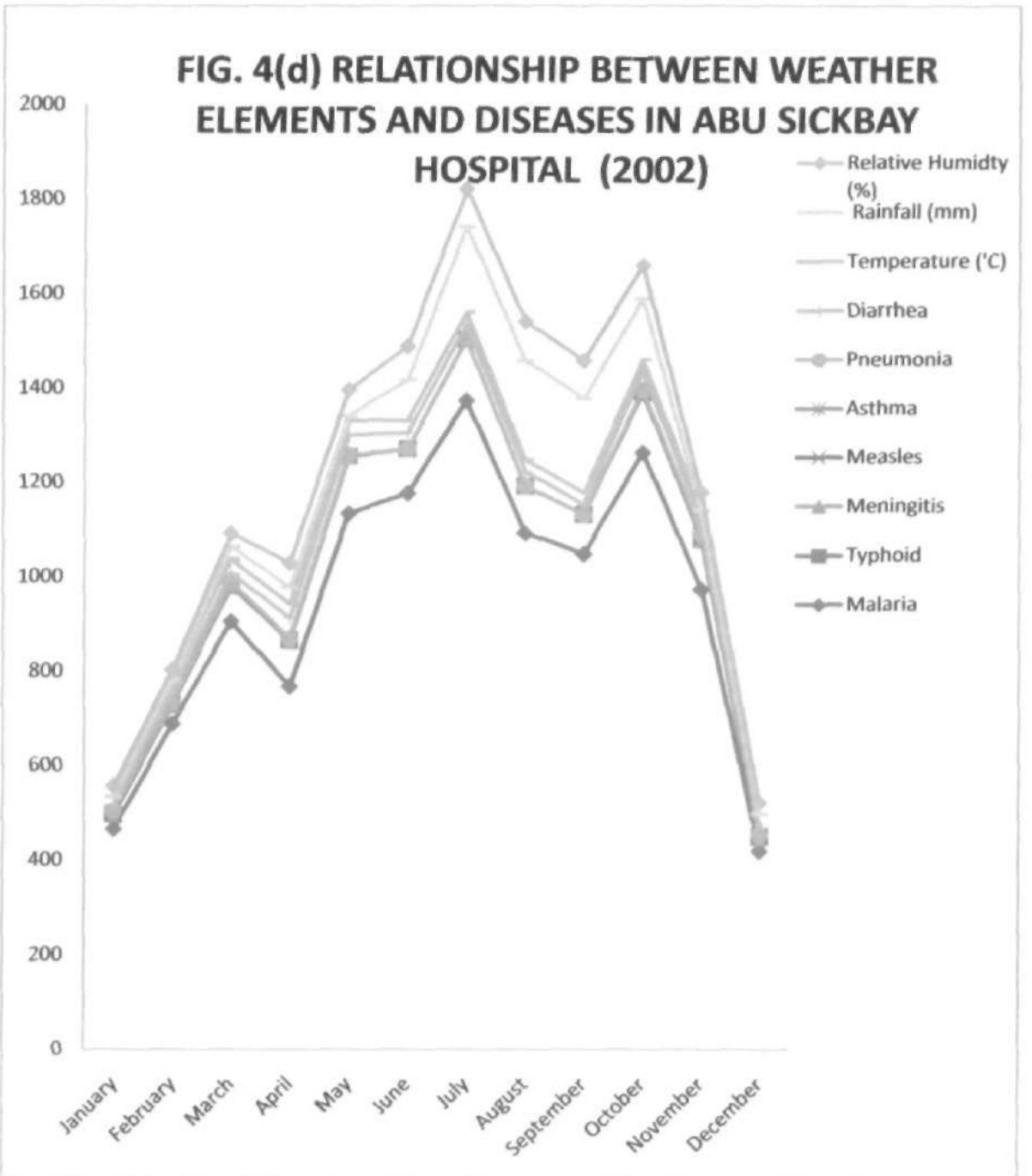

FIG. 3(j) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN ST. LUKES HOSPITAL (2008)
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Typhoid
Pneumonia
Asthma
Measles
Meningitis
Malaria
450
400
350
300
250
200
150
100
50
0
70
60
50
40
30
20
10
0
January
February
March
April
May
June
July
August
September
October
November
December

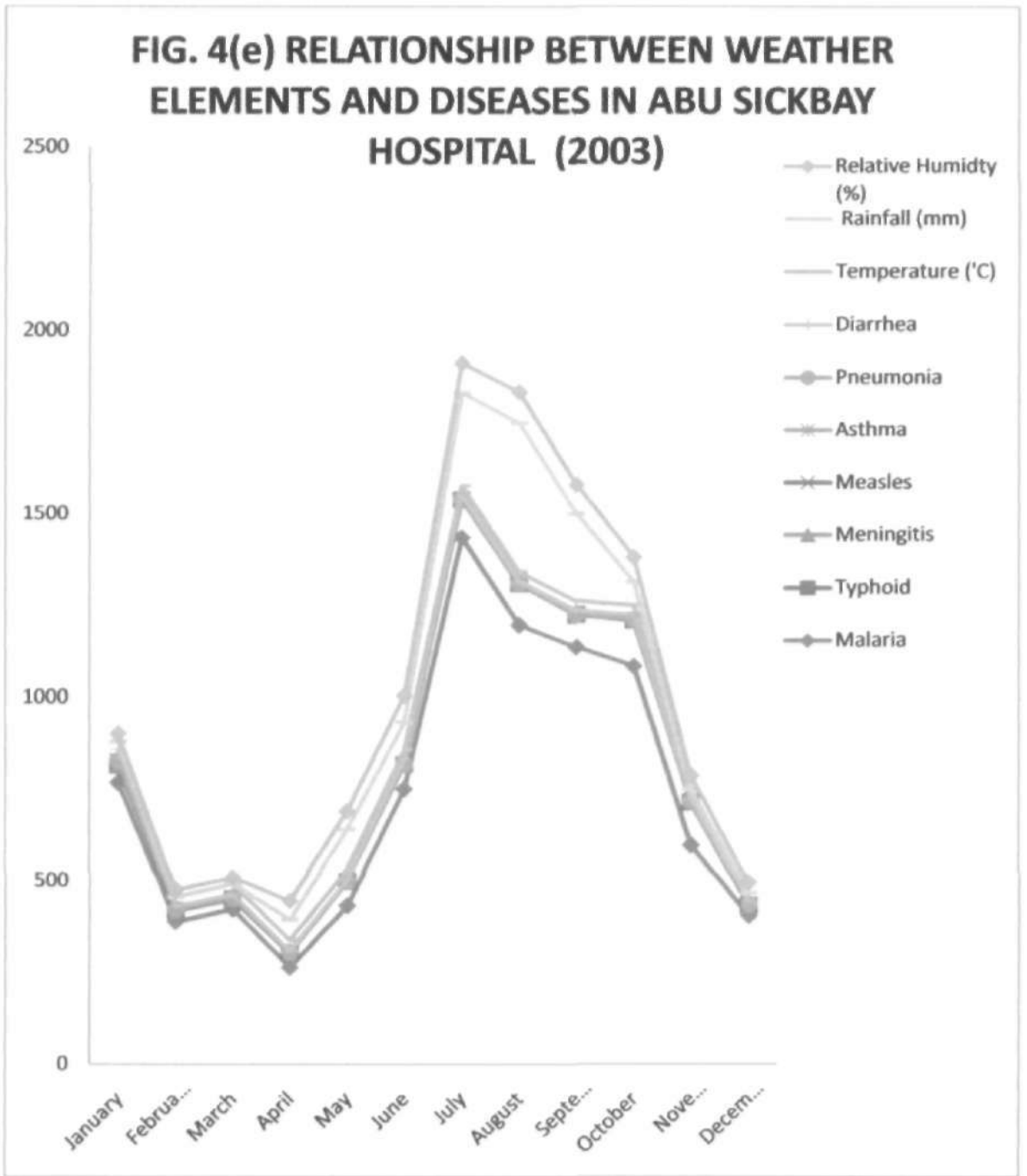
A.B.U Sickbay Samaru, established the occurrence of all the diseases with the highest number of occurrence of most of the disease among the studied hospitals except for meningitis which only occurred twice throughout the period of the study (two cases only in ten years).Malaria, typhoid and diarrhea occurred every month during the period of study. Measles showed a seasonal pattern of occurrence, it is most common during the dry season, while asthma and pneumonia do not show any seasonal pattern (Table 4.2.3, Fig. 4). Secondary axis was not created for graph of this hospital because of the large number of occurrence of most of the diseases and a conspicuous seasonal fluctuation of the relationship.

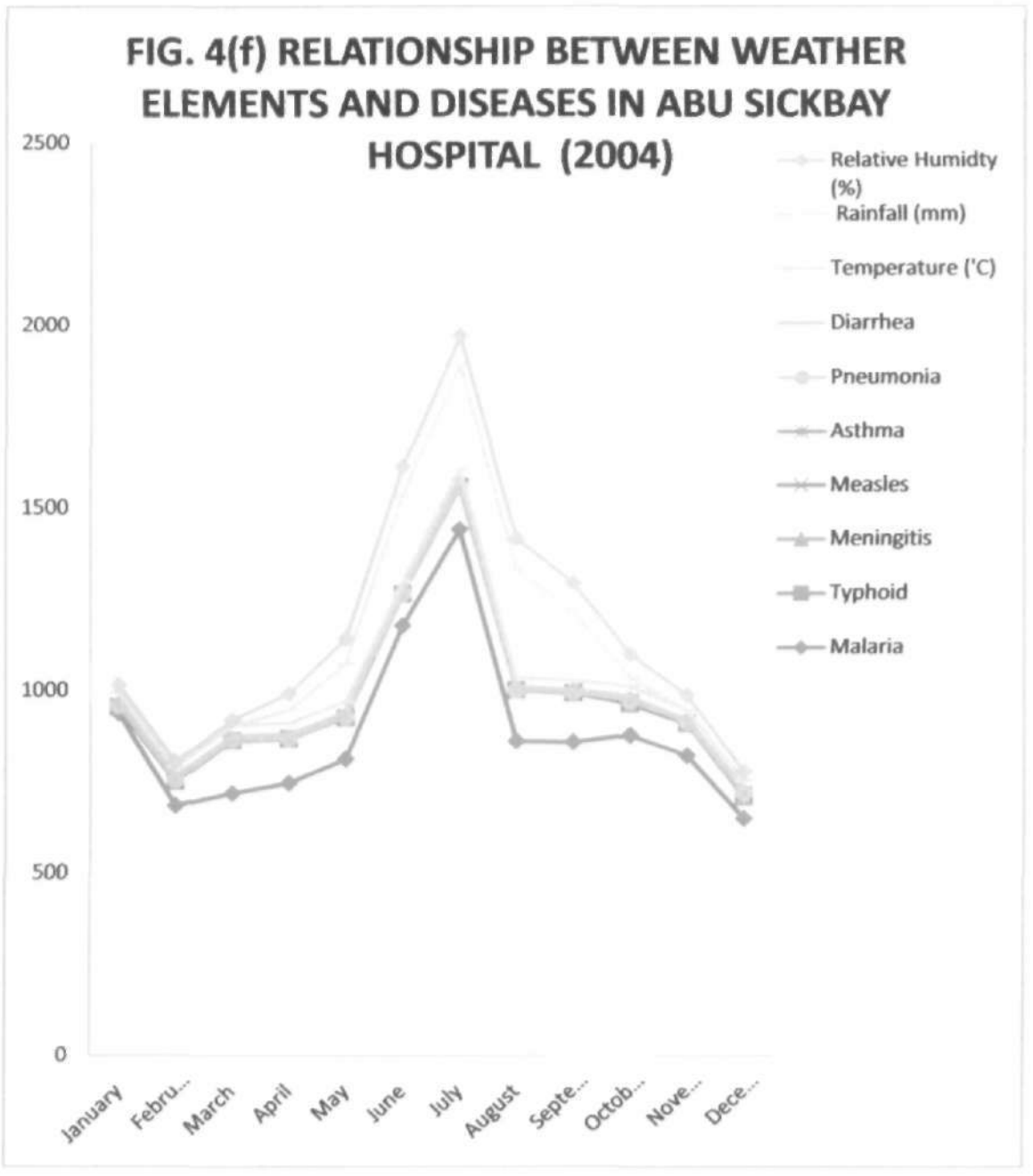

FIG. 4(a) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN ABU SICKBAY HOSPITAL (1999)
1600
1400
1200
1000
800
600
400
200
0
Relative Humidty (%)
Rainfall (mm)
Temperature (°C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
January
February
March
April
May
June
July
August
Septe...
October
Novem...
Decem...

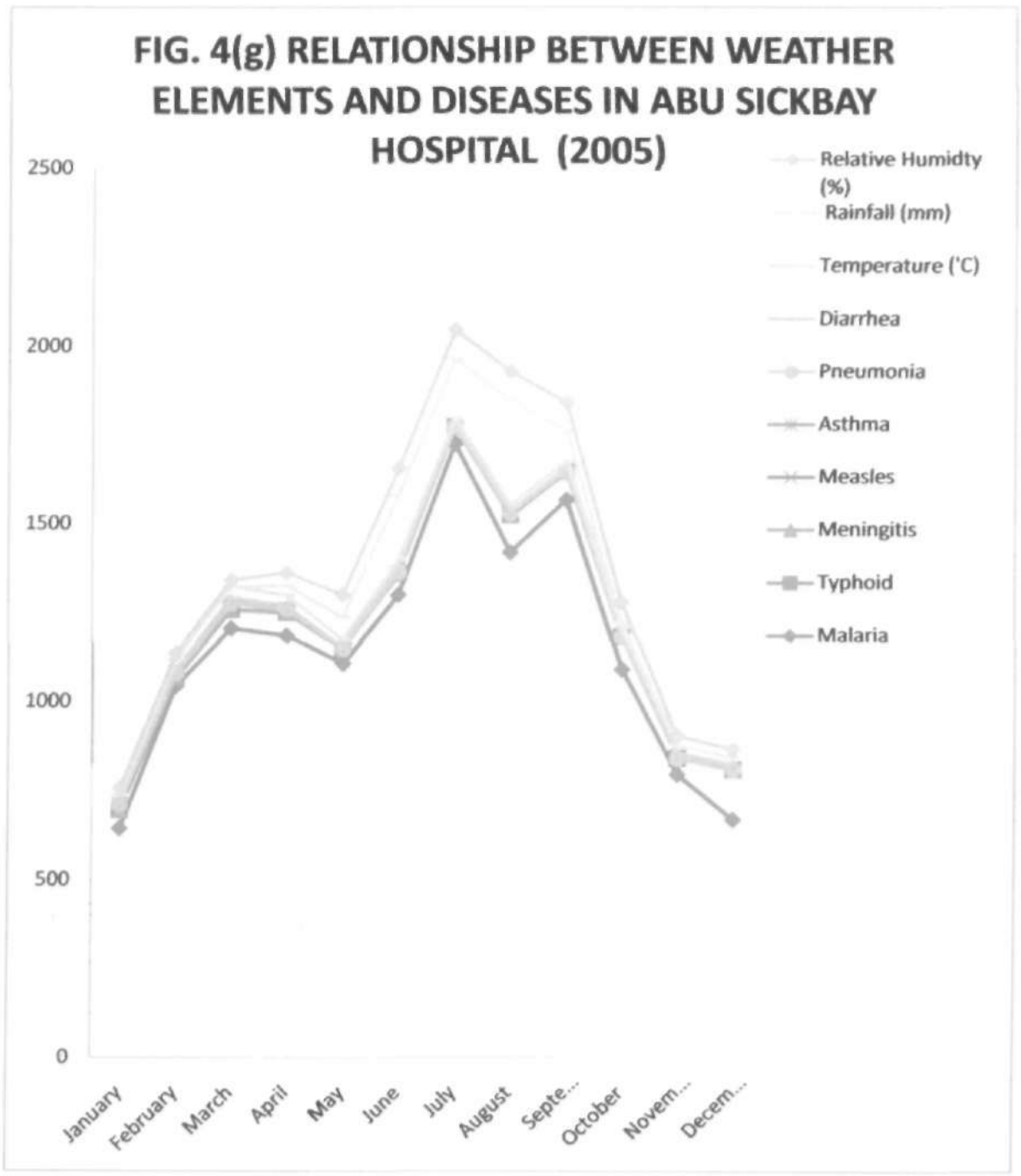

FIG. 4(b) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN ABU SICKBAY HOSPITAL (2000)
2500
2000
1500
1000
500
0
January
February
March
April
May
June
July
August
Septe...
October
Novem...
Decem...
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria

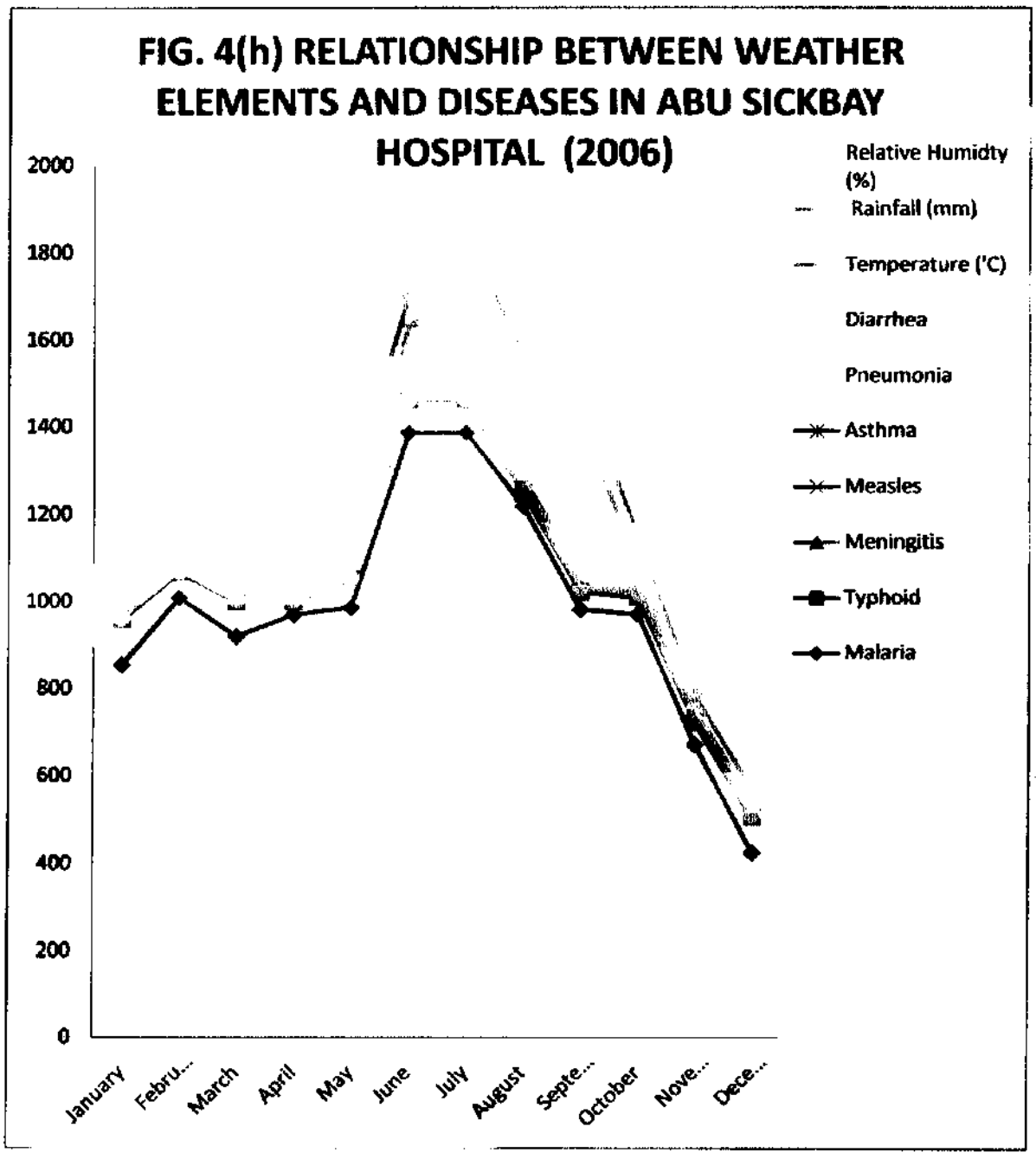

FIG. 4(c) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN ABU SICKBAY HOSPITAL (2001)
Relative Humidty (%)
Rainfall (mm)
Temperature (°C)
Diarrhoea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
1800
1600
1400
1200
1000
800
600
400
200
0
January
February
March
April
May
June
July
August
September
October
November
December

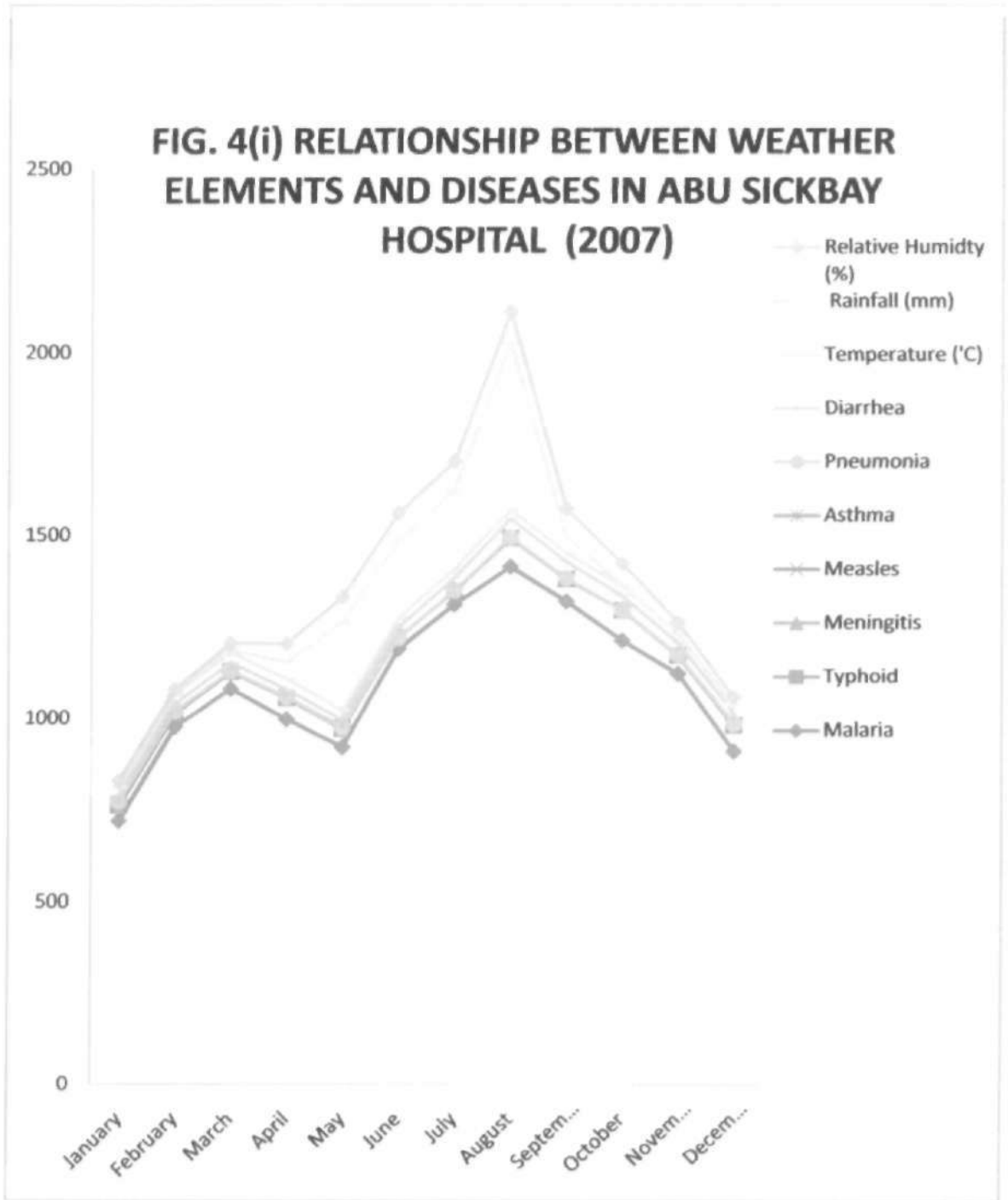

FIG. 4(d) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN ABU SICKBAY HOSPITAL (2002)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
January
February
March
April
May
June
July
August
September
October
November
December
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria

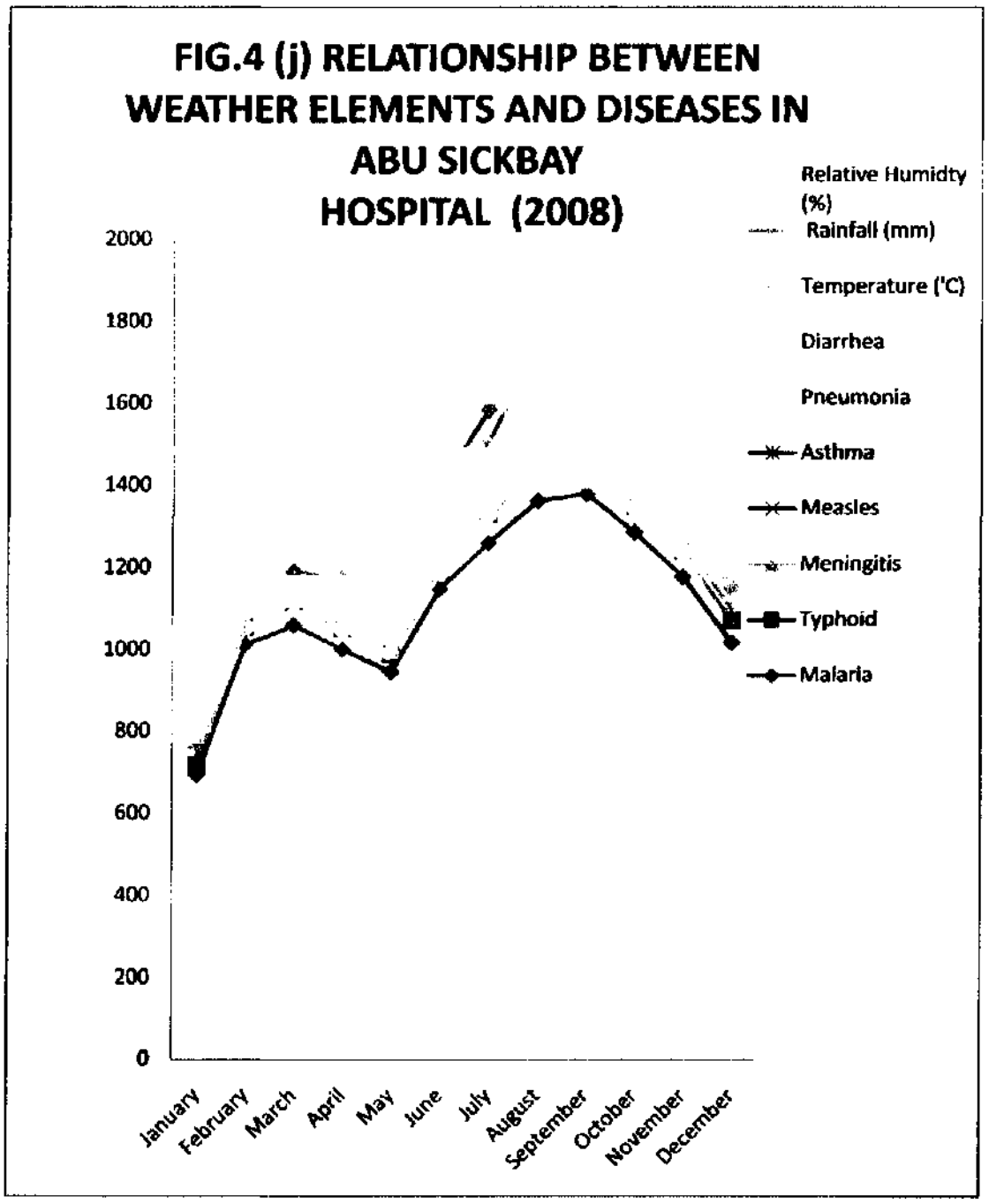

FIG. 4(e) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN ABU SICKBAY HOSPITAL (2003)
2500
2000
1500
1000
500
0
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
January
Februa...
March
April
May
June
July
August
Septe...
October
Nove...
Decem...


FIG. 4(f) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN ABU SICKBAY HOSPITAL (2004)
2500
2000
1500
1000
500
0
January
Febru...
March
April
May
June
July
August
Septe...
Octob...
Nove...
Dece...
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria

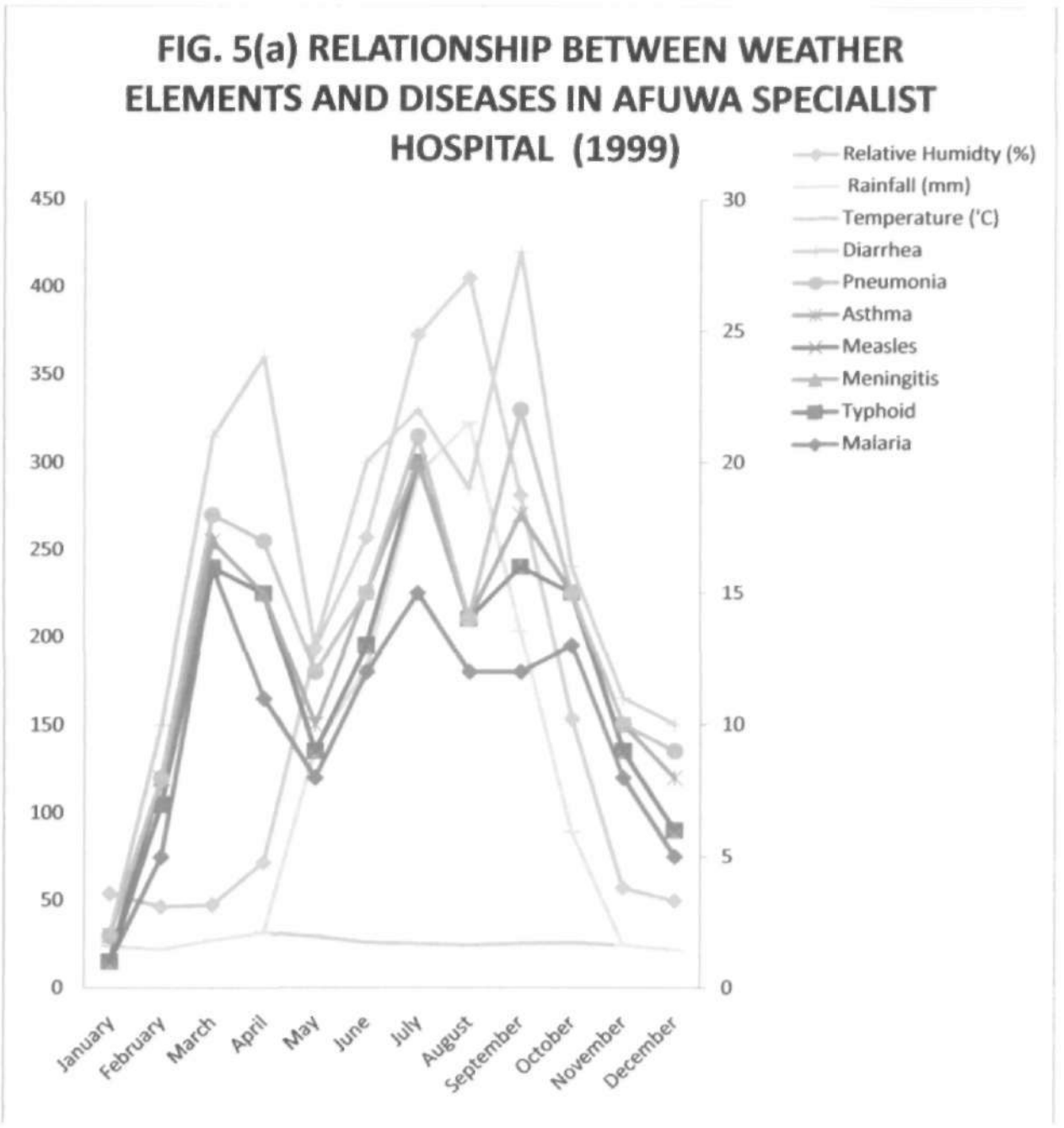

FIG. 4(g) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN ABU SICKBAY HOSPITAL (2005)
2500
2000
1500
1000
500
0
January
February
March
April
May
June
July
August
Septe...
October
Novem...
Decem...
Relative Humidty (%)
Rainfall (mm)
Temperature (°C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria

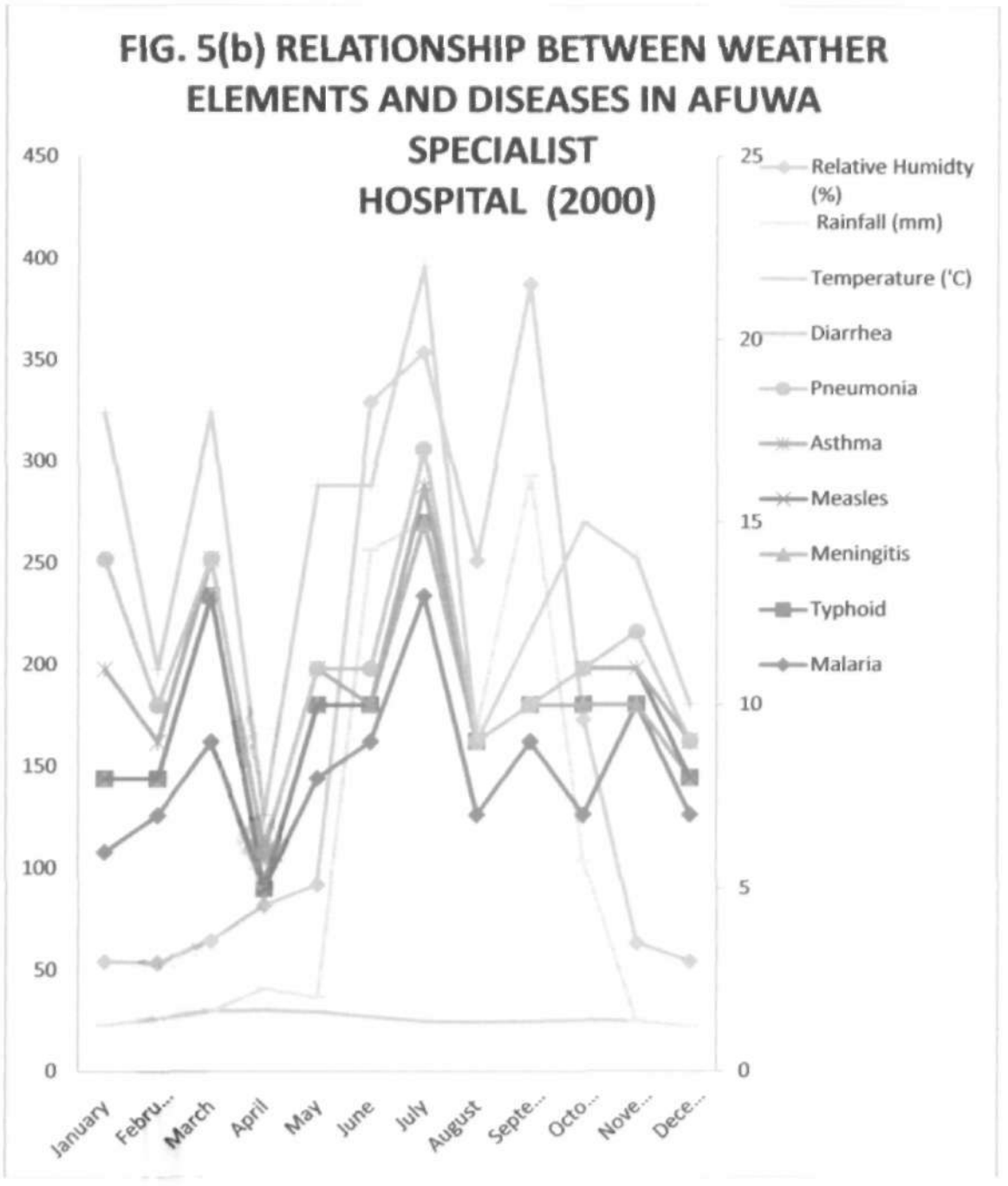

FIG. 4(h) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN ABU SICKBAY HOSPITAL (2006)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
January
Febru...
March
April
May
June
July
August
Septe...
October
Nove...
Dece...
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria

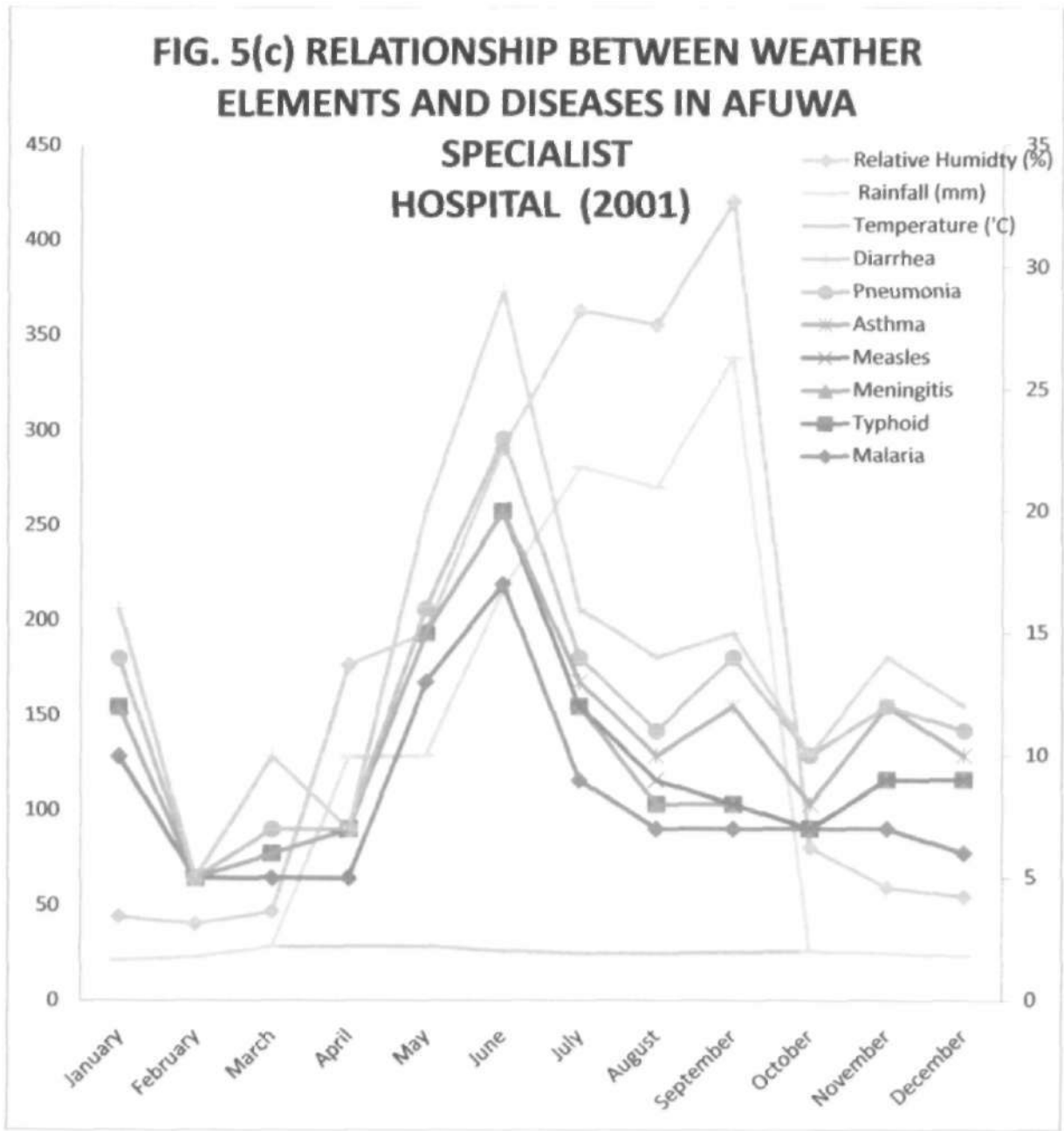

FIG. 4(i) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN ABU SICKBAY HOSPITAL (2007)
2500
2000
1500
1000
500
0
January
February
March
April
May
June
July
August
Septem...
October
Novem...
Decem...
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria

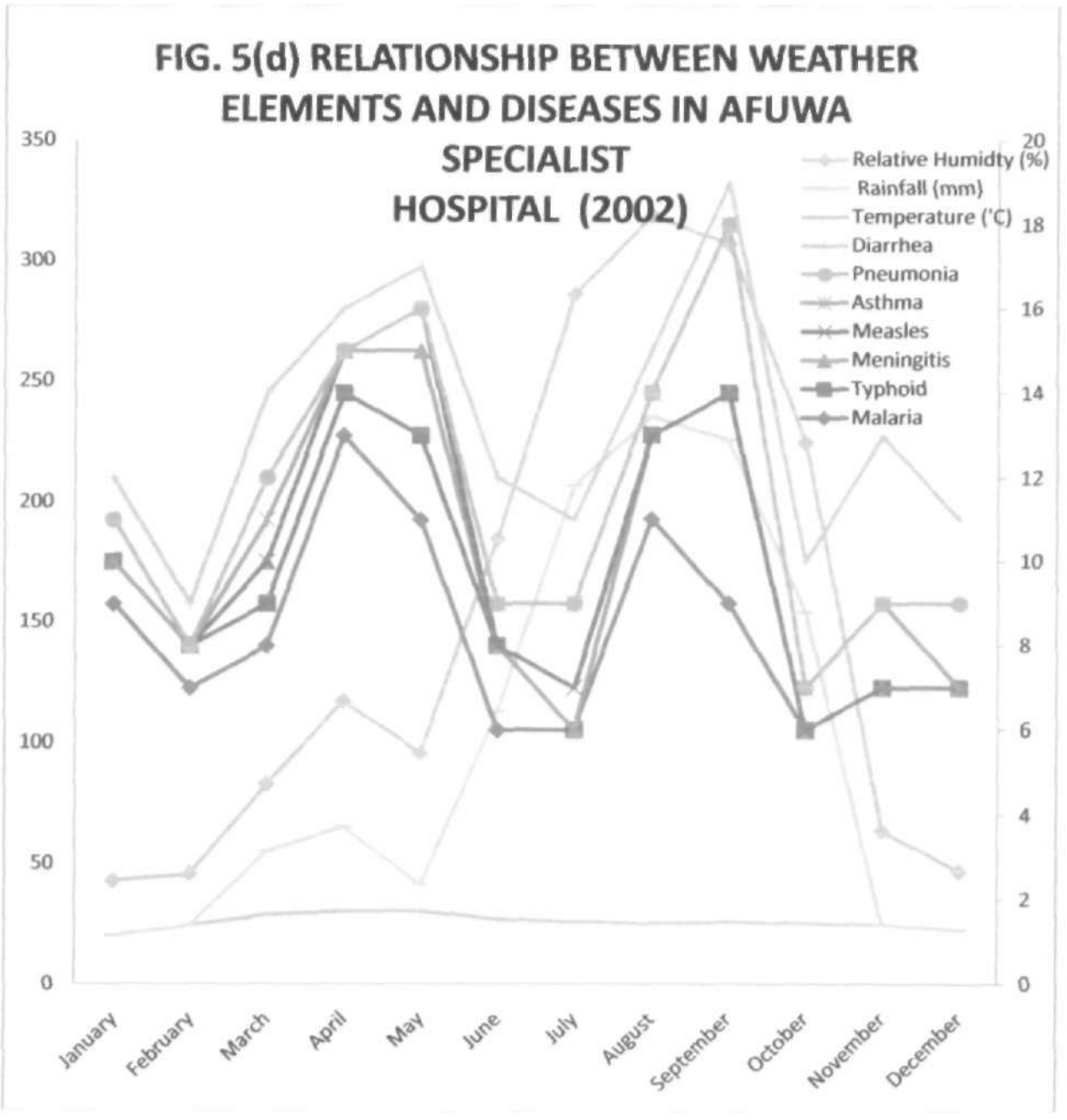

FIG.4 (j) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN ABU SICKBAY HOSPITAL (2008)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
January
February
March
April
May
June
July
August
September
October
November
December
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria

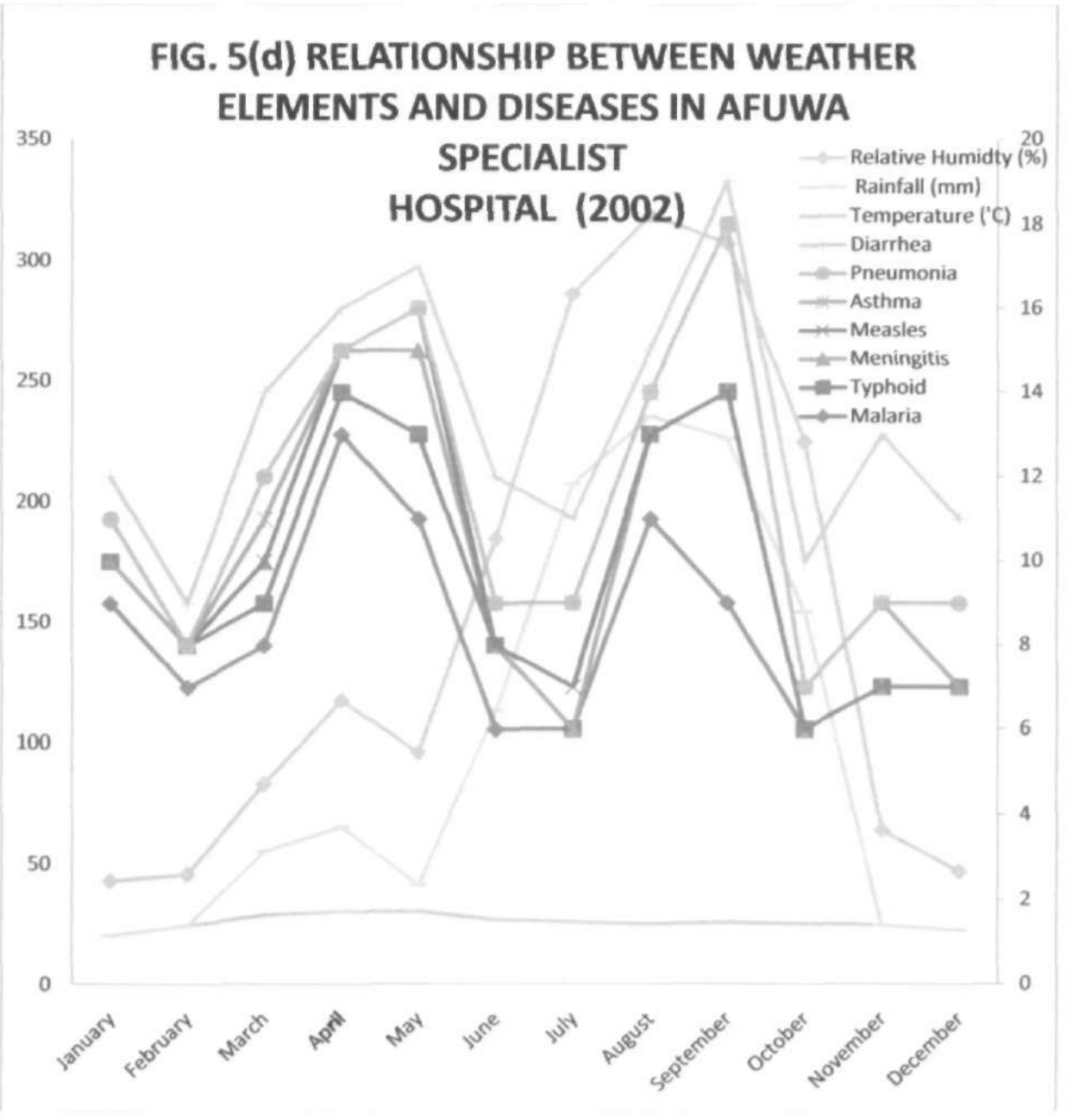
Afuwa Hospital Tudun Wada, also established the occurrence of all the diseases. Malaria occurred throughout the months of the years of study. Typhoid and diarrhea occurred almost throughout the months of the study. Meningitis was seasonal while measles, asthma and pneumonia were not. (Table 4.2.4, Fig. 5). Secondary axis was created for the graphs to project the visibility of most of those with low number of occurrence.

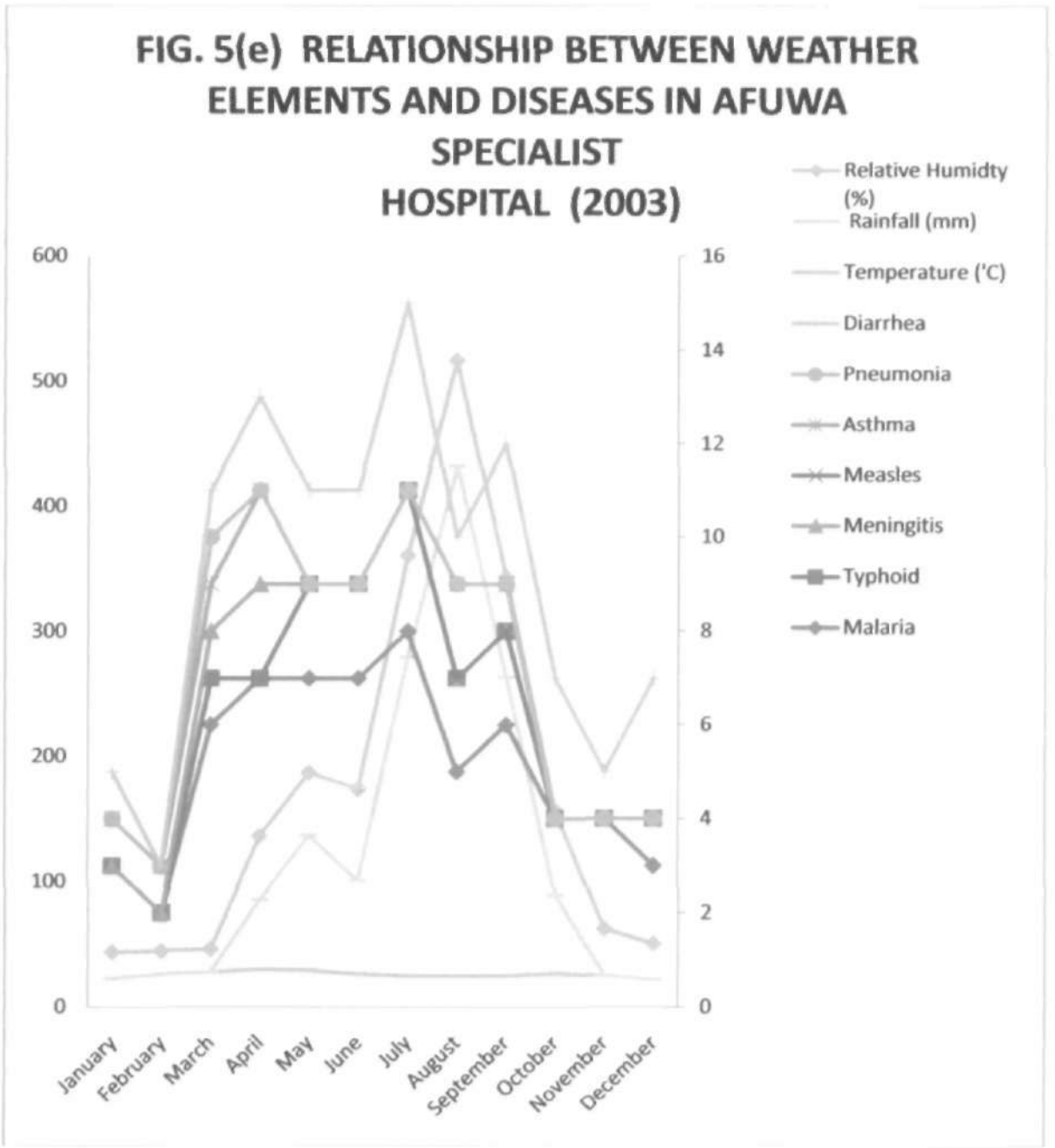

FIG. 5(a) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN AFUWA SPECIALIST HOSPITAL (1999)
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
450
400
350
300
250
200
150
100
50
0
30
25
20
15
10
5
0
January
February
March
April
May
June
July
August
September
October
November
December

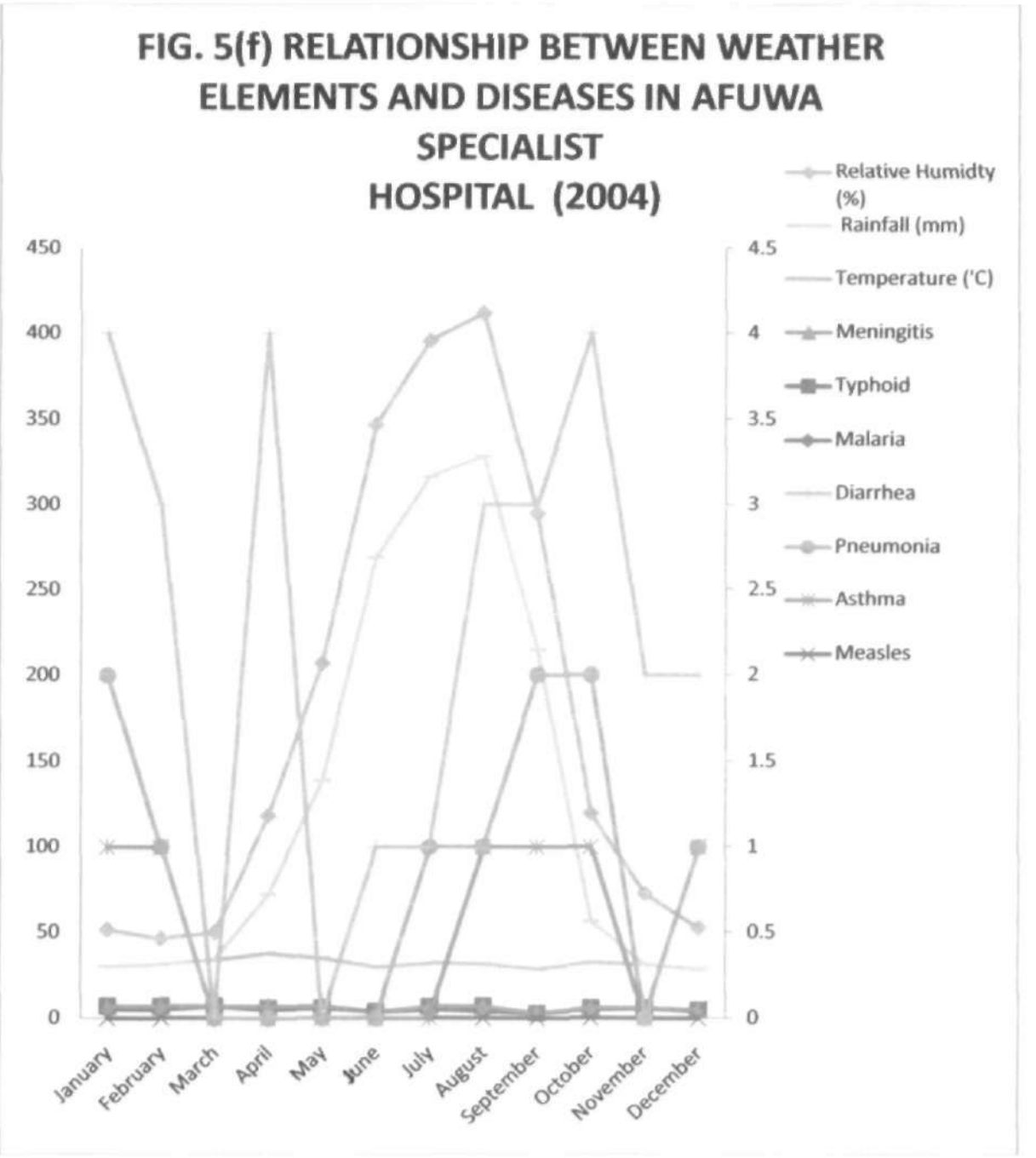

FIG. 5(b) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN AFUWA SPECIALIST HOSPITAL (2000)
450
400
350
300
250
200
150
100
50
0
25
20
15
10
5
0
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
January
Febru...
March
April
May
June
July
August
Septe...
Octo...
Nove...
Dece...

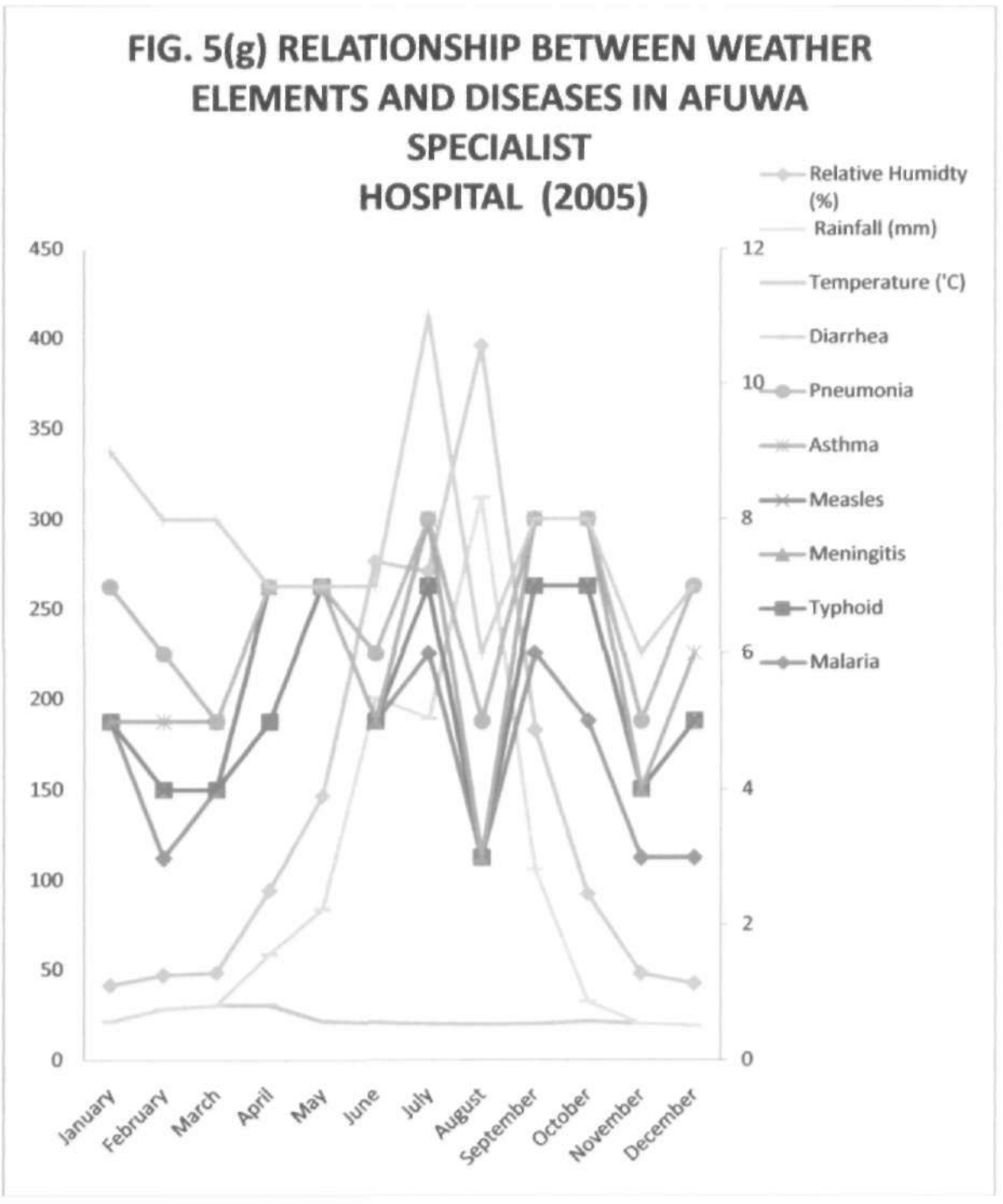

FIG. 5(c) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN AFUWA SPECIALIST HOSPITAL (2001)
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
450
400
350
300
250
200
150
100
50
0
35
30
25
20
15
10
5
0
January
February
March
April
May
June
July
August
September
October
November
December

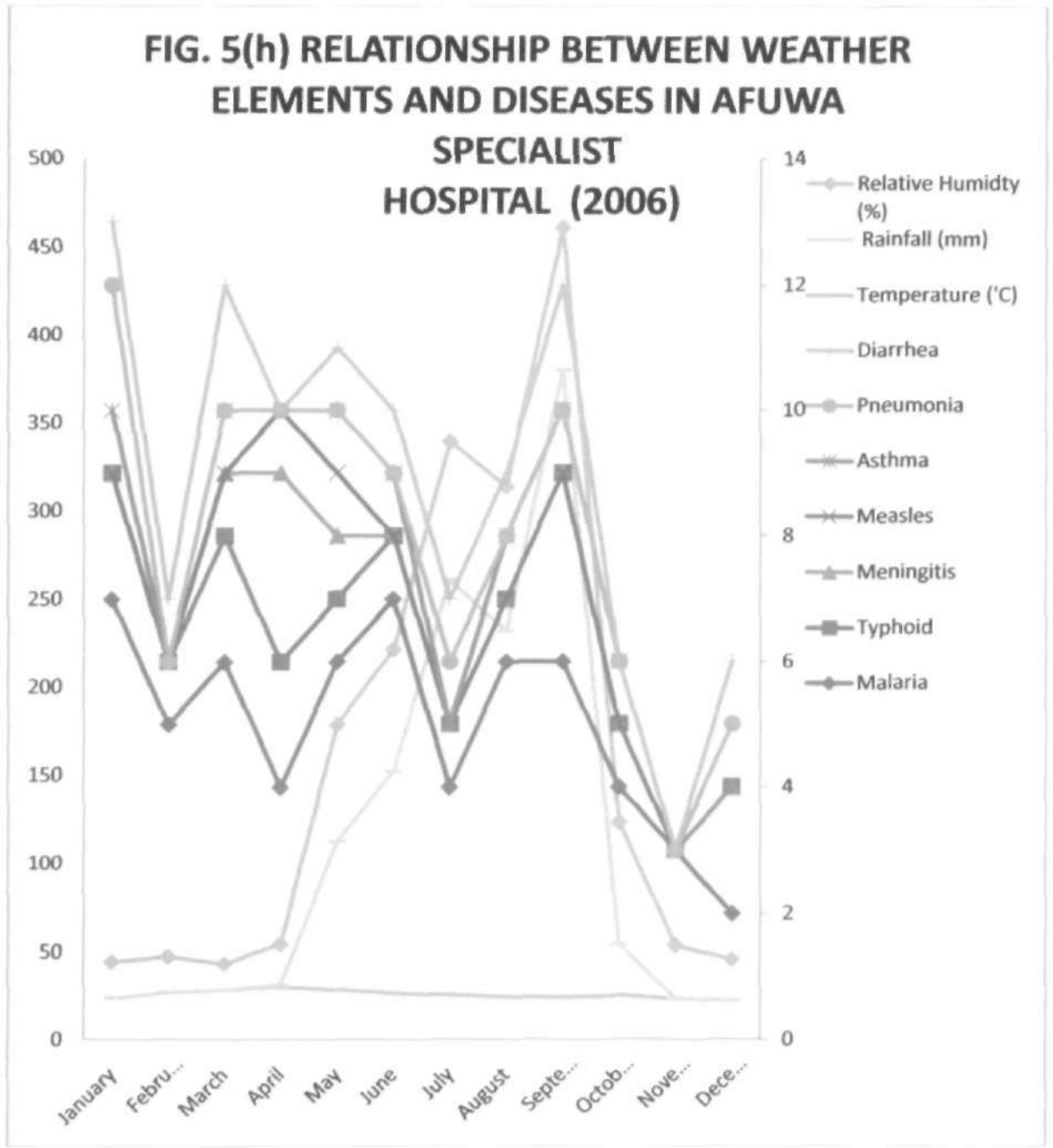

FIG. 5(d) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN AFUWA SPECIALIST HOSPITAL (2002)
Relative Humidty (%)
Rainfall (mm)
Temperature (°C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
350
300
250
200
150
100
50
0
20
18
16
14
12
10
8
6
4
2
0
January
February
March
April
May
June
July
August
September
October
November
December

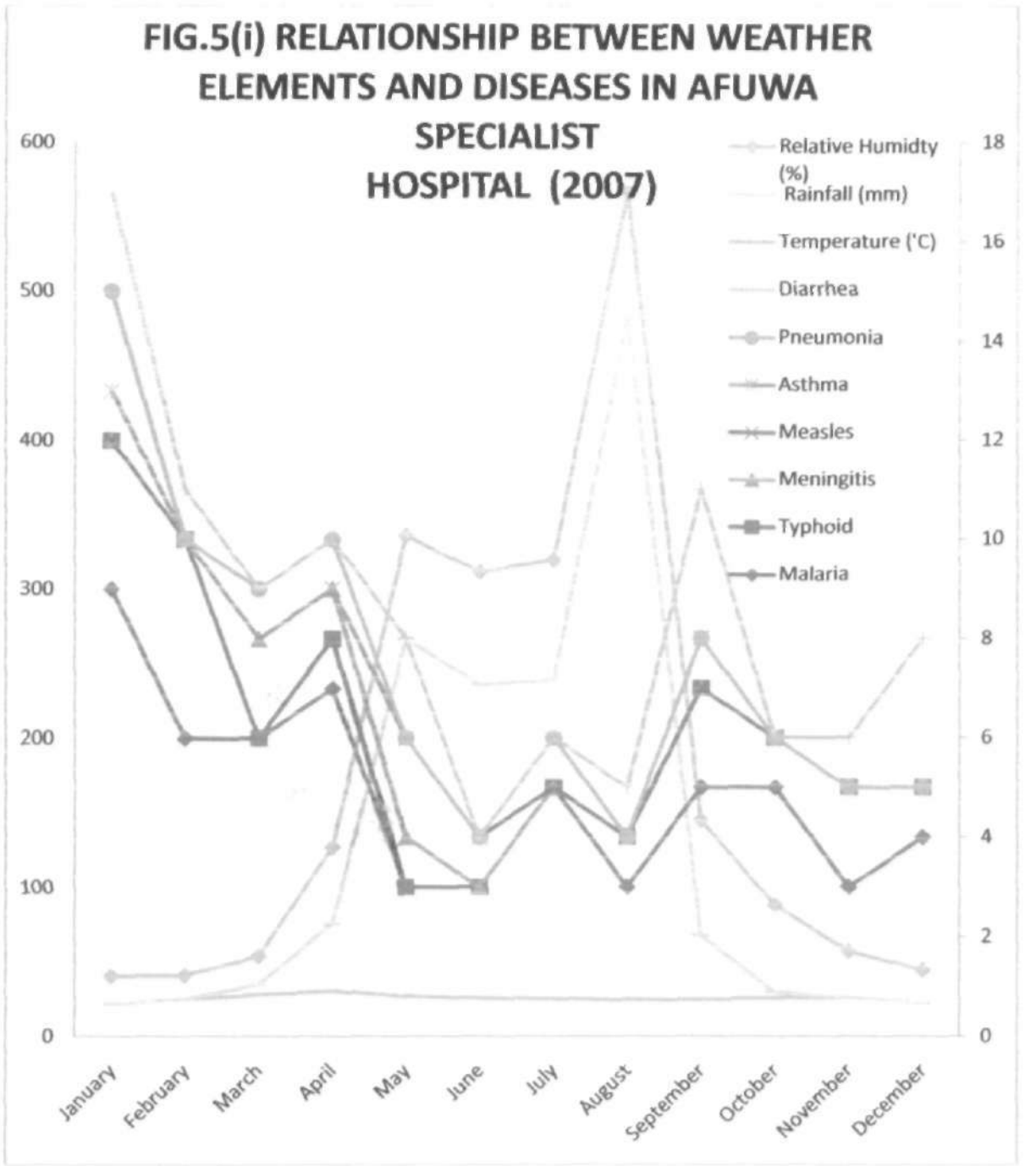

FIG. 5(d) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN AFUWA SPECIALIST HOSPITAL (2002)
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
350
300
250
200
150
100
50
0
20
18
16
14
12
10
8
6
4
2
0
January
February
March
April
May
June
July
August
September
October
November
December

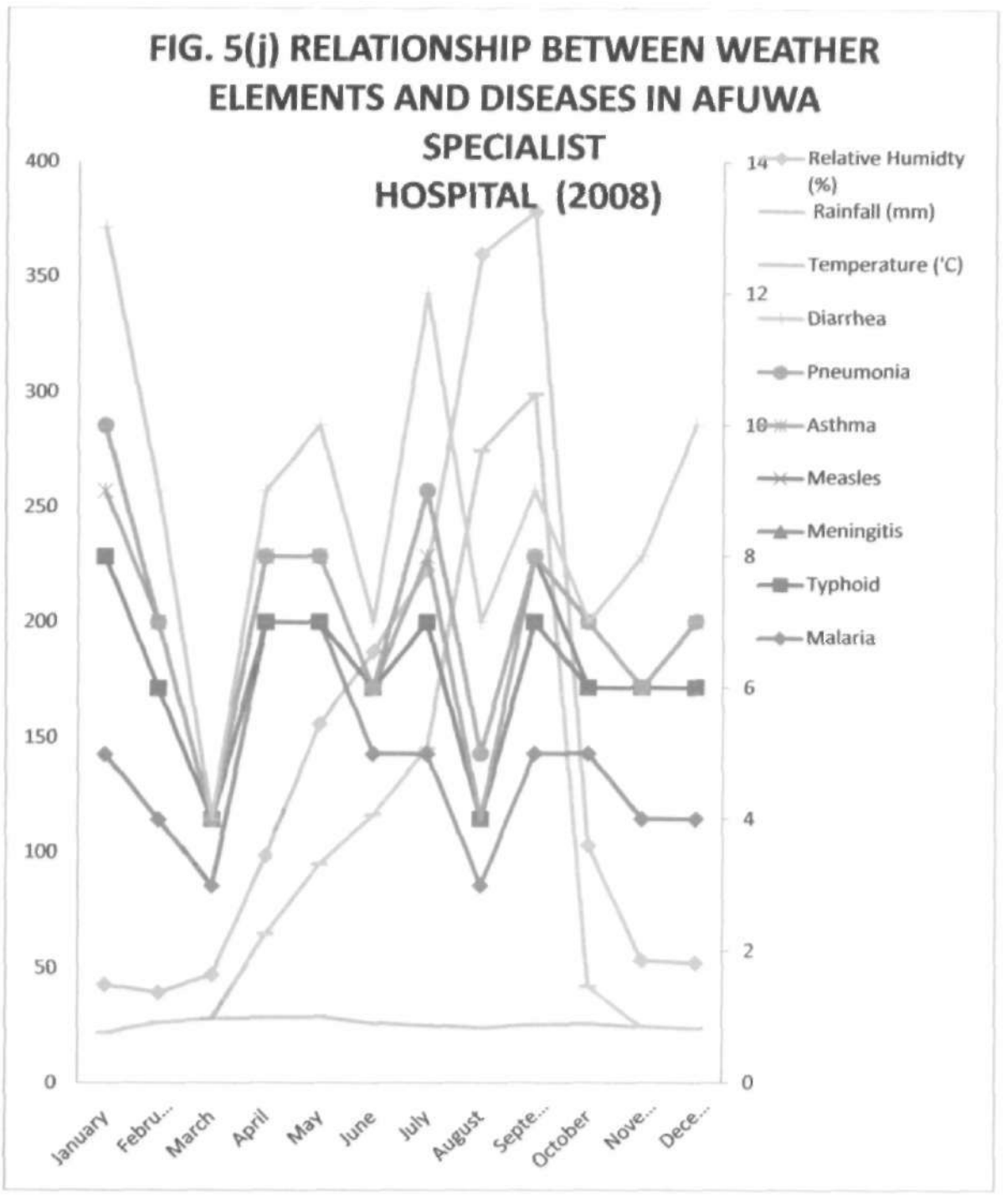

FIG. 5(e) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN AFUWA SPECIALIST HOSPITAL (2003)
Relative Humidty (%)
Rainfall (mm)
Temperature (°C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
600
500
400
300
200
100
0
16
14
12
10
8
6
4
2
0
January
February
March
April
May
June
July
August
September
October
November
December


FIG. 5(f) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN AFUWA SPECIALIST HOSPITAL (2004)
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Meningitis
Typhoid
Malaria
Diarrhea
Pneumonia
Asthma
Measles
450
400
350
300
250
200
150
100
50
0
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
January
February
March
April
May
June
July
August
September
October
November
December

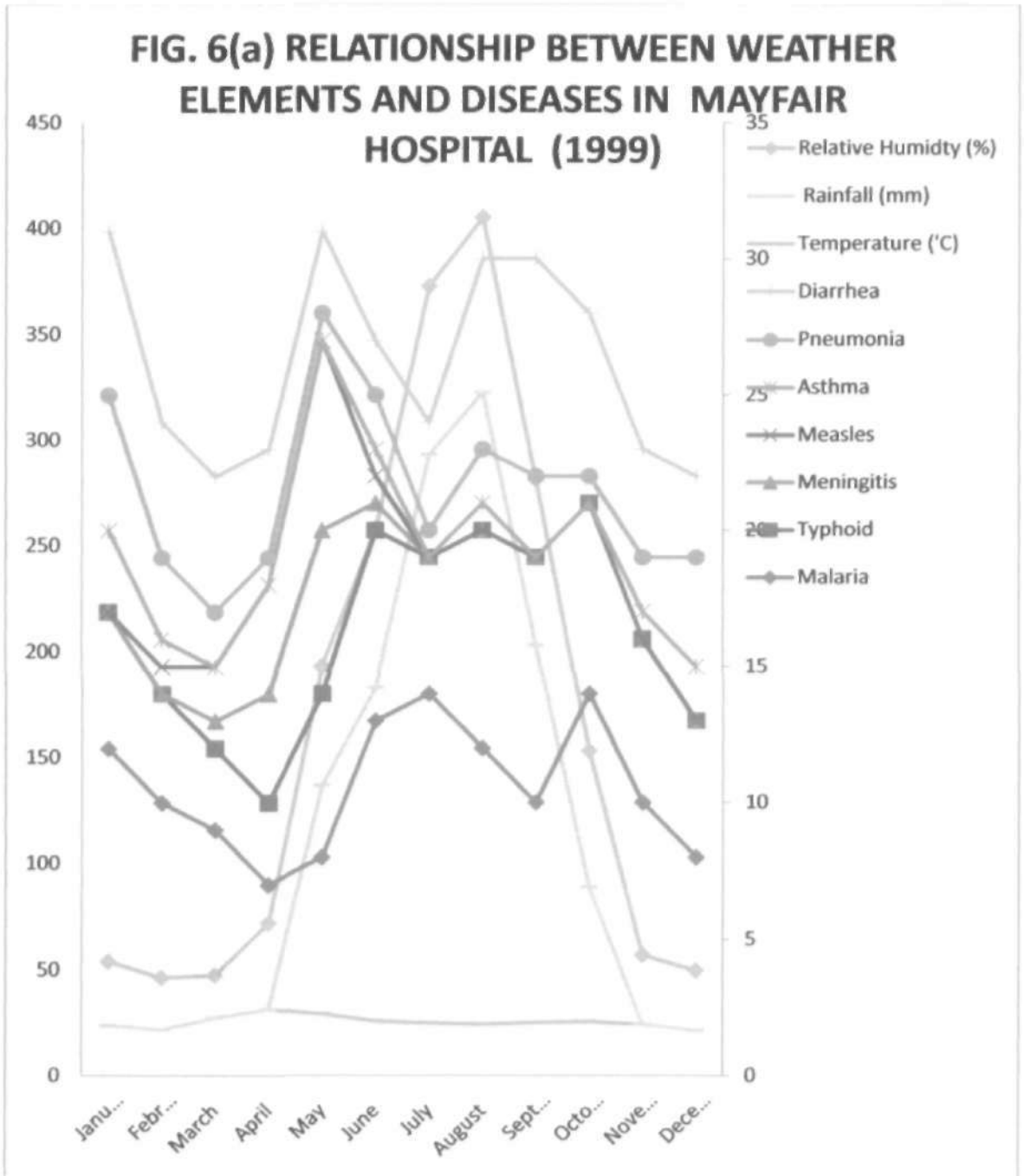

FIG. 5(g) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN AFUWA SPECIALIST HOSPITAL (2005)
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
450
400
350
300
250
200
150
100
50
0
12
10
8
6
4
2
0
January
February
March
April
May
June
July
August
September
October
November
December

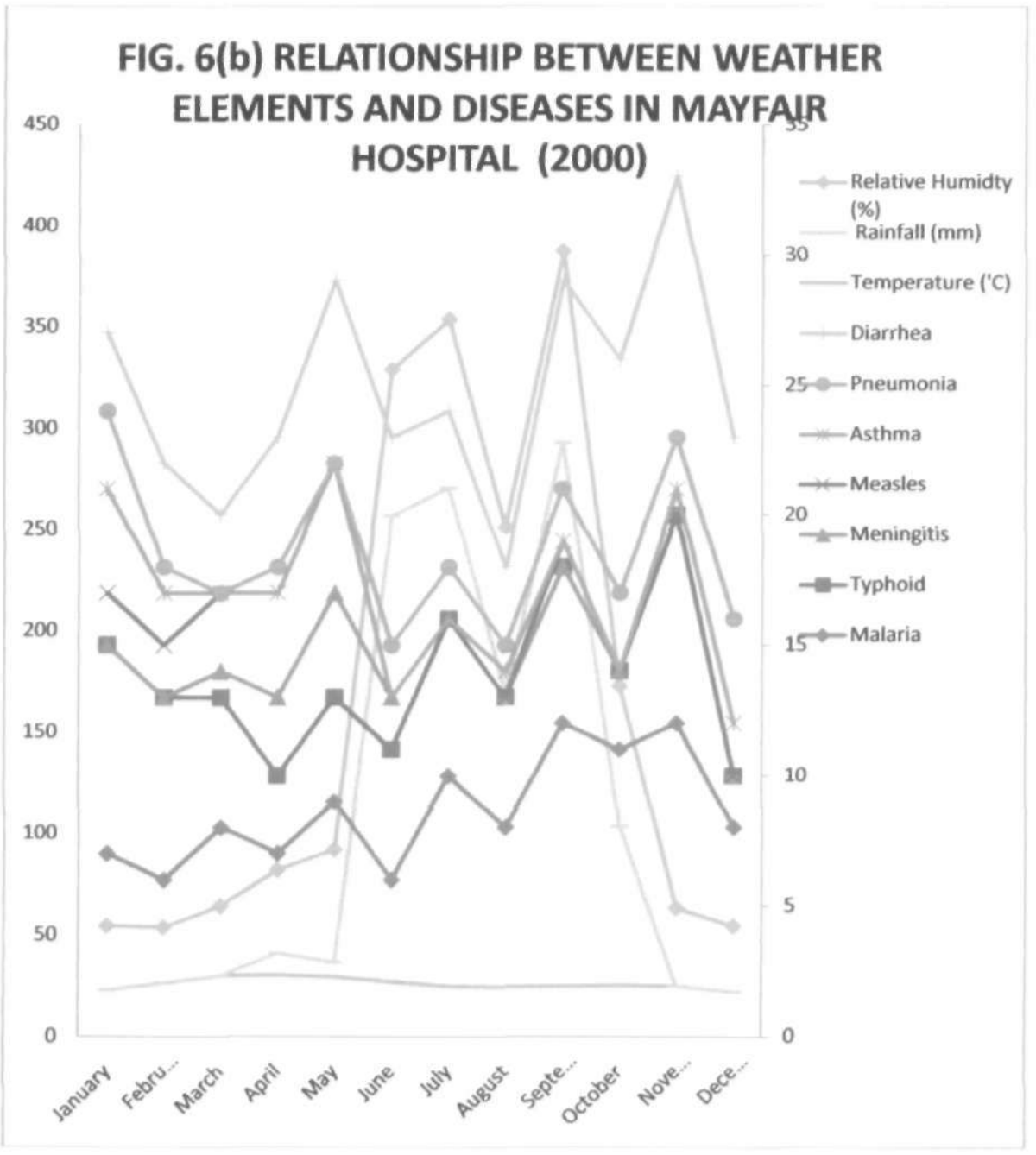

FIG. 5(h) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN AFUWA SPECIALIST HOSPITAL (2006)
500
450
400
350
300
250
200
150
100
50
0
14
12
10
8
6
4
2
0
Relative Humidty (%)
Rainfall (mm)
Temperature (°C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
January
Febru...
March
April
May
June
July
August
Septe...
Octob...
Nove...
Dece...

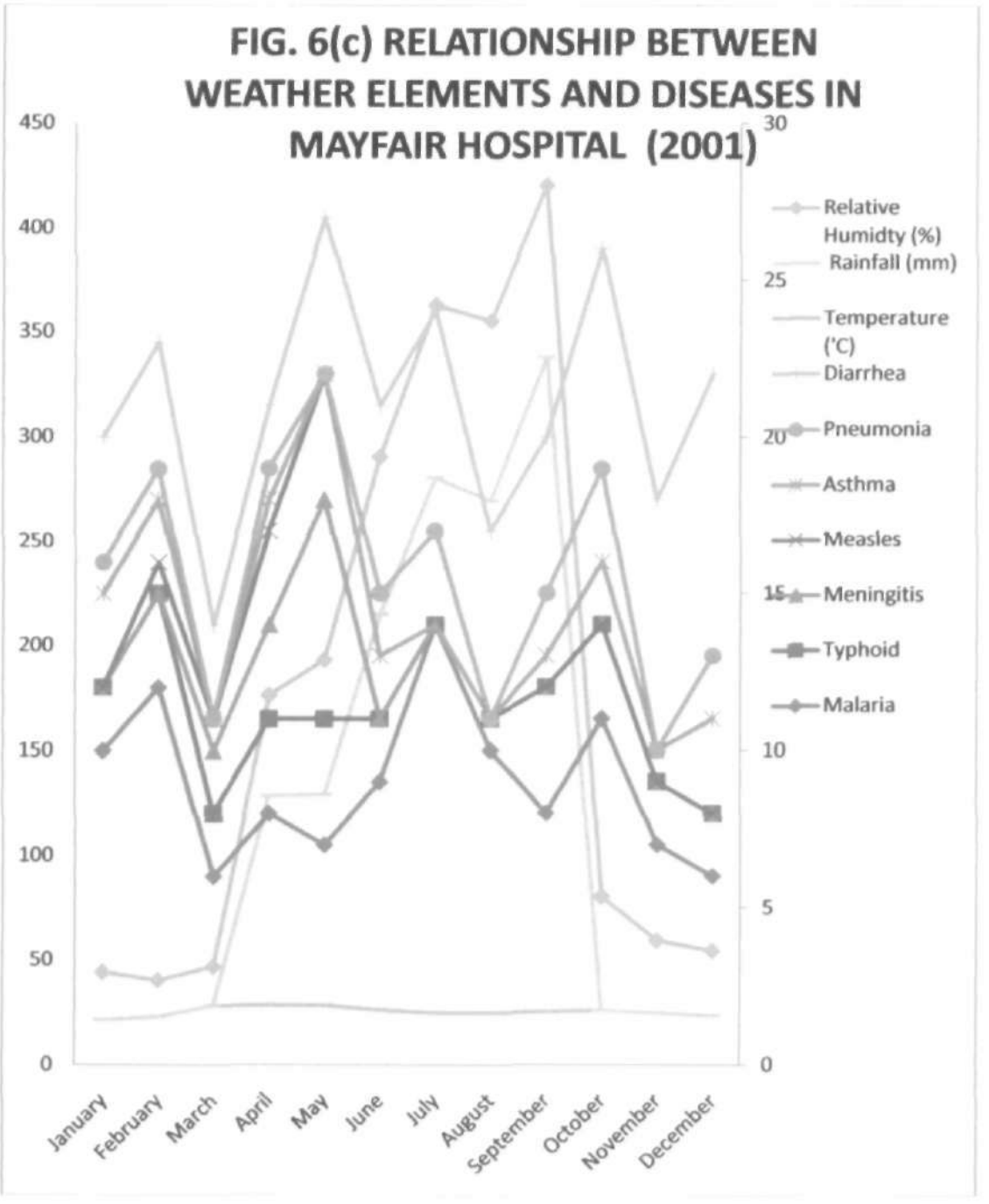

FIG.5(i) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN AFUWA SPECIALIST HOSPITAL (2007)
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
600
500
400
300
200
100
0
18
16
14
12
10
8
6
4
2
0
January
February
March
April
May
June
July
August
September
October
November
December

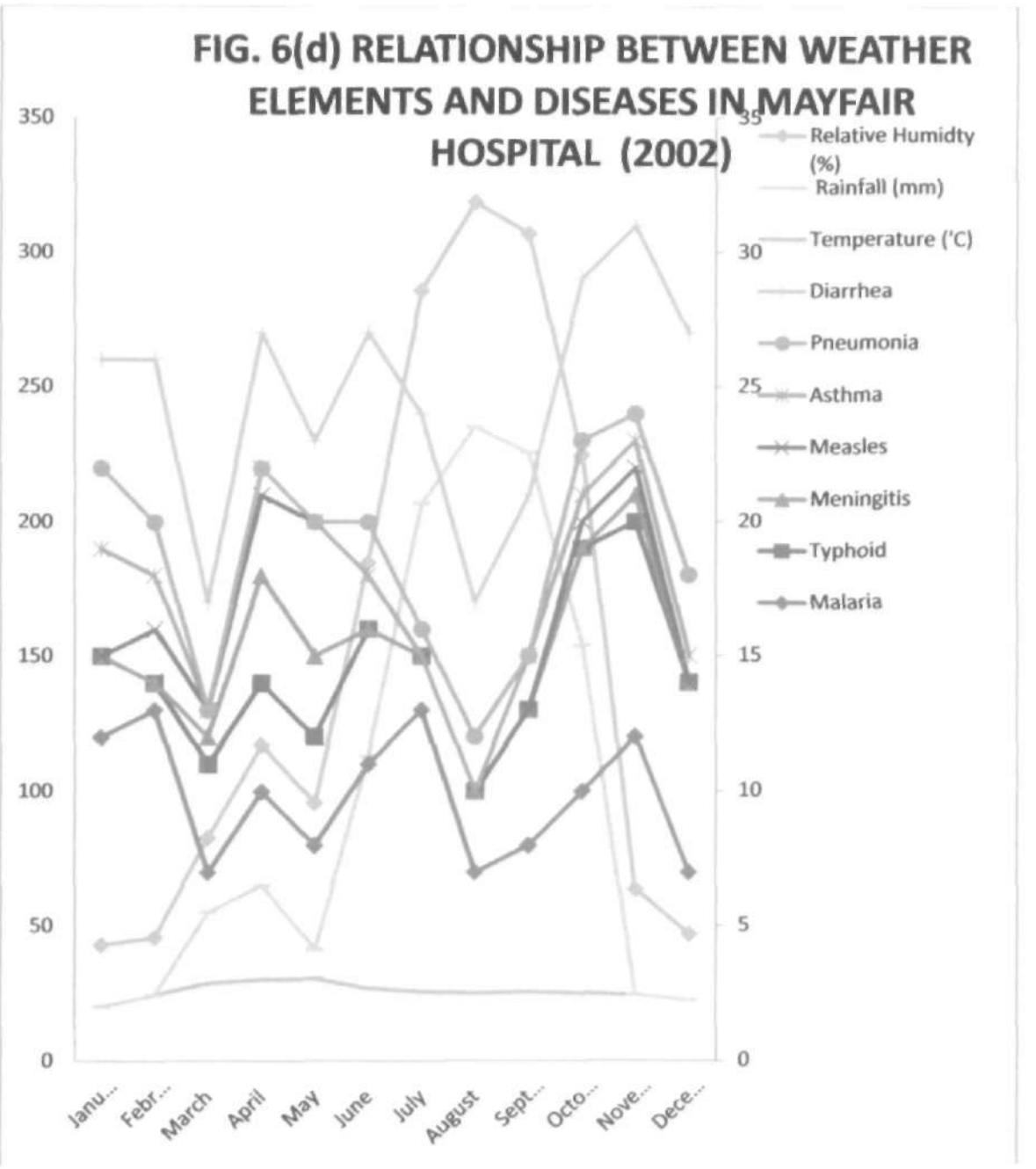

FIG. 5(j) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN AFUWA SPECIALIST HOSPITAL (2008)
400
350
300
250
200
150
100
50
0
14
12
10
8
6
4
2
0
Relative Humidty (%)
Rainfall (mm)
Temperature (°C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
January
Febru...
March
April
May
June
July
August
Septe...
October
Nove...
Dece...

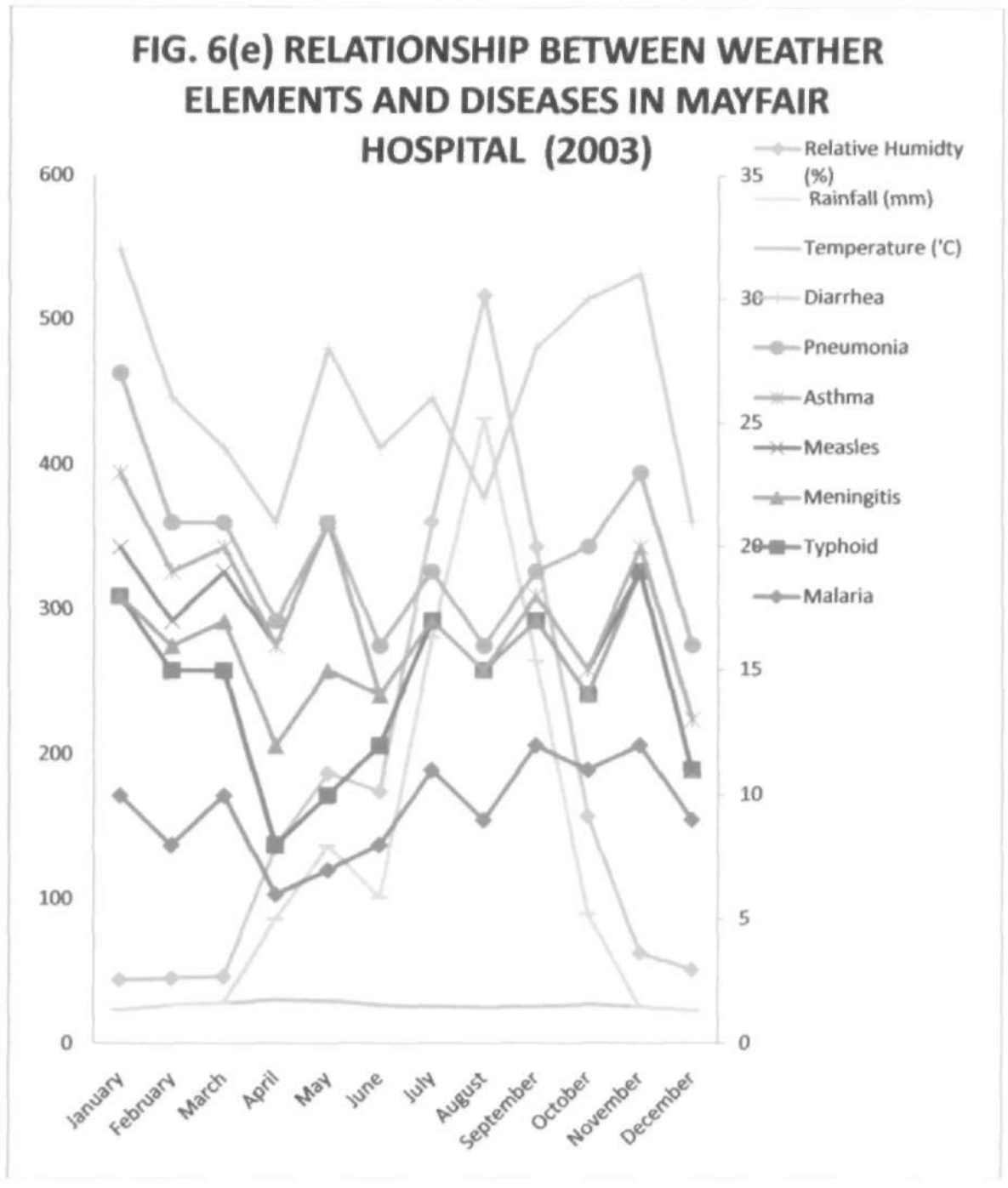
Mayfair hospital also established the occurrence of all the diseases. Malaria, typhoid and diarrhea cases were recorded every month during the period of study, but higher in some months than others. Meningitis and measles showed a seasonal pattern of occurrence while asthma and pneumonia do not (Table 4.2.5, Fig. 6). Secondary axis was created for the graphs for clarity so that the lines are not pressed together because they also do not have large no of occurrences.

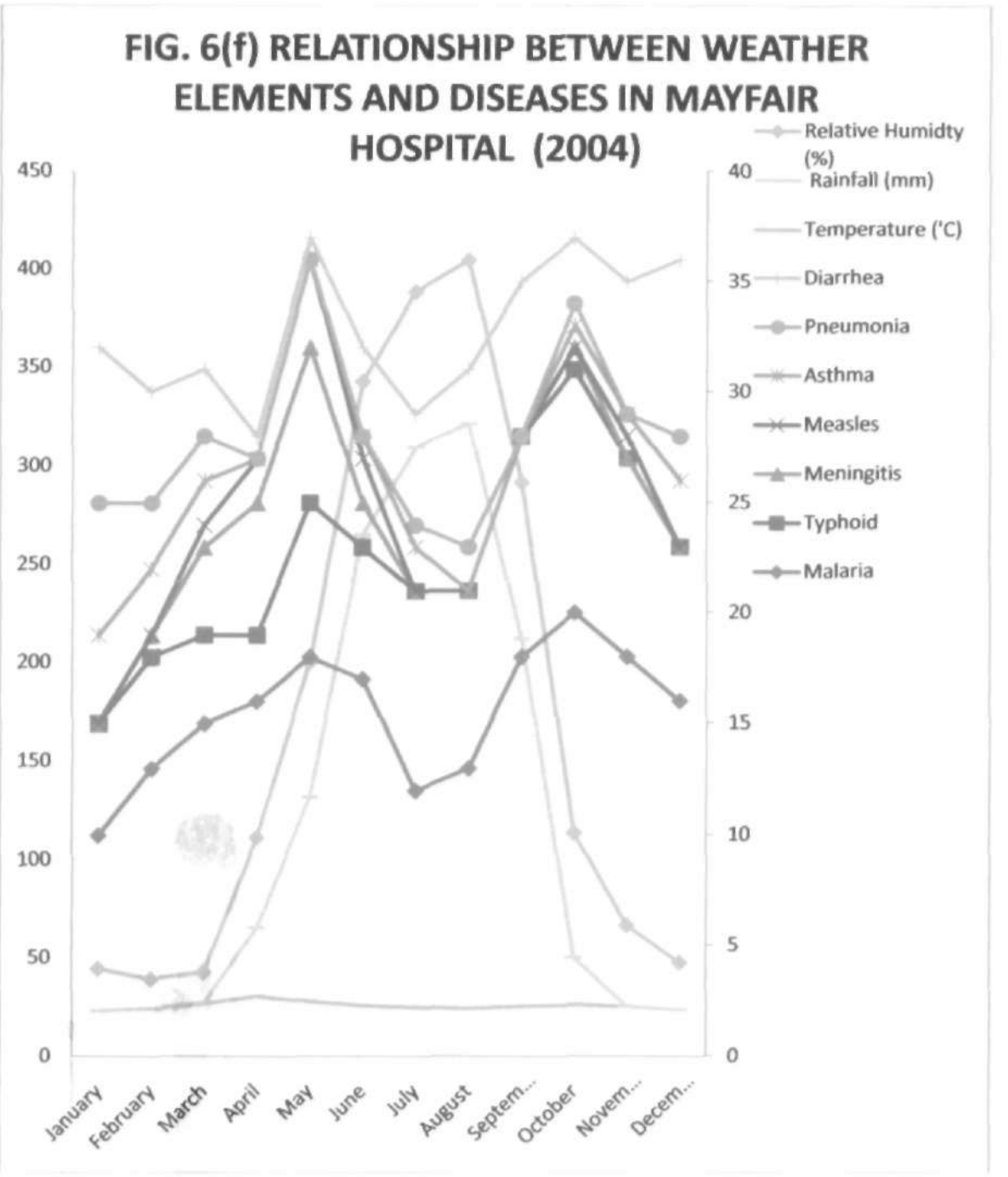

FIG. 6(a) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN MAYFAIR HOSPITAL (1999)
450
400
350
300
250
200
150
100
50
0
35
30
25
20
15
10
5
0
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
Janu...
Febr...
March
April
May
June
July
August
Sept...
Octo...
Nove...
Dece...

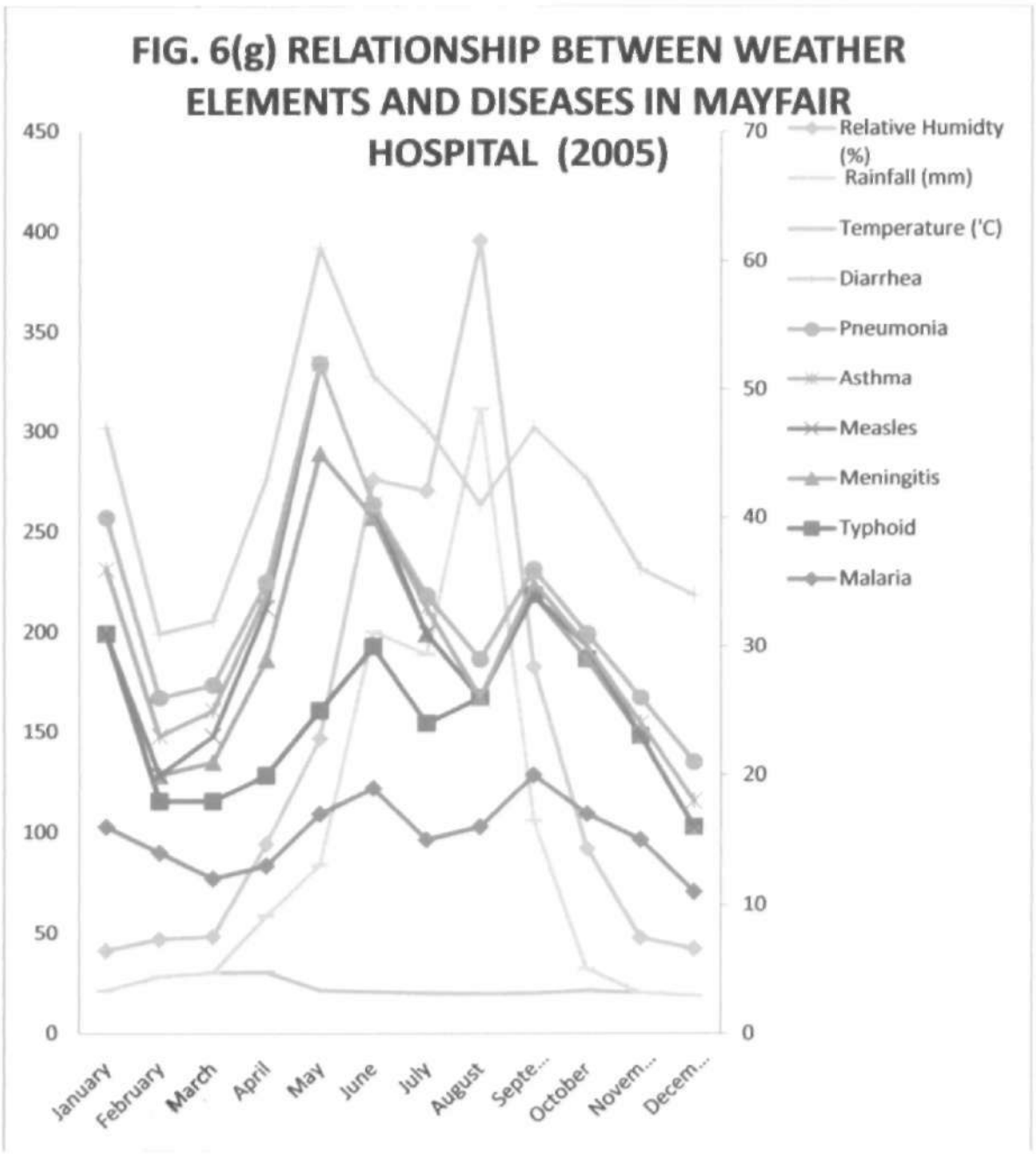

FIG. 6(b) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN MAYFAIR HOSPITAL (2000)
450
400
350
300
250
200
150
100
50
0
35
30
25
20
15
10
5
0
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
January
Febru...
March
April
May
June
July
August
Septe...
October
Nove...
Dece...

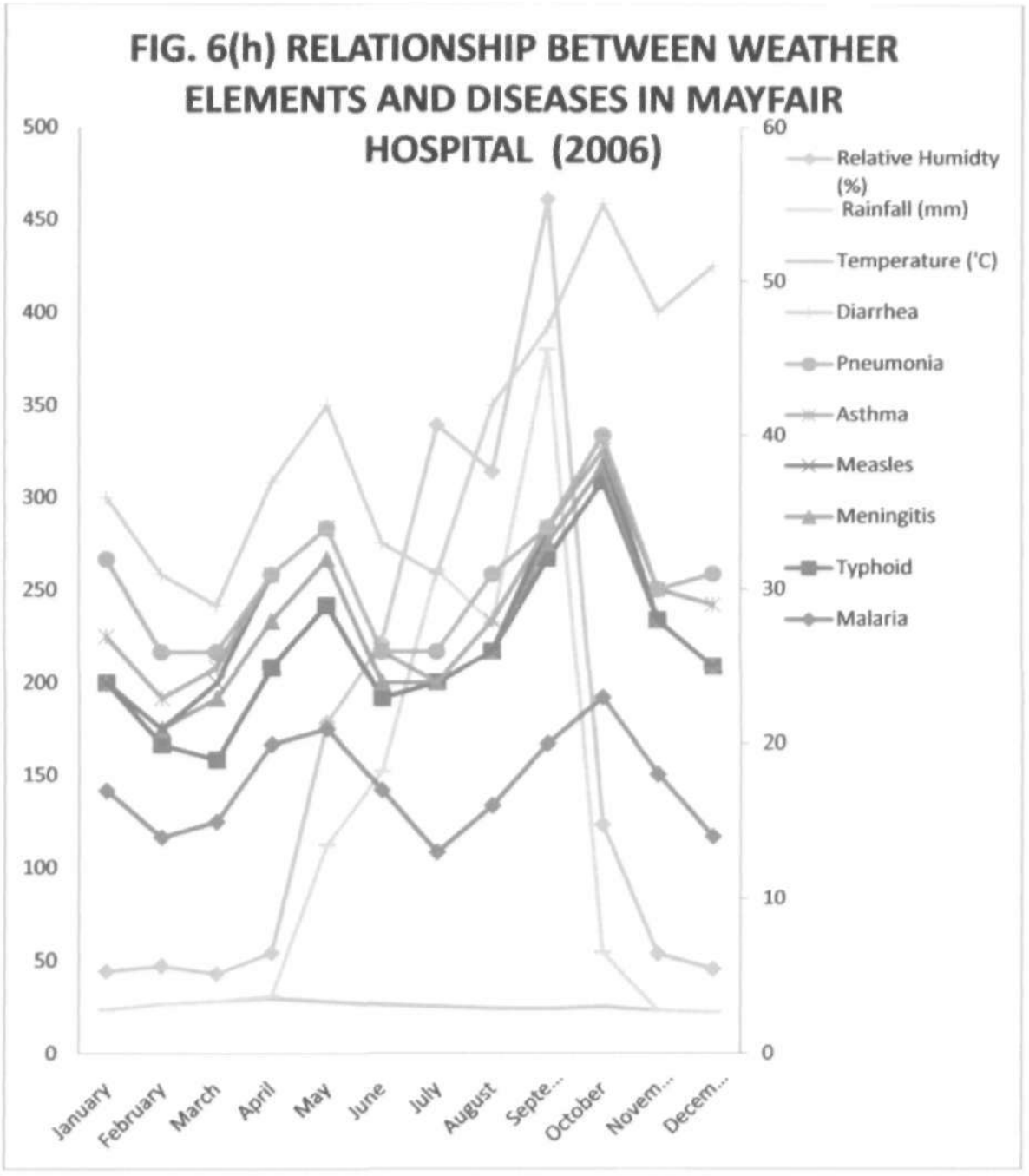

FIG. 6(c) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN MAYFAIR HOSPITAL (2001)
450
400
350
300
250
200
150
100
50
0
30
25
20
15
10
5
0
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
January
February
March
April
May
June
July
August
September
October
November
December

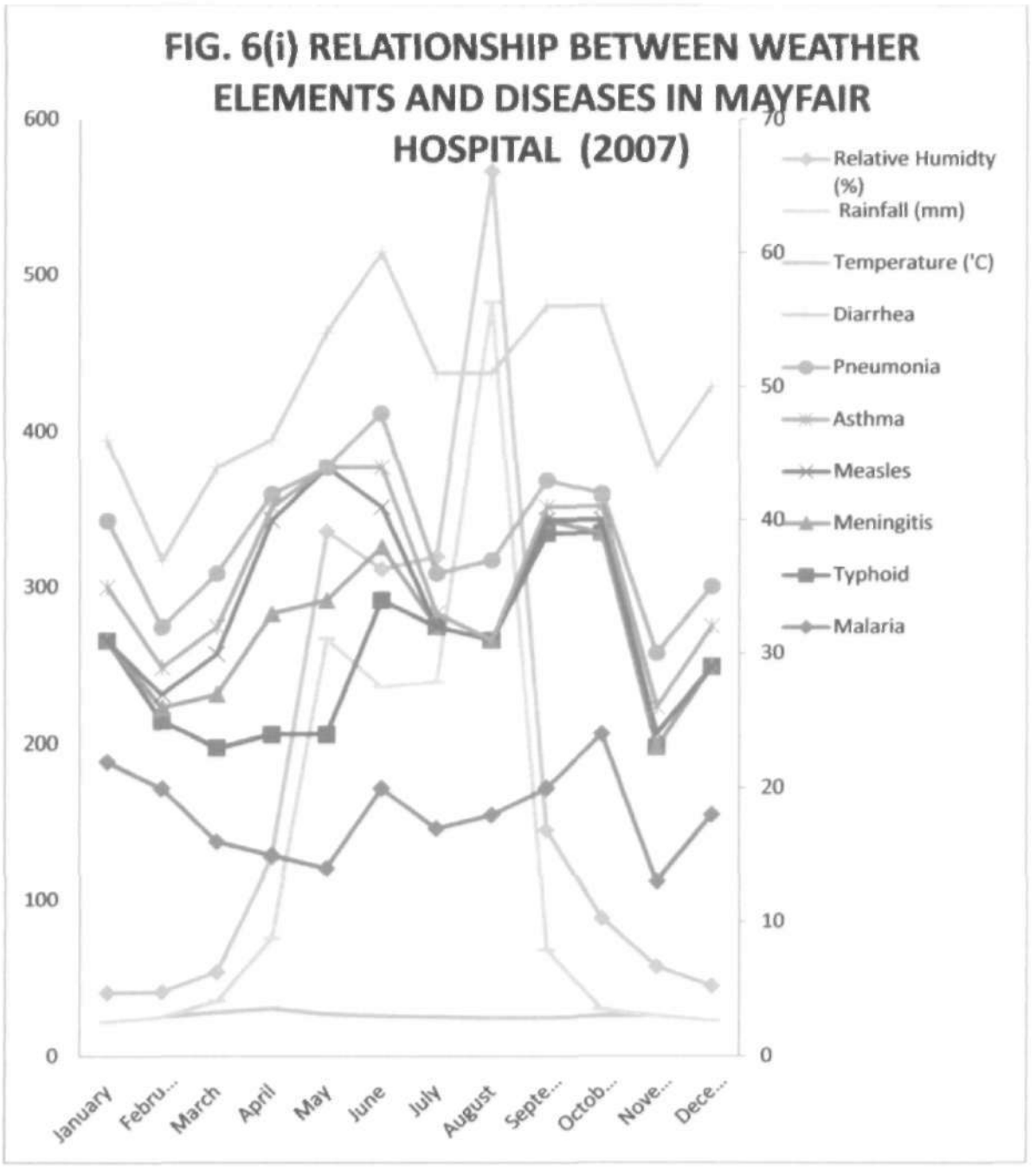

FIG. 6(d) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN MAYFAIR HOSPITAL (2002)
350
300
250
200
150
100
50
0
35
30
25
20
15
10
5
0
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
Janu...
Febr...
March
April
May
June
July
August
Sept...
Octo...
Nove...
Dece...

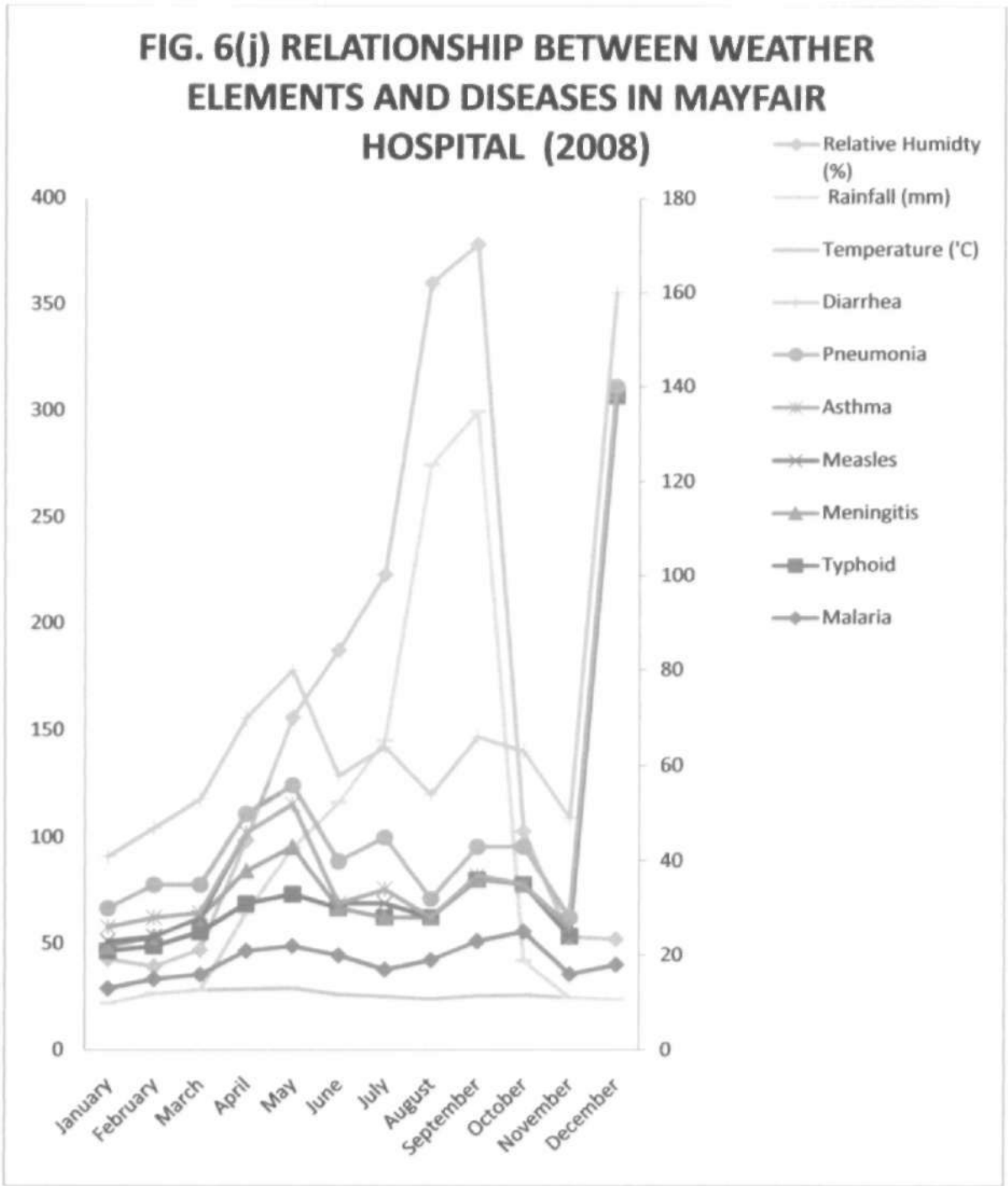

FIG. 6(e) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN MAYFAIR HOSPITAL (2003)
600
500
400
300
200
100
0
35
30
25
20
15
10
5
0
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
January
February
March
April
May
June
July
August
September
October
November
December


FIG. 6(f) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN MAYFAIR HOSPITAL (2004)
Relative Humidty (%)
Rainfall (mm)
Temperature (°C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
450
400
350
300
250
200
150
100
50
0
40
35
30
25
20
15
10
5
0
January
February
March
April
May
June
July
August
Septem...
October
Novem...
Decem...


FIG. 6(g) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN MAYFAIR HOSPITAL (2005)
450
400
350
300
250
200
150
100
50
0
70
60
50
40
30
20
10
0
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
January
February
March
April
May
June
July
August
Septe...
October
Novem...
Decem...


FIG. 6(h) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN MAYFAIR HOSPITAL (2006)
500
450
400
350
300
250
200
150
100
50
0
60
50
40
30
20
10
0
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
January
February
March
April
May
June
July
August
Septe...
October
Novem...
Decem...


FIG. 6(i) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN MAYFAIR HOSPITAL (2007)
600
500
400
300
200
100
0
70
60
50
40
30
20
10
0
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
January
Febru...
March
April
May
June
July
August
Septe...
Octob...
Nove...
Dece...


FIG. 6(j) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN MAYFAIR HOSPITAL (2008)
Relative Humidty (%)
Rainfall (mm)
Temperature (°C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria
400
350
300
250
200
150
100
50
0
180
160
140
120
100
80
60
40
20
0
January
February
March
April
May
June
July
August
September
October
November
December

Hajia Gambo Sawaba General Hospital also established the occurrence of all the diseases with higher number of occurrence of most cases compared to other hospitals except A.B.U Sickbay Samaru. Malaria, typhoid and diarrhea cases were recorded every month during the period of study. Asthma, pneumonia, measles and meningitis occurred almost throughout the period of study with higher values in some months showing the peak of their occurrence and seasonal pattern. Secondary axis was created for the first four years to avoid pressing down those with few number of occurrence so that they are clearly seen while the last six years did not require that (Table 4.2.6, Fig. 7).

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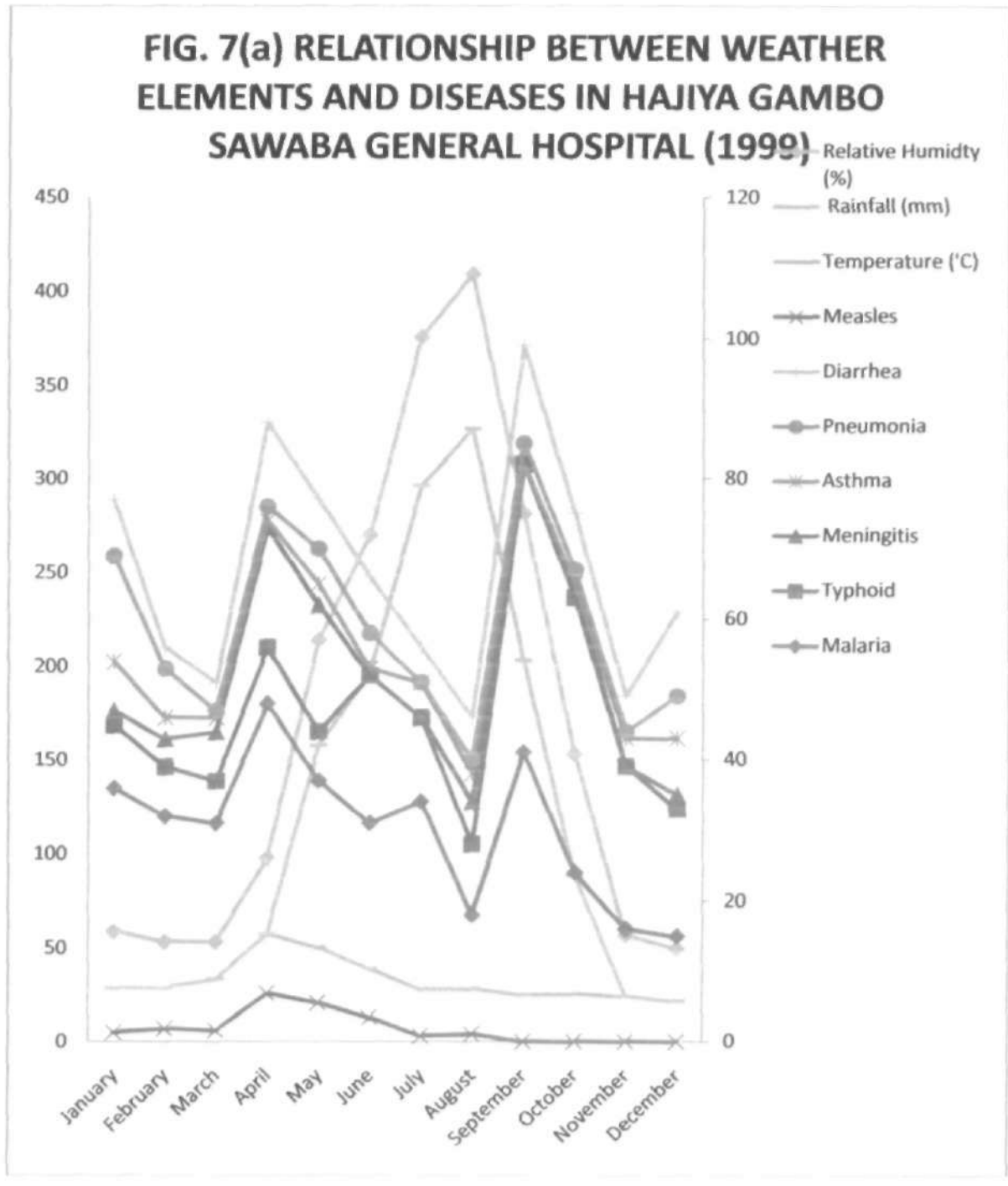

FIG. 7(a) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN HAJIYA GAMBO SAWABA GENERAL HOSPITAL (1999)
Relative Humidty (%)
Rainfall (mm)
Temperature (°C)
Measles
Diarrhea
Pneumonia
Asthma
Meningitis
Typhoid
Malaria
450
400
350
300
250
200
150
100
50
0
120
100
80
60
40
20
0
January
February
March
April
May
June
July
August
September
October
November
December

FIG. 7(b) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN HAJIYA GAMBO SAWABA GENERAL HOSPITAL (2000)

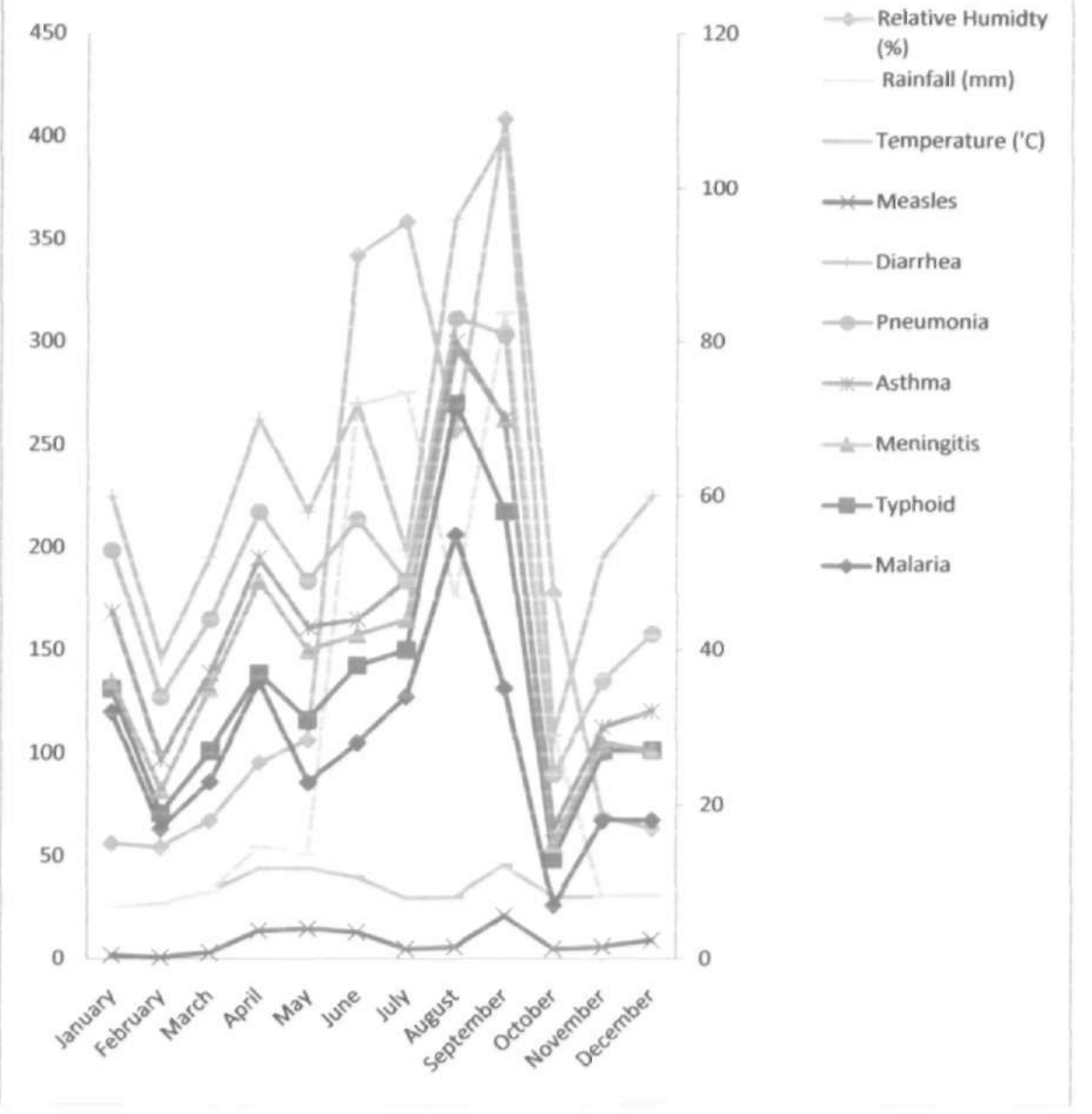
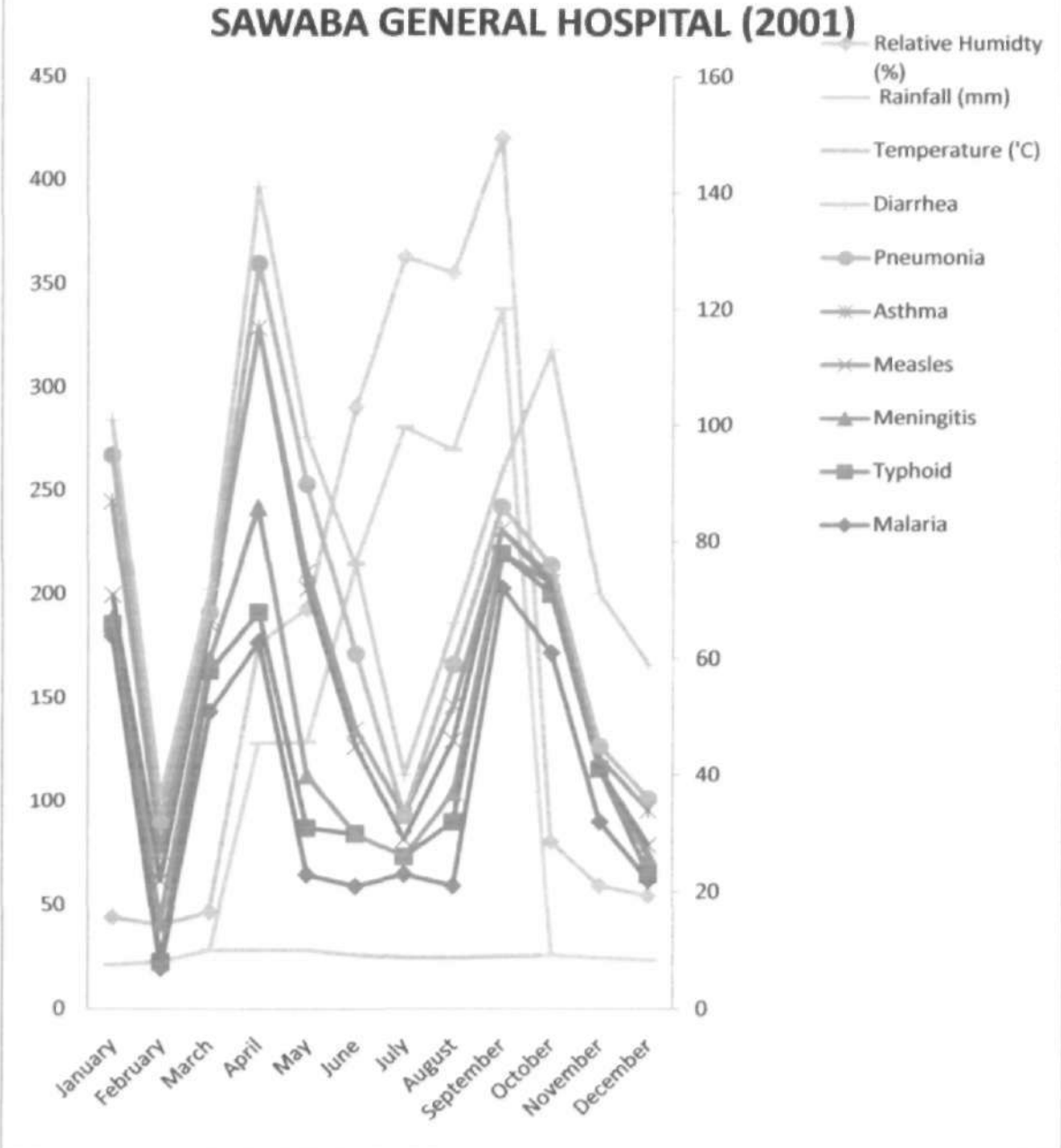
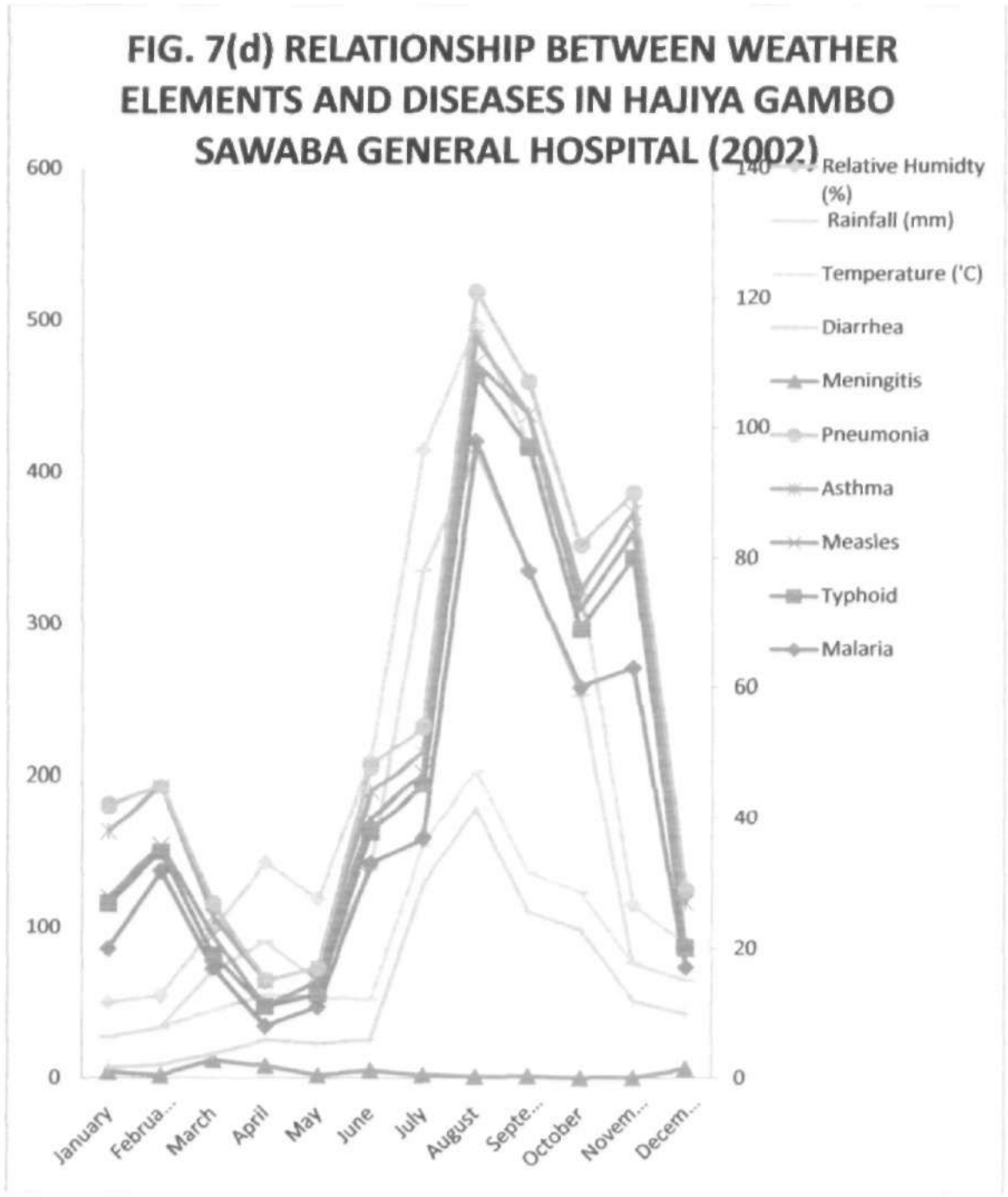


FIG. 7(c) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN HAJIYA GAMBO SAWABA GENERAL HOSPITAL (2001)




FIG. 7(d) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN HAJIYA GAMBO SAWABA GENERAL HOSPITAL (2002)
600
500
400
300
200
100
0
140
120
100
80
60
40
20
0
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Meningitis
Pneumonia
Asthma
Measles
Typhoid
Malaria
January
Februa...
March
April
May
June
July
August
Septe...
October
Novem...
Decem...

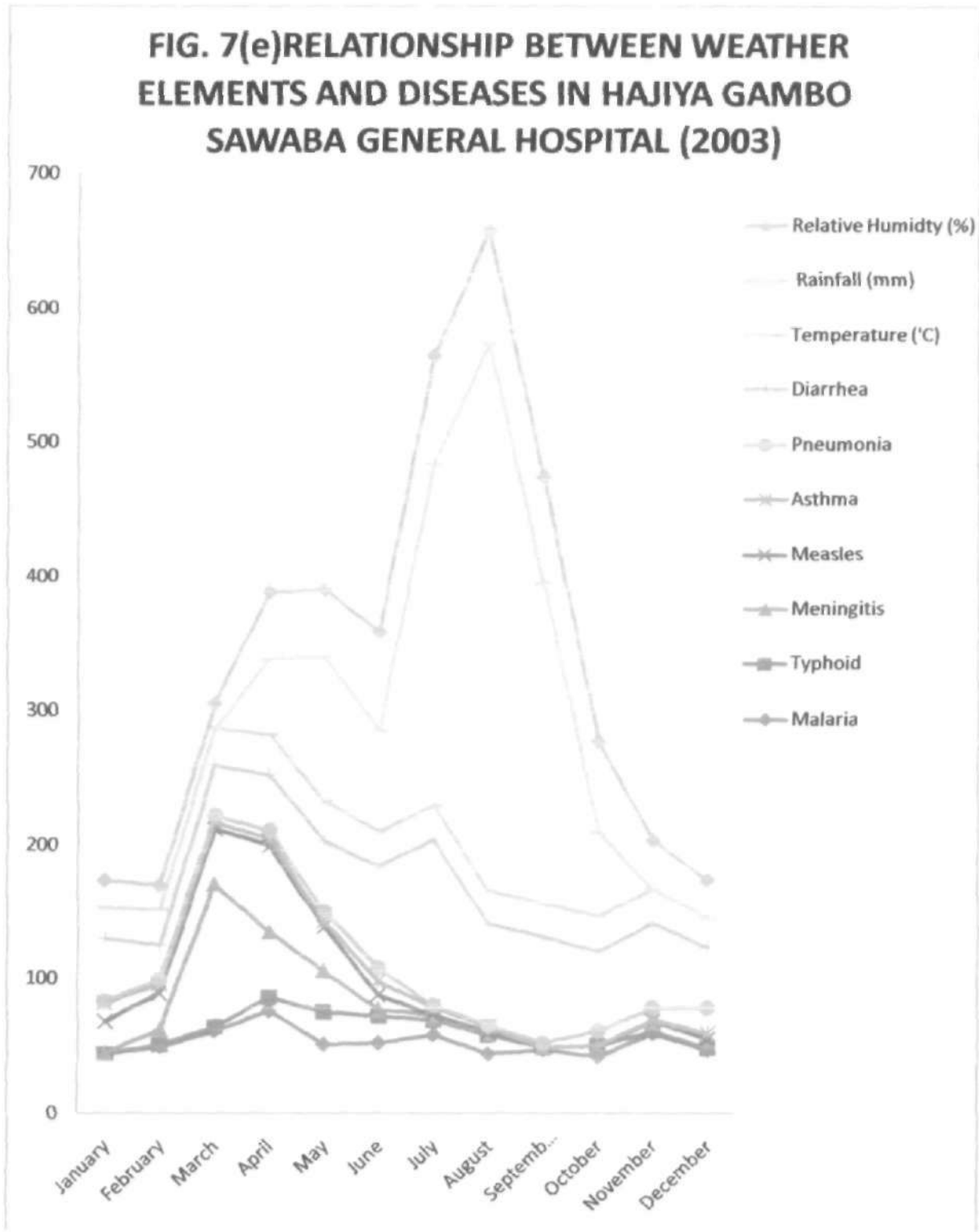

FIG. 7(e)RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN HAJIYA GAMBO SAWABA GENERAL HOSPITAL (2003)
700
600
500
400
300
200
100
0
January
February
March
April
May
June
July
August
Septemb...
October
November
December
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria

FIG. 7(f) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN HAJIYA GAMBO SAWABA GENERAL HOSPITAL (2004)

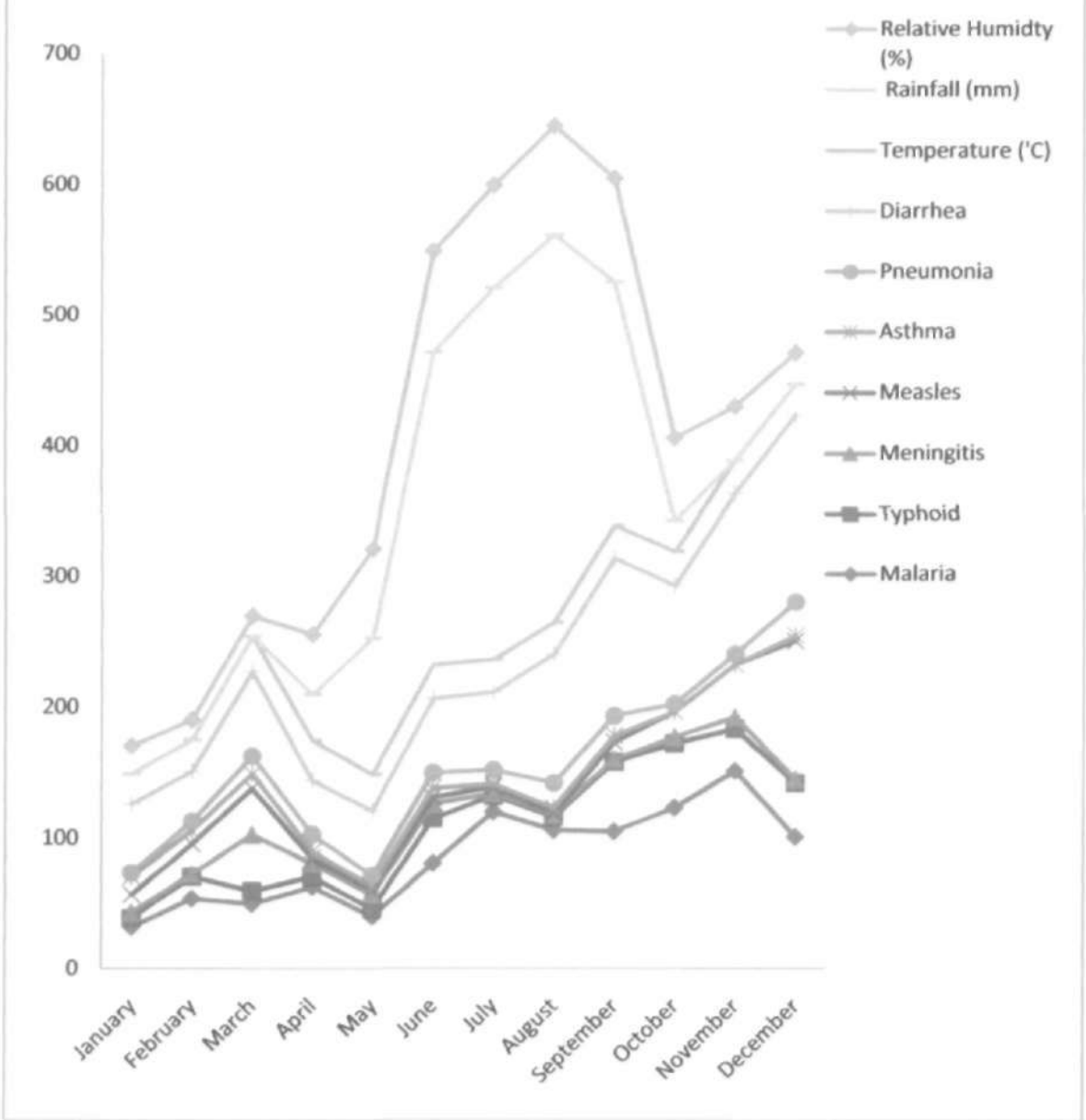
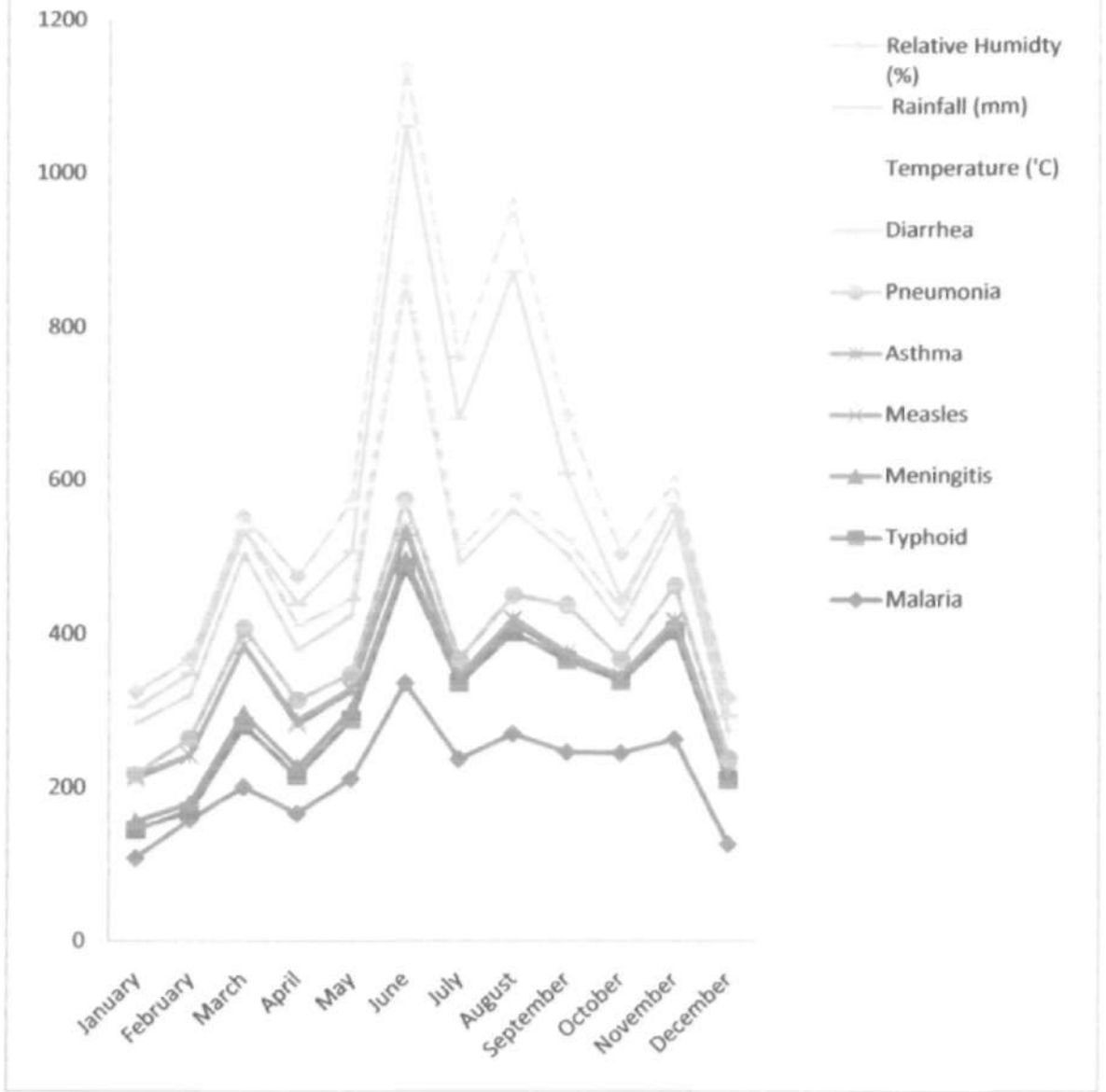
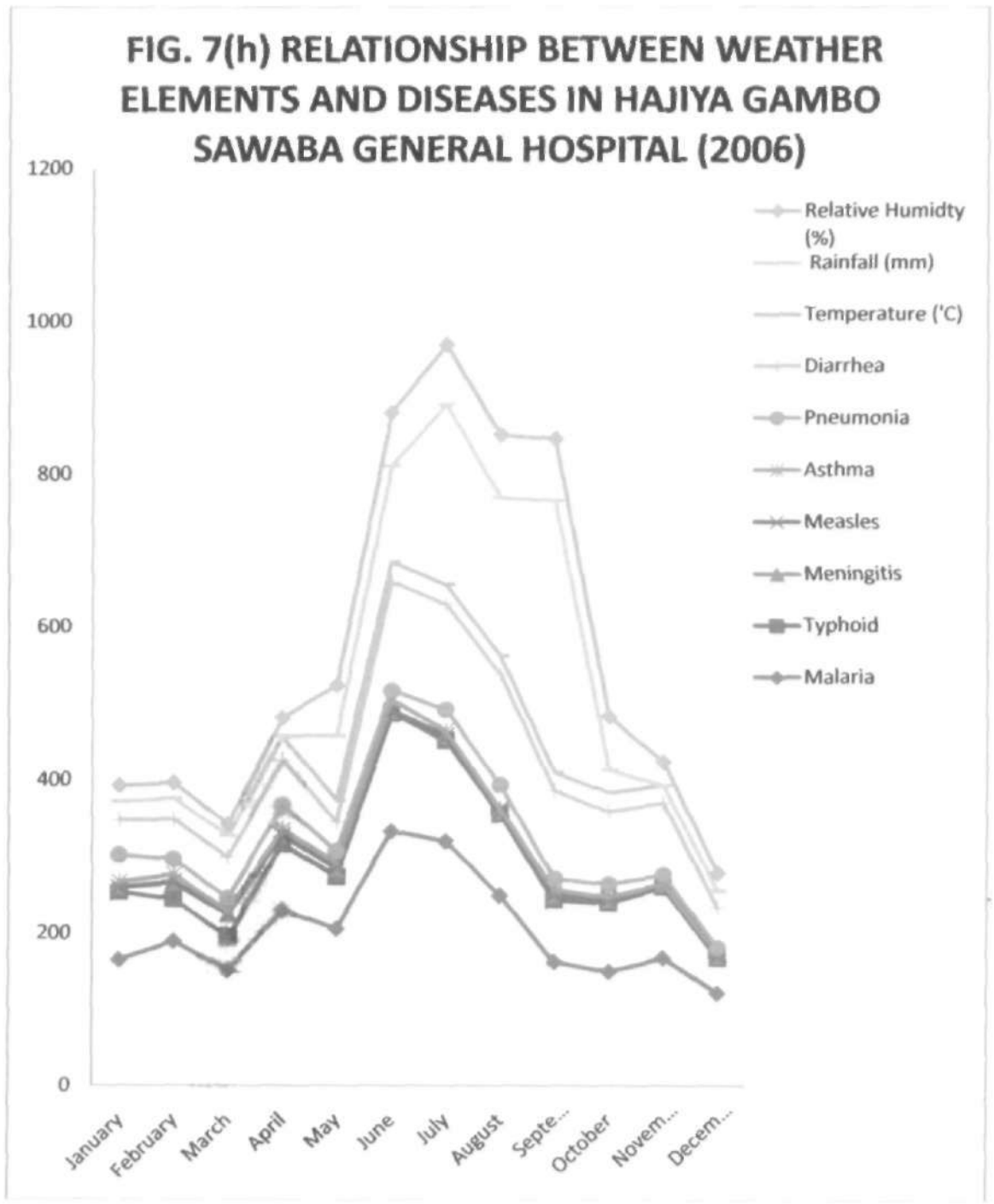
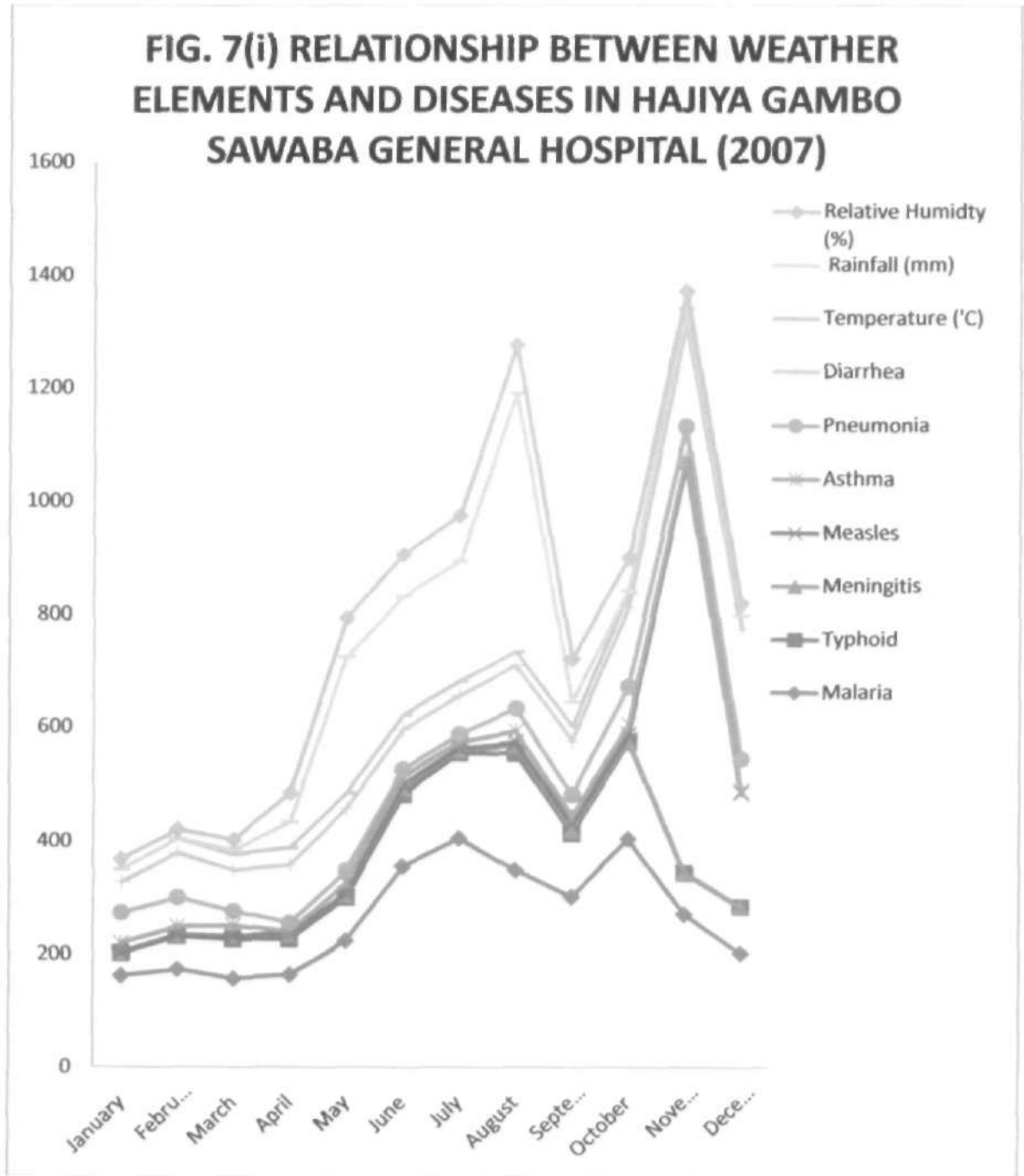
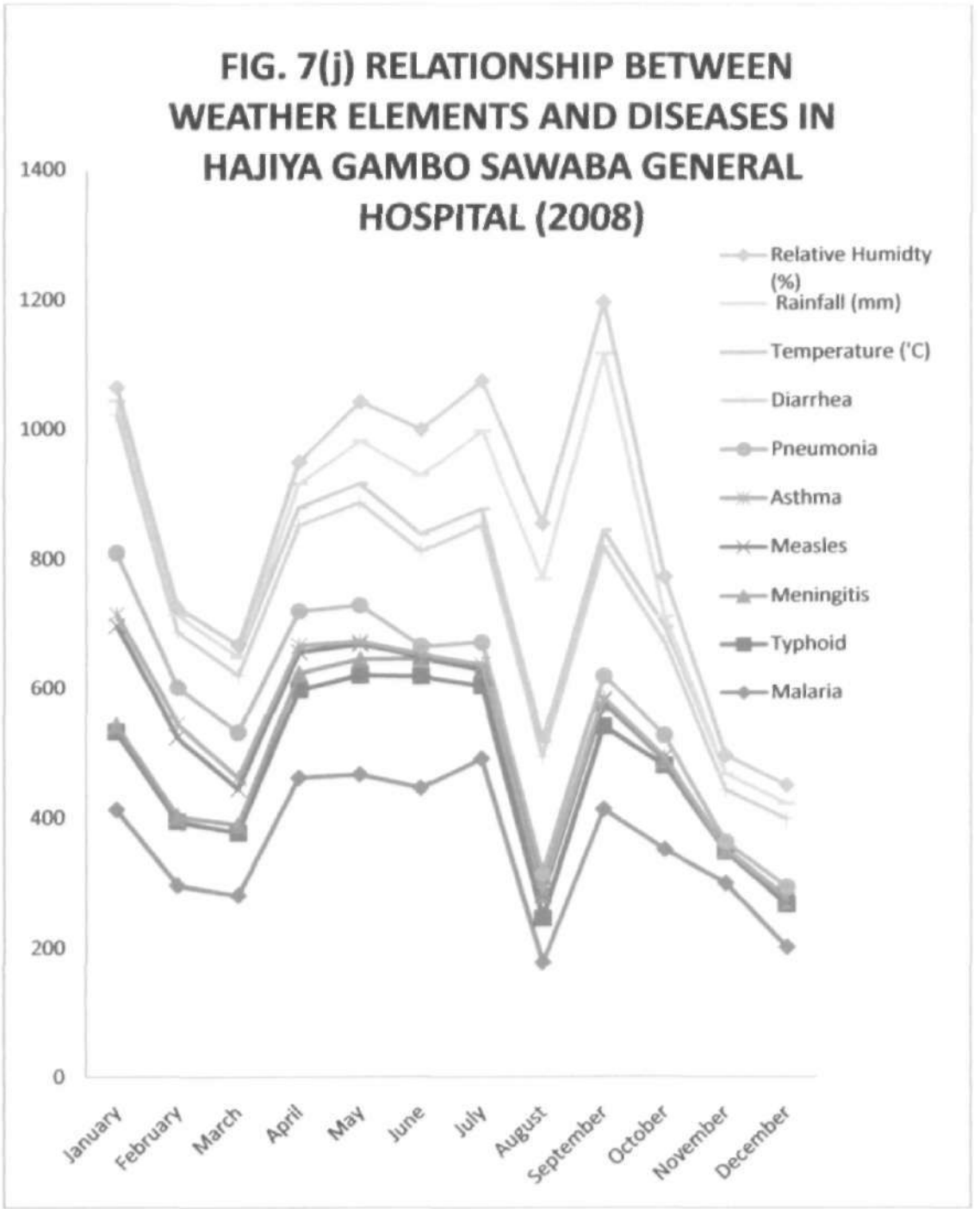


FIG. 7(g) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN HAJIYA GAMBO SAWABA GENERAL HOSPITAL (2005)



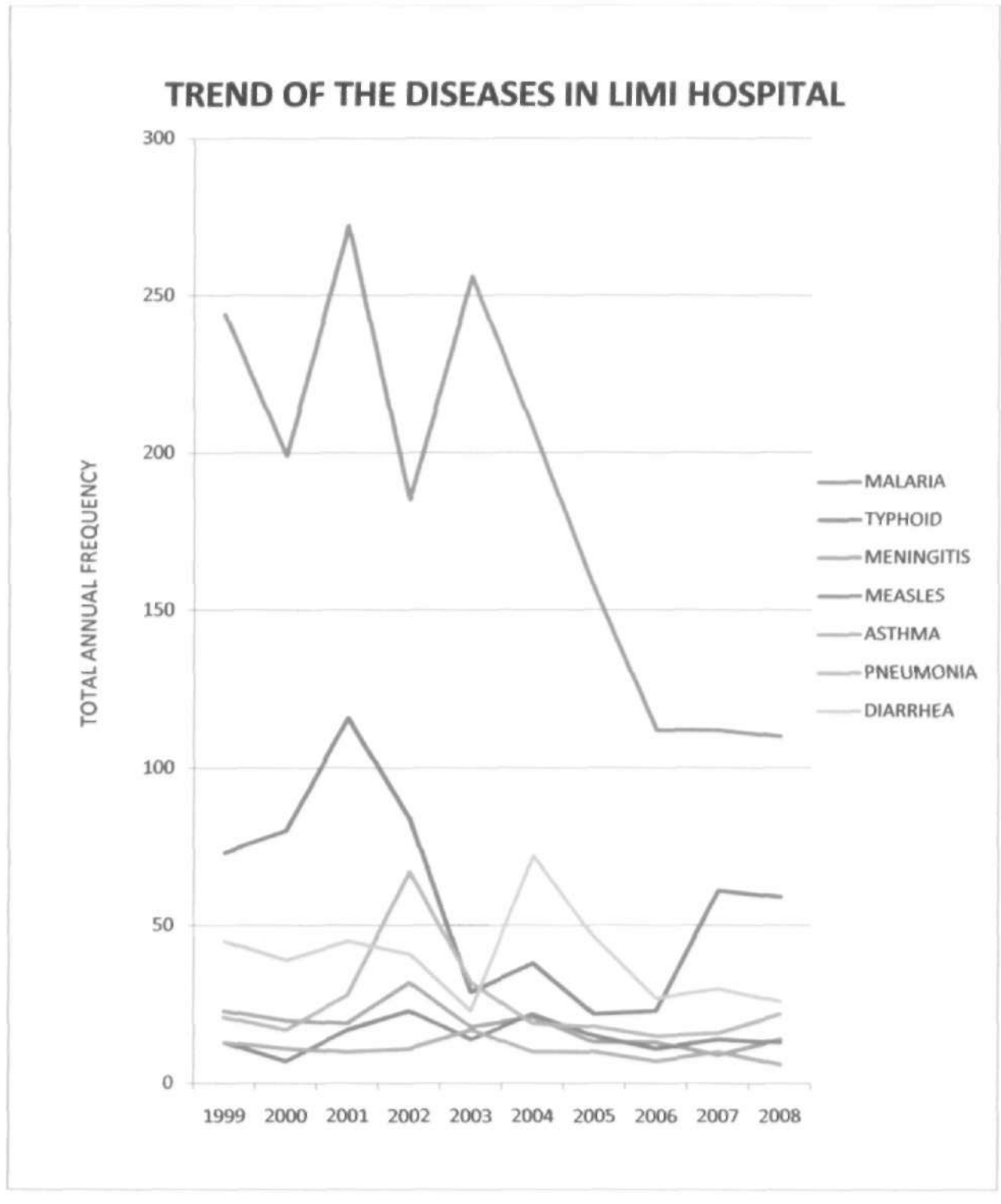

FIG. 7(h) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN HAJIYA GAMBO SAWABA GENERAL HOSPITAL (2006)
1200
1000
800
600
400
200
0
January
February
March
April
May
June
July
August
Septe...
October
Novem...
Decem...
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria

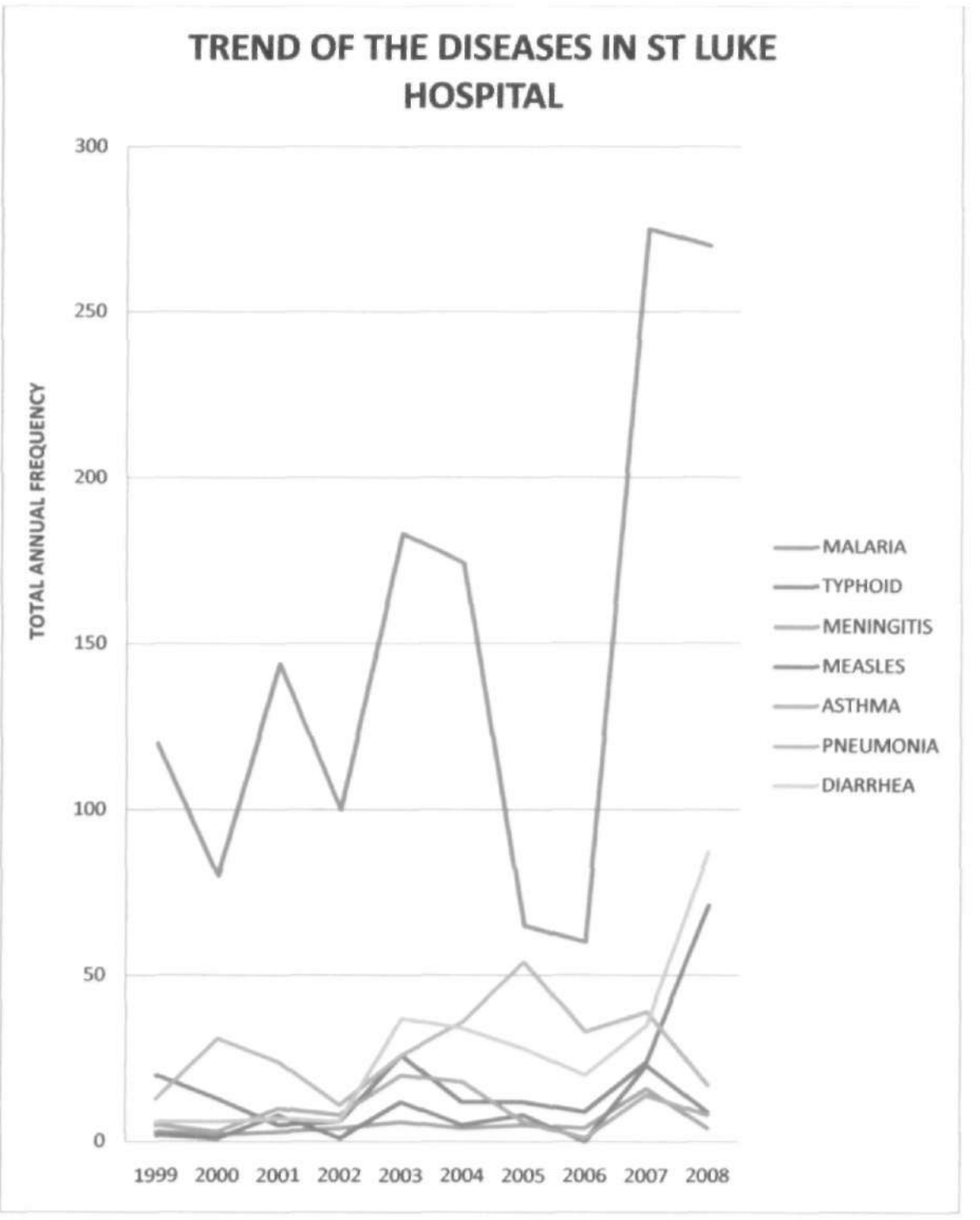

FIG. 7(i) RELATIONSHIP BETWEEN WEATHER ELEMENTS AND DISEASES IN HAJIYA GAMBO SAWABA GENERAL HOSPITAL (2007)
1600
1400
1200
1000
800
600
400
200
0
January
Febru...
March
April
May
June
July
August
Septe...
October
Nove...
Dece...
Relative Humidty (%)
Rainfall (mm)
Temperature ('C)
Diarrhea
Pneumonia
Asthma
Measles
Meningitis
Typhoid
Malaria

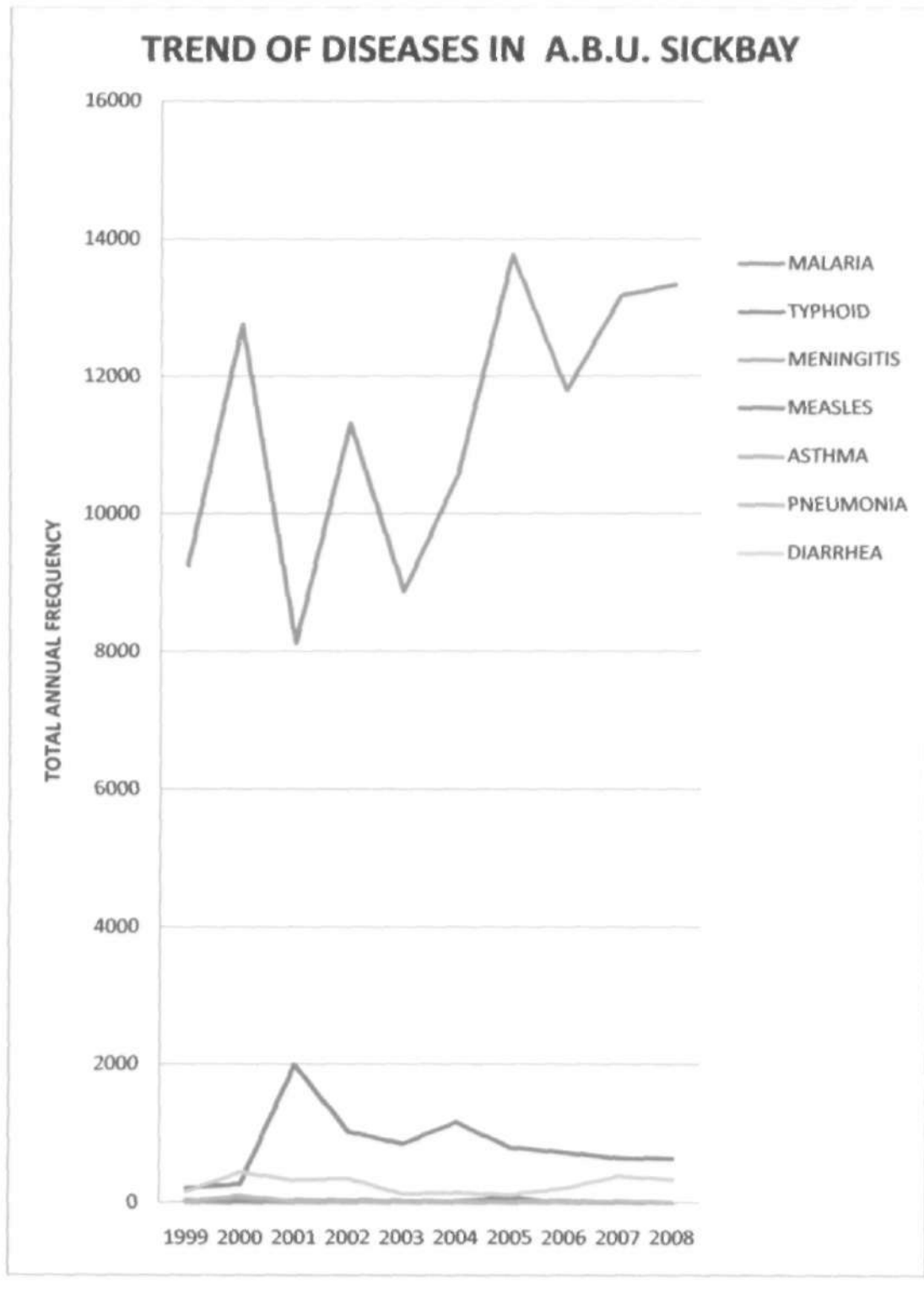


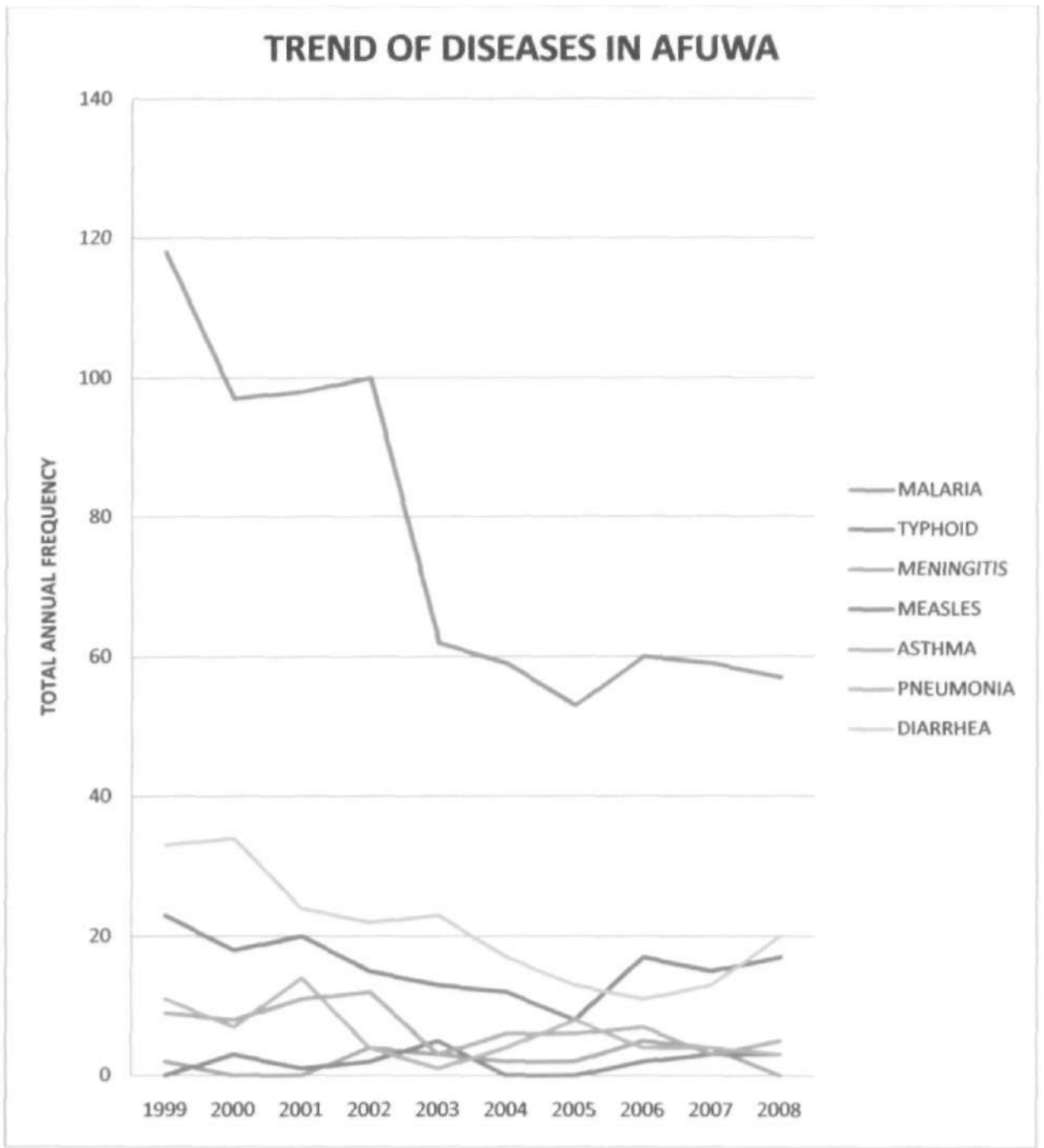
In general, these data showed a level of relationship with the meteorological data. The graphs were able to present this clearly. Fig. 8, shows the trend of occurrence of these diseases.

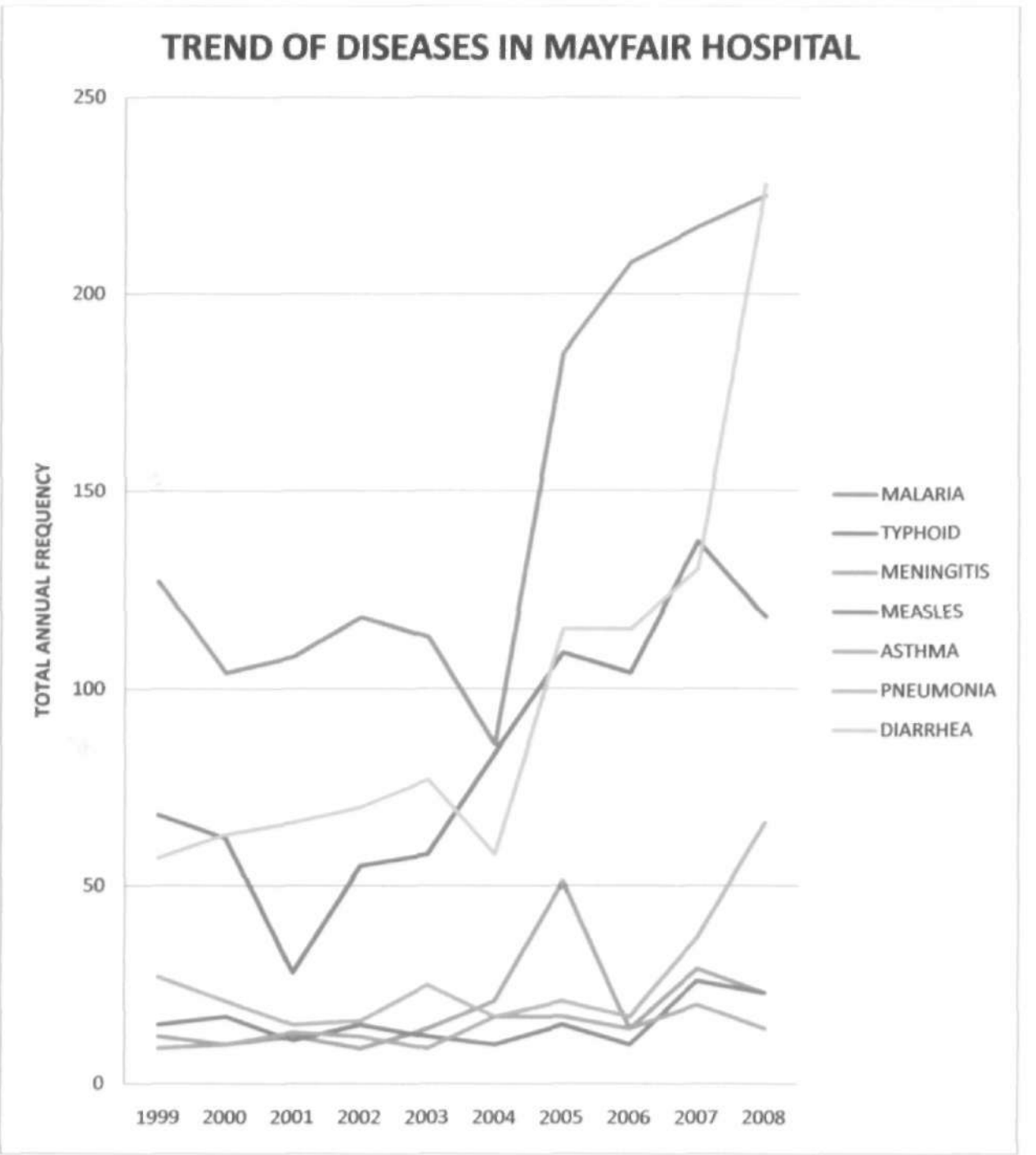
FIG. 8 TREND OF OCCURRENCE OF THE DISEASES IN THE VARIOUS HOSPITAL




TREND OF THE DISEASES IN ST LUKE HOSPITAL
TOTAL ANNUAL FREQUENCY
300
250
200
150
100
50
0
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
MALARIA
TYPHOID
MENINGITIS
MEASLES
ASTHMA
PNEUMONIA
DIARRHEA


TREND OF DISEASES IN A.B.U. SICKBAY
TOTAL ANNUAL FREQUENCY
16000
14000
12000
10000
8000
6000
4000
2000
0
1999 2000 2001 2002 2003 2004 2005 2006 2007 2008
MALARIA
TYPHOID
MENINGITIS
MEASLES
ASTHMA
PNEUMONIA
DIARRHEA


TREND OF DISEASES IN AFUWA
TOTAL ANNUAL FREQUENCY
140
120
100
80
60
40
20
0
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
MALARIA
TYPHOID
MENINGITIS
MEASLES
ASTHMA
PNEUMONIA
DIARRHEA


TREND OF DISEASES IN MAYFAIR HOSPITAL
TOTAL ANNUAL FREQUENCY
250
200
150
100
50
0
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
MALARIA
TYPHOID
MENINGITIS
MEASLES
ASTHMA
PNEUMONIA
DIARRHEA

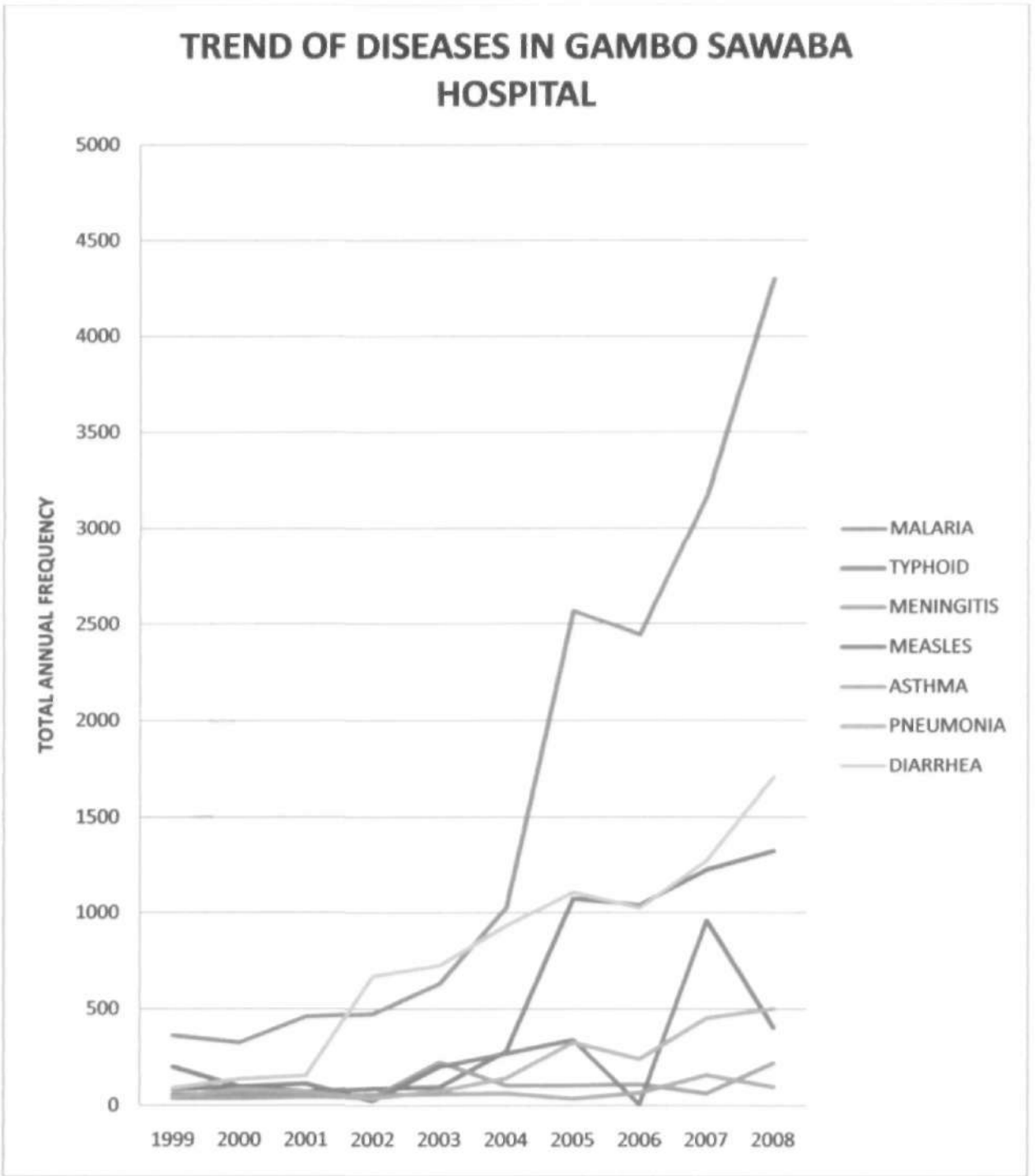

TREND OF DISEASES IN GAMBO SAWABA HOSPITAL
TOTAL ANNUAL FREQUENCY
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
MALARIA
TYPHOID
MENINGITIS
MEASLES
ASTHMA
PNEUMONIA
DIARRHEA

Table 4.3.1 Relationship between temperature and malaria.

Variables	N	Mean	SD	SE	R	df	P	r critical
Malaria occurrence	719	186.9263	367.19353	13.69401	.789	717	.010	.195
Temperature	719	25.4442	2.70814	110100				

From table 4.3.1, there is no significant relationship between temperature and the occurrence of malaria in Zaria. The table showed that the observed or calculated correlation coefficient R (.789) is greater than the critical value of r (.195) at df 717 while the observed level of significance p (.010) is less than the tolerance level of 0.05 signifying that the two variables of occurrences of malaria and temperature are significantly related.

Table 4.3.2 Relationsship between temperature and typhoid.

Variables	N	Mean	SD	SE	R	df	P	r critical
Typhoid occurrence	719	21.7942	40.91437	1.52585	.033	717	.376	.195
Temperature	719	25.4442	2.70814	.10100				

An understanding of the above correlation statistics table revealed that the calculated correlation coefficient R (.033) is lower than the r critical (.195) and the calculated p (.376) is higher than the level of tolerance (0.05) at df 717 indicating that there is no significant relationship between the general occurrence of typhoid and temperature within the period under study.

Table 4.3.3 Relationship between temperature and meningitis.

Variables	N	Mean	SD	SE	R	df	P	r critical
Meningitis occurrence	719	2.0723	6.21574	.23181	.172	717	.000	.105
Temperature	719	25.4442	2.70814					

** Correlation is significant at the 0.01 level (2 – tailed).

The outcome of the above correlation statistics table revealed a significant relationship between the occurrences of meningitis and temperature. The calculated P (0.000) is lower than the level of tolerance P (0.01) while the level of relationship is .172.

Table 4.3.4 Relationship between temperature and measles.

Variables	N	Mean	SD	SE	R	df	P	r critical
Measles occurrence	719	4.3922	29.95278	1.11705	.033	717	.379	.195
Temperature	719	25.4442	2.70814	.10100				

According to the results obtained in the above correlation statistics table there is no significant relationship between occurrences of measles and temperature. This is because the calculated correlation coefficient of R (.033) is less than the critical r (.195) just as the calculated probability indicating that there is no significant relationship between the occurrence of measles and temperature.

Table 4.3.5 Relationship between temperature and asthma.

Variables	N	Mean	SD	SE	R	df	P	r critical
Asthma occurrence	719	1.7483	2.90601	.10838	.097*	717	.009	.195
Temperature	719	25.4442	2.70814	.10100				

* Correlation is significant at the 0.01 level (2 – tailed).

There was significant relationship between the occurrences of asthma and temperature within the period under study. This is because the calculated P (0.009) is less than the 0.01 level of tolerance at df 717

indicating that significant relationship exist between the occurrence of asthma and temperature.

Table 4.3.6 Relationship between temperature and pneumonia.

Variables	N	Mean	SD	SE	R	df	P	r critical
Pneumonia occurrence	719	4.1613	9.40687	.35082	.057	717	.128	.195
Temperature	719	25.4442	2.70814	.10100				

A critical study of the correlation statistics table above showed that there is no significant relationship between occurrence of pneumonia and temperature because the calculated correlation R .057 is less than the r critical .195 while the calculated p .128 is greater than the 0.05 level of tolerance indicating clearly that there is no significant relationship between the two variables.

Table 4.3.7 Relationship between temperature and diarrhea.

Variables	N	Mean	SD	SE	R	df	P	r critical
Diarrhea occurrence	719	16.9930	33.15497	1.23647	.044	717	.242	.195
Temperature	719	25.4442	2.7814	.10100				

The outcome of the correlation statistics table above revealed that no significant relationship between occurrence of diarrhea and temperature because the calculated correlated coefficient R (.044) is less than the r critical (.195) while the calculated probability p (.242) is greater than the 0.05 of tolerance indicating that there is no significant relationship between the two variables.

4.4 RELATIONSHIP BETWEEN RAINFALL AND THE DISEASES

Table 4.4.1 Relationship between and rainfall and malaria.

Variables	N	Mean	SD	SE	R	df	P	r critical
Malaria occurrence	719	186.9263	367.1935	13.6940	.0073	717	.051	.195
Rainfall	719	87.1502	111.0271	4.14062				

The results of the above correlation statistics revealed that there is no significant relationship between the occurrence of malaria fever and rainfall within the period under study. The result showed that the calculated P .051 is greater than the 0.05 level of tolerance.

Table 4.4.2 Relationship between rainfall and typhoid.

Variables	N	Mean	SD	SE	R	df	P	r critical
Typhoid occurrence	719	21.7942	40.9143	1.5258	.072	717	.051	.195
Rainfall	719	87.1502	111.0271	4.1406				

According to the table above there is no significant relationship between the occurrence of typhoid fever and rainfall under the period under study. This is because the calculated P (.051) is greater than the 0.05 while the calculated R (0.072) is less than the r critical (.195).

Table 4.4.3 Relationship between rainfall and meningitis.

Variables	N	Mean	SD	SE	R	df	P	r critical
Meningitis occurrence	719	2.0723	6.2157	.23181	.039	717	.296	.195
Rainfall	719	87.1502	111.0271	4.14062				

A careful study of the above table showed that there is no significant relationship between the occurrence of meningitis and rainfall. This is because the calculated P (.296) is greater than the 0.05 while the r calculated .039 is less than .195 r critical indicating that there is no significant relationship between the occurrence of meningitis and rainfall within the period under study.

Table 4.4.4 Relationship between rainfall and measles.

Variables	N	Mean	SD	SE	R	df	P	r critical
Measles occurrence	719	4.3922	29.9527	1.11705	.070	717	.061	.195
Rainfall	719	87.1502	111.0272	4.14062				

From the table above, the value of calculated P (.061) is greater than 0.05 while R calculated .070 is less than r critical .195 hence there is no significant relationship between the occurrence of measles and rainfall within the period under study.

Table 4.4.5 Relationship between rainfall and asthma.

Variables	N	Mean	SD	SE	R	df	P	r critical
Asthma occurrence	719	1.7483	2.90601	.10838	.078	717	.038	.195
Rainfall	719	87.1502	111.02721	4.14062				

* correlation is significant at the 0.05 level (2-tailed).

Outcome of the above correlation statistics revealed that significant relationship exist between the occurrence of asthma and rainfall under the period of study. Results revealed that the calculated P (.038) is less than the 0.05

level of tolerance signifying that significant relationship exist between occurrence of asthma and rainfall.

Table 4.4.6 Relationship between rainfall and pneumonia.

Variables	N	Mean	SD	SE	R	df	P	r critical
Pneumonia occurrence	719	4.1613	9.4068	.35082	.036	717	.337	.195
Rainfall	719	87.1502	111.0272	4.14062				

The above correlation table revealed a significant relationship between occurrence of Pneumonia and rainfall within the period under study because the calculated value correlation coefficient R (.036) is less than the r critical .195 just as the calculated p (.337) is greater than the 0.05 level of tolerance indicating that there is no significant relationship between pneumonia and rainfall.

Table 4.4.7 Relationship between rainfall and diarrhea.

Variables	N	Mean	SD	SE	R	df	P	r critical
Diarrhea occurrence	719	16.9930	33.15497	1.23647	.060	717	.107	.195
Rainfall	719	87.1502	111.0272	4.14062				

The above table showed that there is no significant relationship between occurrence of diarrhea and rainfall as the calculated correlation coefficient R .060 is less the r critical .195 and the P calculated .107 is greater than the 0.05 level of tolerance indicating that there is no significant relationship between rainfall and the occurrence of diarrhea.

4.5 RELATIONSHIP BETWEEN RELATIVE HUMIDITY AND THE DISEASES

Table 4.5.1 Relationship between relative humidity and malaria.

Variables	N	Mean	SD	SE	R	df	P	r critical
Malaria occurrence	719	186.9263	367.1940	13.6940	.088	717	.019	.195
Relative humidity	719	50.7588	25.0801	.9353				

* Correlation is significant at the 0.05 level (2 – tabled).

The details of the above table revealed a significant relationship between the occurrence of malaria fever and relative humidity under the period of study. This is because the value of calculated P (0.019) is less than the 0.05 level of tolerance at df 717 signifying a significant relationship between the two variables.

Table 4.5.2 Relationship between relative humidity and typhoid.

Variables	N	Mean	SD	SE	R	df	P	r critical
Typhoid occurrence	719	21.7942	40.9143	1.5258	.088	717	.018	.195
Relative humidity	719	50.7586	25.0801	.9353				

* Correlation is significant at the 0.05 level (2 – tailed).

Significant relationship has been established between the occurrence of typhoid fever and relative humidity because the correlation coefficient P = .018 is less than the 0.05.

Table 4.5.3 Relationship between relative humidity and meningitis

Variables	N	Mean	SD	SE	R	Df	P	r critical
Meningitis occurrence	719	2.0723	6.21574	.231181	.081	717	.172	.195
Relative humidity	719	50.7588	25.0801	.9353				

Because the calculated correlation coefficient P (.172) is greater than the 0.05 then there is no significant relationship between occurrence of meningitis and relative humidity.

Table 4.5.4 Relationship between relative humidity and measles.

Variables	N	Mean	SD	SE	R	Df	P	r critical
Measles occurrence	719	186.9263	367.1940	13.6940	.088	717	.019	.195
Relative humidity	719	50.7588	25.0801	.9353				

* Correlation is significant at the 0.05 level (2 – tailed).

There is significant relationship between occurrence of measles and relative humidity because the Pearson correlation significant P (.019) is less than the 0.05 level of tolerance implying that significant relationship exist between the occurrence of measles and relative humidity.

Table 4.5.5 Relationship between relative humidity and asthma.

Variables	N	Mean	SD	SE	R	Df	P	r critical
Asthma occurrence	719	1.7483	2.9060	.10838	.135	717	.000	.195
Relative humidity	719	50.7588	25.0801	.9353				

* Correlation is significant at the 0.05 level (2 – tailed).

According to the correlation statistics above significant relationship has been proven to exist between the occurrence of asthma and relative humidity

because the calculated correlation significant (p) of .000 is less than the 0.05 confirming significant relationship.

Table 4.5.6 Relationship between relative humidity and pneumonia.

Variables	N	Mean	SD	SE	R	df	P	r critical
Pneumonia occurrence	719	4.1613	9.4068	.35082	.045	717	.233	.195
Relative humidity	719	50.7588	25.0801	.9353				

Outcome of the above correlation statistics table above revealed that there is no significant relationship between the occurrence of pneumonia and relative humidity because the calculated P .233 is greater than the 0.05 level of tolerance while the r calculated .045 is less than r critical .195 confirming that there is no significant relationship.

Table 4.5.7 Relationship between relative humidity and diarrhea.

Variables	N	Mean	SD	SE	R	Df	P	r critical
Diarrhea occurrence	719	16.9930	33.1549	1.23647	.077	717	.038	.195
Relative humidity	719	50.7588	25.0801	.9353				

* Correlation is significant at the 0.05 level (2 – tailed).

An understanding of the correlation statistics table above revealed a significant relationship between the occurrence of diarrhea and relative humidity because the calculated P (.038) is less than the 0.05 level of tolerance indicating a significant relationship between diarrhea occurrence and relative humidity.

4.6 RELATIONSHIP OF THE DISEASES AMONG THE VARIOUS HOSPITALS

Table 4.6.1(a) ANOVA statistics difference on the occurrences of malaria among the hospitals

	Sum of squares	Df	Mean square	F	Sig
Between groups	84239562	5	16847912.356	955.717	.000
Within groups	12569161	713	17628.557		
Total	96808723	718			

Table 4.6.1 (b) ANOVA descriptive on occurrences of malaria in the hospitals

Hospital	N	Mean	S.D.	S.E.	Minimum occurrence	Maximum occurrence
St. Lukes Hospital	120	12.2583	8.87684		1.00	63.00
Limi Hospital	120	15.4417	6.85969		4.00	33.00
May fair Hospital	120	13.2583	4.72699		6.00	25.00
Afuwa Spec. Hospital	120	6.3750	2.98473		1.00	17.00
A.B.U. sickbay	119	949.2101	300.54862		265.00	1727.00
Hajia Gambo Hospital	120	131.3667	126.07814		7.000	491.00
Total	719	186.9263	367.19353		1	1727.00

Table 4.6.1(c) Post-hoc multiple comparism test among the various hospitals on the occurrence of malaria fever.

(I) Hospital	(J) hospitals	Mean difference (I-J)	S.E.	Sig.
St. Lukes Hospital	Limi hospital	3.18333	17.14087	.853
	Mayfair hospital	1.00000	17.14087	.953
	Afuwa hospital	5.88333	17.14087	.732
	ABU sickbay	936.95175*	17.17684	.000
	Hajia Gambo	119.10833*	17.14087	.000
Limi Hospital	St. Lukes hospital	3.18333	17.14087	.853
	Mayfair hospital	2.18333	17.14087	.899
	Afuwa hospital	9.06667	17.14087	.597
	ABU Sickbay	933.76842*	17.17684	.000
	Hajia Gambo	115.92500*	17.14087	.000
Mayfair hospital	St. Lukes hospital	1.0000	17.14087	.953
	Limi hospital	2.18333	17.14087	.899
	Afuwa hospital	6.88333	17.14087	.688
	ABU Sickbay	935.95175*	17.17684	.000
	Hajia Gambo	118.10833*	17.17684	.000

Afuwa hospital	St. Lukes hospital	5.88333	17.14087	.732
	Limi hospital	9.06667	17.14087	.597
	Mayfair hospital	6.88333	17.14087	.688
	ABU Sickbay	942.83508*	17.17684	.000
	Hajia Gambo	124.99167*	17.14087	.000
ABU Sickbay	St. Lukes hospital	936.95175*	17.17684	.000
	Limi hospital	933.76842*	17.17684	.000
	Mayfair hospital	935.95175*	17.17684	.000
	Afuwa hospital	942.83508*	17.17684	.000
	Hajia Gambo	817.84342*	17.17684	.000
Hajia Gambo	St. Lukes hospital	119.10833	17.14087	.000
	Limi hospital	115.92500*	17.14087	.000
	Mayfair hospital	118.10833*	17.14087	.000
	Afuwa hospital	124.99167*	17.14087	.000
	ABU Sickbay	817.84342*	17.17654	.000

The analysis of the tables above revealed that significant difference exist among the various hospitals in the occurrence of malaria fever within the period under study. The first Analysis of Variance (ANOVA) table (a) showed a calculated F of 955.717 which is higher than the critical value of F (2.60) indicating a significant difference. The second, table(b) showed that the mean occurrence of malaria were 12.2583, 15.4417, 13.2583, 6.3750, p49.2101 and 131.3667 for St. Lukes hospital, Limi hospital, Mayfair hospital, Afuwa specialist hospital, ABU Sickbay and Hajia Gambo Sawaba General hospital respectively also revealed a significant differences. The third, table (c) revealed where significant differences exist within the hospitals in the occurrence of malaria fever. It revealed that significant difference exist between ABU sickbay and all the other hospitals, just like significant difference exist between Hajia Gambo Sawaba hospital and other hospitals in the occurrences of malaria fever within the period under study.

Table 4.6.2(a) ANOVA statistics difference on the occurrence of typhoid fever among the hospitals.

	Sum of squares	Df	Mean square	F	Sig.
Between groups	499622.52	5	99924.503	101.447	.000
Within groups	702299.02	713	984.993		
Total	1201921.50	708			

Table 4.6.2(b) ANOVA descriptive on occurrence of typhoid in the hospitals.

Hospital	N	Mean	SD	SE	Minimum occurrence	Maximum occurrence
St Lukes Hospital	120	1.6500	2.27759	.20791	0	15.00
Limi hospital	120	4.8750	3.57762	.32659	0	22.00
May fair hospital	120	7.7583	10.9437	.99902	0	120.00
Afuwa spec. hospital	120	1.3250	1.1534	.10550	0	5.00
ABU Sickbay	119	69.7143	57.1913	5.2427	0	363.00
Hajiya Gambo hospital	120	45.8417	50.1919	4.5818	0	205.00
Total	719	21.7942	40.9143	1.5258	0	363.00

Table 4.6.2(c) Post-hoc multiple comparism test among the various hospitals on the occurrence of typhoid fever.

(I) hospital	(J)hospitals	Mean difference (I-J)	S.E.	Sig.
St. Lukes	Limit Hospital	3.22500	4.05173	.426
	May fair	6.10833	4.05173	.132
	Afuwa spec	.32500	4.05173	.936
	ABU Sickbay	-68.06429*	4.06023	.000
	Hajia Gambo	-44.19167*	4.05173	.000
Limi hospital	St. Lukes	3.22500	4.05173	.426
	May fair	2.88333	4.05173	.477
	Afuwa spec	3.55000	4.05173	.381

	ABU Sickbay	-64.88929*	4.06023	.000
	Hajia Gambo	-40.96667*	4.05173	.000
May fair	St. Lukes	6.10833	4.05173	.132
	Limi hospital	2.88333	4.05173	.477
	Afuwa spec	6.43333	4.05173	.113
	ABU Sickbay	-61.95595*	4.06023	.000
	Hajia Gambo	-38.08333*	4.05173	.000
Afuwa spec.	St. Lukes	.32500	4.05173	.936
	Limi hospital	3.55000	4.05173	.381
	May fair	6.4333	4.05173	.113
	ABU Sickbay	68.38929*	4.06023	.000
	Hajia Gambo	44.51667	4.05173	.000
ABU Sickbay	St. Lukes	68.06429*	4.06023	.000
	Limi hospital	64.83929*	4.06023	.000
	May fair	61.95595*	4.06023	.000
	Afuwa spec.	68.38929*	4.06023	.000
	Hajia Gambo	23.87262*	4.05173	.000
Hajia Gambo	St. Lukes	44.19167*	4.05173	.000
	Limi hospital	40.96667*	4.05173	.000
	May fair	38.08333*	4.05173	.000
	Afuwa spec.	44.51667*	4.05173	.000
	ABU Sickbay	-23.87262*	4.06023	.000

The tables above revealed that significant difference exist in the occurrences of typhoid fever among the various hospitals within the period under study. Results of table (a) showed that the calculated F value of 101.447 at df 5, 713 is higher than the F critical of 2.60 individual significant difference just as the typhoid mean occurrences in table (b) descriptive were 1.6500, 4.8750, 7.7583, 1.3250, 69.7143 and 45.8417 for St. Luke, Limi hospital, Mayfair hospital, Afuwa general hospital, ABU Sickbay and Gambo Sawaba hospital respectively confirms this significant mean difference. The third, table (c) further revealed the various levels of differences between each hospital and the other hospitals on the occurrences of typhoid fever.

Table 4.6.3(a) ANOVA statistics difference on the occurrence of meningitis among the hospitals

	Sum of squares	Df	Mean square	F	Sig
Between groups	6509.590	5	1301.918	43.723	.000
Within groups	21230.650	713	29.777		
Total	27740.239	718			

Table 4.6.3(b) ANOVA descriptive on occurrences of meningitis among the hospitals

Hospital	N	Mean	S.D.	S.E.	Minimum occurrence	Maximum occurrence
St. Luke Hospital	120	.4250	.74091	.06764	.2911	.5589
Limi Hospital	120	1.5167	198728	.18141	1.1574	1.8759
May fair Hospital	120	1.6250	3.00158	.27401	1.0824	2.1676
Afuwa Spec. Hospital	120	.1833	.51829	.04731	.0896	.2270
A.B.U. sickbay	119	.0168	.12909	.01183	.0066	.0402
Hajia Gambo Hospital	120	8.6500	12.83028	1.17124	6.3308	10.9692
Total	719	2.0723	6.21574	.23181	1.6172	2.5274

Table 4.6.3(c) Post-hoc multiple comparism test among the various hospitals on the occurrence of meningitis

(I) Hospital	(J) hospitals	Mean difference (I-J)	S.E.	Sig.
St. Luke's Hospital	Limi hospital	1.09167	.70447	.122
	Mayfair hospital	1.20000	.70447	.089
	Afuwa hospital	.24167	.70447	.732

	ABU sickbay	.40819	.70595	.563
	Hajia Gambo	8.22500*	.70447	.000
Limi Hospital	St. Lukes hospital	1.09167	.70447	.122
	Mayfair hospital	.10833	.70447	.878
	Afuwa hospital	1.33333	.70447	.059
	ABU Sickbay	1.49886*	.70595	.034
	Hajia Gambo	7.133333	.70447	.000
Mayfair hospital	St. Lukes hospital	1.20000	.70447	.089
	Limi hospital	.10833	.70447	.878
	Afuwa hospital	1.44167*	.70447	.041
	ABU Sickbay	1.60819*	.70595	.023
	Hajia Gambo	7.02500*	.70447	.000
Afuwa hospital	St. Lukes hospital	.24167	.70447	.732
	Limi hospital	1.3333	.70447	.059
	Mayfair hospital	1.44167*	.70447	.041
	ABU Sickbay	.16653	.70595	.814
	Hajia Gambo	8.46667*	.70447	.000
ABU Sickbay	St. Lukes hospital	.40819	.70595	.563

	Limi hospital	1.49986*	.70595	.034
	Mayfair hospital	1.6819*	.70595	.023
	Afuwa hospital	.16653	.70595	.814
	Hajia Gambo	8.63319*	.70595	.000
Hajia Gambo	St. Lukes hospital	8.22500*	.70447	.000
	Limi hospital	7.13333*	.70447	.000
	Mayfair hospital	7.02500*	.70447	.000
	Afuwa hospital	8.46667*	.70447	.000
	ABU Sickbay	8.63319*	.70595	.000

A thorough examination of the above tables showed that significant relationship exist among the various hospitals on the occurrence of meningitis disease. The ANOVA table (a) revealed a calculated F of 43.723 at df 5,713 greater than 2.60 F. critical indicating significant difference while the ANOVA descriptive table (b) revealed that meningitis mean occurrence were .4250, 1.5167, 1.6250, .1833, .0168 and 8.6500 for St Lukes, Limi Hospital, may fair hospital, Afuwa Specialist hospital, A.B.U. Sickbay and Hajia Gambo hospital respectively. In the same vein the third, table (c) further revealed the degree of difference among one hospital and the others in the occurrences of meningitis within the period under study.

For instance significant differences were observed between ABU sickbay and other hospital just like between Hajia Gambo hospital and other hospitals in the occurrences of meningitis.

Table 4.6.4(a) ANOVA statistics difference on the occurrence of measles among the hospitals.

	Sum of squares	Df	Mean square	F	Sig
Between groups	39079.151	5	7815.830	9.210	.000
Within groups	605088.25	713	848.651		
Total	644167.40	718			

Table 4.6.4(b) ANOVA descriptive statistics on the occurrence of measles in the hospitals.

Hospital	N	Mean	S.D.	S.E.	Minimum occurrence	Maximum occurrence
St. Luke's Hospital	120	.5750	1.67865	.15324	0	13
Limi Hospital	120	1.2417	1.79165	.16355	0	8
May fair Hospital	120	1.3250	2.05456	.18755	0	10
Afuwa Spec. Hospital	120	.1583	.40987	.03742	0	2
A.B.U. sickbay	119	2.2353	3.44621	.31591	0	19
Hajia Gambo Hospital	120	20.8000	71.15182	6.49524	0	723
Total	719	4.3922	29.95278	1.11705	0	723

Table 4.6.4(c) Post-hoc multiple comparism test among various hospitals on the occurrence of measles.

(I) Hospital	(J) hospitals	Mean difference (I-J)	S.E.	Sig.
St. Lukes Hospital	Limi hospital	.66667	3.76088	.859
	Mayfair hospital	.25000	3.76088	.842
	Afuwa hospital	.41667	3.76088	.912
	ABU sickbay	1.66029	3.70877	.660
	Hajia Gambo	20.22500*	3.76088	.000
Limi Hospital	St. Lukes hospital	.66667	3.76088	.859
	Mayfair hospital	.08333	3.76088	.982
	Afuwa hospital	1.08333	3.76088	.773
	ABU Sickbay	.99363	3.70877	.792
	Hajia Gambo	19.55833*	3.76088	.000
Mayfair hospital	St. Lukes hospital	.75000	3.76088	842
	Limi hospital	.08333	3.76088	.982
	Afuwa hospital	1.16667	3.76088	.756
	ABU Sickbay	.91029	3.70877	.809
	Hajia Gambo	19.47500*	3.76088	.000
Afuwa hospital	St. Lukes hospital	.41667	3.76088	.912

	Limi hospital	1.08333	3.76088	.773
	Mayfair hospital	1.16667	3.76088	.756
	ABU Sickbay	2.07696	3.70877	.582
	Hajia Gambo	20.64167*	3.76088	.000
ABU Sickbay	St. Lukes hospital	1.66029	3.70877	.660
	Limi hospital	.99363	3.70877	.792
	Mayfair hospital	.91029	3.70877	.809
	Afuwa hospital	2.07696	3.70877	.582
	Hajia Gambo	18.56471*	3.70877	.000
Hajia Gambo	St. Lukes hospital	20.22500*	3.76088	.000
	Limi hospital	19.55833*	3.76088	.000
	Mayfair hospital	19.47500*	3.76088	.000
	Afuwa hospital	20.64167*	3.76088	.000
	ABU Sickbay	18.56471*	3.76088	.000

*The mean difference is significant at the .05 level

Outcome of the analysis showed that significant difference exist between the various hospitals on the occurrence of measles within the period under study. Table 4.6.4(a) showed that the calculated value of F (9.210) is higher than

the critical value of F (2.60) at df 5,713 indicating a significant difference among the hospitals in the occurrence of measles disease. Also table 4.6.4(b) revealed that the mean occurrences of measles are .5750, 1.2417, 1.3250, .1583, 2.23.53 and 20.8000 in St. Lukes hospital, Limi hospital, May fair hospital, Afuwa Specialist Hosp. A.B.U. Sickbay and Hajia Gambo Hospital respectively confirms significant difference in the occurrence of measles disease.

Then, the post-hoc multiple comparism table 4.6.4(c) revealed that significant difference exist between St. Lukes and Hajia Gambo hospital in measles disease occurrence. Also significant difference exist between Limi hospital and Hajia Gambo hospital and between Afuwa hospital and Hajia Gambo Hospital and between ABU Sickbay and Hajia Gambo. It was observed that significant difference exist between Hajia Gambo hospital and between each of the rest hospital on the occurrence of measles disease.

Table 4.6.5(a) ANOVA Statistics on the occurrence of asthma among the hospitals

	Sum of squares	Df	Mean square	F	Sig
Between groups	2105.363	5	421.073	75.851	.000
Within groups	2958.073	713	5.551		
Total	6063.431	718			

Table 4.6.5(b) ANOVA descriptive statistics on the occurrence of asthma in the hospitals

Hospital	N	Mean	S.D.	S.E.	Minimum occurrence	Maximum occurrence
St. Lukes Hospital	120	.7750	1.03276	.09428	0	4.00
Limi Hospital	120	.8750	1.10433	.10081	0	6.00
May fair Hospital	120	1.1250	1.26067	.11508	0	5.00
Afuwa Spec. Hospital	120	.5833	.80527	.07351	0	4.00
A.B.U. sickbay	119	1.6303	2.07840	.19053	0	10.00
Hajia Gambo Hospital	120	5.5000	4.94508	.45142	0	21.00
Total	719	1.7483	2.90601	.10838	0	21.00

Table 4.6.5(c) Post- hoc multiple comparism test among various hospitals on the occurrence of Asthma.

(I) Hospital	(J) hospitals	Mean difference (I-J)	S.E.	Sig.
St. Lukes Hospital	Limi hospital	.10000	.30417	.743
	Mayfair hospital	.35000	.30417	.250
	Afuwa hospital	.19167	.30417	.529

	ABU sickbay	.85525*	.30417	.005
	Hajia Gambo	4.72500	.30417	.000
Limi Hospital	St. Lukes hospital	4.72500	.30417	.742
	Mayfair hospital	.10000	.30417	.411
	Afuwa hospital	.29167	.30417	.338
	ABU Sickbay	.75525*	.30481	.013
	Hajia Gambo	4.62500*	.30417	.000
Mayfair hospital	St. Lukes hospital	.35000	.30417	.250
	Limi hospital	.2500	.30417	.411
	Afuwa hospital	.54167	.30417	.075
	ABU Sickbay	.50525	.30481	.098
	Hajia Gambo	4.37500*	.30417	.000
Afuwa hospital	St. Lukes hospital	.19167	.30417	.529
	Limi hospital	.29167	.30417	.338
	Mayfair hospital	.54167	.30417	.075
	ABU Sickbay	1.04692*	.30481	.000
	Hajia Gambo	4.9167*	.30417	.000
ABU Sickbay	St. Lukes hospital	.85525*	.30481	.005

	Limi hospital	.75525*	.30481	0.13
	Mayfair hospital	.50525	.30481	.098
	Afuwa hospital	1.04692*	.30481	.001
	Hajia Gambo	3.86975*	.30481	.000
Hajia Gambo	St. Lukes hospital	4.72500*	.30417	.000
	Limi hospital	4.62500*	.30417	.000
	Mayfair hospital	4.37500*	.30417	.000
	Afuwa hospital	4.91607*	.30417	.000
	ABU Sickbay	3.86975*	.30481	.000

*The mean difference is significant at the .05 level

According to the outcome of table 4.6.5(a) above, significant difference exist among the various hospitals on the occurrence of asthma because the calculated F 75.851 is higher than F critical 2.60 at df 3,715. The individual mean occurrences of asthma in each of the hospital also confirm this significant difference just as the post hoc multiple comparisms table further reveal the level of difference between each hospitals on the occurrence of asthma.

Table 4.6.6(a) ANOVA Statistics on the occurrence of pneumonia among the hospitals

	Sum of squares	Df	Mean square	F	Sig
Between groups	2207.185	5	4441.437	76.624	.000
Within groups	41328.100	713	57.964		
Total	63535.285	718			

Table 4.4.6(b) ANOVA descriptive on the occurrence of pneumonia among the various hospitals

Hospital	N	Mean	S.D.	S.E.	Minimum occurrence	Maximum occurrence
St. Lukes Hospital	120	2.3667	2.24893	.20530	0	17.00
Limi Hospital	120	2.0250	2.08823	.19063	0	12.00
May fair Hospital	120	2.1750	1.99437	.07199	0	11.00
Afuwa Spec. Hospital	120	.500	.78887	.29596	0	4.00
A.B.U. sickbay	119	1.3782	3.22856	.29596	0	26.00
Hajia Gambo Hospital	120	16.5000	17.97056	1.6448	0	95.00
Total	719	4.1613	9.40687	.35062	0	95.00

Table 4.6.6(c) Multiple comparism test among hospitals on the occurrence of pneumonia

(I) Hospital	(J) hospitals	Mean difference (I-J)	S.E.	Sig.
St. Lukes Hospital	Limi hospital	.34167	.98288	.728
	Mayfair hospital	.19167	.98288	.845
	Afuwa hospital	1.86667	.98288	.058
	ABU sickbay	.98852	.98495	.316
	Hajia Gambo	14.13333*	.98288	.000
Limi Hospital	St. Lukes hospital	.34167	.98288	.845
	Mayfair hospital	.15000	.98288	.879
	Afuwa hospital	1.52500	.98288	.089
	ABU Sickbay	.64085	.98495	.149
	Hajia Gambo	14.47500*	.98288	.000
Mayfair hospital	St. Lukes hospital	.19167	.98288	.058
	Limi hospital	.15000	.98288	.121
	Afuwa hospital	1.67500	.98288	.089
	ABU Sickbay	.79685	.98495	.373
	Hajia Gambo	14.32500*	.98288	.000

Afuwa hospital	St. Lukes hospital	1.86667	.98288	.316
	Limi hospital	1.52500	.98288	.512
	Mayfair hospital	1.67500	.98288	.419
	ABU Sickbay	.87815	.98495	.373
	Hajia Gambo	16.0000*	.98288	.600
ABU Sickbay	St. Lukes hospital	.98852	.98495	.728
	Limi hospital	.64685	.98495	.899
	Mayfair hospital	.79685	.98495	.121
	Afuwa hospital	.87815	.98495	.512
	Hajia Gambo	15.12183	.98495	.000
Hajia Gambo	St. Lukes hospital	14.133*	.98288	.000
	Limi hospital	14.47500*	.98288	.000
	Mayfair hospital	14.32500*	.98288	.000
	Afuwa hospital	16.000*	.98288	.000
	ABU Sickbay	15.12185*	.98288	.000

ANOVA statistics table 4.6.6(a), ANOVA descriptive table 4.6.6(b) and the multiple comparism table 4.6.6(c) all showed that significance difference exist

between the hospitals on the occurrence of pneumonia. First table 4.6.6(a) revealed an F value of 76.624 greater than critical F (2.60) at df 3,715 confirming a significant difference.

Table 4.6.7(a) ANOVA statistics on the occurrence of diarrhea among the hospitals

	Sum of squares	Df	Mean square	F	Sig
Between groups	367610.86	5	73522.172	124.324	.000
Within groups	421652.10	713	591.377		
Total	789262.97	718			

Table 4.6.7(b) ANOVA descriptive on occurrence of diarrhea in the hospitals

Hospital	N	Mean	S.D.	S.E.	Minimum occurrence	Maximum occurrence
St. Lukes Hospital	120	2.2167	3.7353	.34099	0.00	34.00
Limi Hospital	120	3.2833	2.16226	.19739	0.00	8.00
May fair Hospital	120	8.2417	25.15148	.47026	1.00	24.00
Afuwa Spec. Hospital	120	1.7500	1.51325	.13814	0.0	7.00
A.B.U. sickbay	119	21.2353	12.9246	1.18480	3.00	56.00
Hajia Gambo Hospital	120	65.2667	57.7078	5.26798	3.00	287.00
Total	719	16.9930	33.15497	1.23647	0.00	287.00

Table 4.6.7(c) Post- hoc multiple comparism test among various hospitals on the occurrence of diarrhea

(I) Hospital	(J) hospitals	Mean difference (I-J)	S.E.	Sig.
St. Lukes Hospital	Limi hospital	1.06667	3.13947	.734
	Mayfair hospital	6.02500	3.13947	.055
	Afuwa hospital	.46667	3.13947	.882
	ABU sickbay	19.0180*	3.14606	.000
	Hajia Gambo	63.0500*	3.13947	.000
Limi Hospital	St. Lukes hospital	1.06667	3.13947	.734
	Mayfair hospital	4.95833	3.13947	.115
	Afuwa hospital	1.53333	3.13947	.625
	ABU Sickbay	17.95196*	3.14606	.000
	Hajia Gambo	61.98333*	3.13947	.000
Mayfair hospital	St. Lukes hospital	6.02500	3.13947	.055
	Limi hospital	4.95833	3.13947	.115
	Afuwa hospital	6.49167*	3.13947	.039
	ABU Sickbay	12.99363	3.14606	.000
	Hajia Gambo	57.02800*	3.13947	.000

Afuwa hospital	St. Lukes hospital	.4667	3.13947	.882
	Limi hospital	1.5333	3.13947	.625
	Mayfair hospital	6.49167*	3.13947	.039
	ABU Sickbay	19.48529*	3.14606	.000
	Hajia Gambo	63.51667*	3.13947	.000
ABU Sickbay	St. Lukes hospital	19.01863*	3.14606	.000
	Limi hospital	17.95196*	3.14606	.000
	Mayfair hospital	12.99363*	3.14606	.000
	Afuwa hospital	19.48529*	3.14606	.000
	Hajia Gambo	44.03137*	3.14606	.000
Hajia Gambo	St. Lukes hospital	63.05000*	3.13947	.000
	Limi hospital	61.98533*	3.13947	.000
	Mayfair hospital	57.02500*	3.13947	.000
	Afuwa hospital	63.51667*	3.13947	.000
	ABU Sickbay	44.03137*	3.13947	.000

*The mean difference is significant at the .05 level

Outcome of tables 4.6.7(a), (b) and (c) above confirms that significant difference exist among the various hospitals on the occurrence of diarrhea. The first table

showed that the calculated F of 124.324 is higher than 2.60 at df 5,713 confirming significant difference. The second table revealed the hospitals' mean occurrence of diarrhea to further confirm the significant difference while the post-hoc multiple comparism revealed the level of differences among the various hospitals.

4.7 TEST OF HYPOTHESES

Hypothesis 1

There is no significant relationship between temperature and the occurrence of the diseases.

Typhoid, measles, pneumonia, and diarrhea showed no significant relationship with temperature. Therefore, the null hypothesis was accepted for these four diseases but rejected for malaria, meningitis and asthma which showed significant relationship with it.

Hypothesis 2

There is no significant relationship between rainfall and the occurrence of the diseases.

Malaria, typhoid, meningitis, measles, pneumonia and diarrhea showed no significant relationship with rainfall. Therefore, the null hypothesis was accepted for these six diseases but rejected for asthma which showed significant relationship with it.

Hypothesis 3

There is no significant relationship between relative humidity and the occurrence of the diseases.

Meningitis and pneumonia showed no significant relationship with relative humidity. Therefore, the null hypothesis was accepted for these two diseases but rejected for malaria, typhoid, measles, asthma and diarrhea which showed significant relationship with it.

Hypothesis 4

There is no significant difference among the various studied hospitals in Zaria on the frequency of occurrence of these diseases.

All the hospitals showed significant relationship with the occurrence of the diseases. Therefore the null hypothesis was rejected for all the hospitals.

The test of hypotheses above showed that diseases such as malaria, typhoid, asthma, measles, meningitis and diarrhea are triggered by weather while pneumonia is not weather induced.

Rainfall does not have direct significant effect on the occurrence of malaria, although it has indirect effects such as influencing the life cycle of the parasite and creating breading site in some places.

But relative humidity and temperature have significant effect on the occurrence of malaria because when relative humidity is high, mosquitoes are more active and they feed more voraciously but when it is low, they do not live long. Also, the optimum temperature for the development of the malaria parasite in the insect vector is between 20°C to 30°C. The parasites cease to undergo development in the mosquito if the mean temperature is below 16°C. Temperatures higher than 30°C are lethal to the parasites (Park, 1997).

Typhoid fevers are observed all through the year but more significantly high observations were recorded during the rainy season. Although rainfall does not significantly affect it occurrence but relative humidity does, relative humidity is generally high during the rainy season which explains its significant effect on the occurrence of typhoid fevers. This is also the season of increase in fly

population and water is not usually pure because of the effect of the rainfall. Temperature does not have any significant effect on the occurrence of typhoid fever.

The main trigger factor of meningitis among rainfall, temperature and relative humidity is temperature. Temperature had significant effect on the occurrence of meningitis while rainfall and relative humidity does not. High temperature, poor housing condition with overcrowding, inadequate ventilation could lead to the spread of the disease.

Asthma had significant relationship with rainfall, temperature and relative humidity. This means that these three weather elements are trigger factors to asthma. When temperature is low and the environment is cold, asthma could be triggered. When the temperature is extremely high and the environment stuffy, it could also be triggered. When it rains and humidity is high, breathing could be affected and it can also trigger an asthma attack.

Rainfall and temperature does not have significant effect on the occurrence of measles but relative humidity does. It prevails more between the months of April and September. It is a highly contagious virus disease and its

virus can remain active in the air or on infected surfaces for up to two hours and even more than two hours when relative humidity is high.

Pneumonia was not significantly affected by temperature, rainfall and relative humidity. It occurs almost randomly through the year but with higher frequency in a few months. Other factors like housing condition, socio-economic development and poor nutritional habit could have more effects on it occurrence than the weather.

Temperature and rainfall did not significantly affect the occurrence of diarrhea but relative humidity does. Diarrhea is also a disease that occur throughout the year but at times its occurrence is higher during the rainy and this is the season in which relative humidity is highest in the year. It is also the season when fresh vegetables and fruits are harvested since diarrhea could be transmitted through water or food, this could be the reason for its prevalence during this period.

The relationship of the diseases among the various hospitals showed that there is significant difference among the various hospitals in Zaria on the occurrence of the diseases. Although, their frequencies varies in size, it could

contact the disease. Pipe-borne water is usually not clean during this period because of the overland flow as a result of high rainfall which washes all sort of dirts, rubbish and contaminants into water reservoirs. Many times these reservoirs are not well treated leading to outbreaks of diarrhea. This may contribute to the prevalence of the disease.

Typhoid fever was triggered by relative humidity too. Its occurrence is higher when relative humidity is higher usually during the rainy season. This is because, it is transmitted through soiled hands contaminated with faeces or urine of carriers, or indirectly by the ingestion of contaminated water, food, or through flies. It prevalence during this season can be explained, there is usually increase in fly population so food and water might not be safe. Kalamullah(2002) confirms this.

Measles showed a significant relationship with relative humidity too. It is more common during late dry seasons to early onset of rainfall (March to June). Relative humidity is very low because of the high temperature, since it is highly contagious and the virus can be active for two hours in the air or on infected surfaces, the disease spread easily during this period. Healthscout Network, 2010; WHO, 2009; Kidshealth,2010 confirmed this.

traced to the capacity of the hospital, distance from major settlement areas and the billing system of each of the hospitals.

4.8 DISCUSSION

It is obvious that some diseases are sensitive to weather than others.

Meningitis for example was only triggered by temperature. This is because it is majorly spread when temperature is very high in the dry season and there is overcrowding. Normally when the temperature is high, relative humidity is very low and there is usually no rainfall, this probably is the reason why it only showed a relationship with temperature. Oshaji (2000),Ogbaji(2006) and Bukhari (2009) studied this relationship in Zaria and also discovered that high temperature is the only weather element that triggers meningitis.

Diarrhea was triggered by only relative humidity. Diarrhea may occur throughout the year in some cases but can be seasonal increasing during the wet season to the end of the rainy season when its frequency begins to drop. Relative humidity is higher between July and September because of the amount of rainfall in those months. Relative humidity favours the growth of disease pathogens. Since diarrhea can be transmitted through water or food and harvest of fresh fruits, vegetables and fresh crops are abundant during this period, it is easy to

Asthma showed significant relationship with the three weather elements. Extrinsic asthma is more prevalent during the cold period because it is triggered by allergies such as pollen, smoke and dusts which is more common during this period. While intrinsic asthma is more prevalent when the temperature is extremely high and the environment stuffy, also when it rains and humidity is high breathing is affected. Matthew,2005;Coleman, 2010; Ericsson, 2010 also confirms this.

Malaria was triggered by temperature and relative humidity. Malaria has a predictable seasonal pattern with maximum prevalence during the rainy season which is the period of high relative humidity. Temperature influences the occurrence of malaria directly because it affects the life cycle of the malaria parasite (Beniston, 2002). The optimum temperature for the development of malaria parasite is between 20°C to 30°C. The parasites cease to undergo development in the mosquito if the mean temperature is below 16°C. Temperatures higher than 30°C are lethal to the parasites (Park, 1997). Relative humidity has direct effect on the length of life of the mosquitoes. When relative humidity is high, mosquitoes are more active but when it is low, they do not live long, and when it is 60%, they live their normal span of life.

Pneumonia was not significantly affected by temperature, rainfall and relative humidity. Though they have their contributions, others factors like housing condition, clothing, socio-economic development and poor nutritional habit must have prevailed over the weather. Also there is general awareness of the disease so more preventive measures must have been taking over time to reduce the spread of the disease in Zaria because of the nature of cold in the place (*harmattan*).

So, the weather of Zaria to some extent has some effects on the occurrence of some common diseases in Zaria, though the effect varies with the weather element and the type of disease.

CHAPTER FIVE: SUMMARY, RECOMMENDATION AND CONCLUSION

5.0 INTRODUCTION

This chapter involves the summary of findings from this research work. From these findings, recommendations and conclusions were made.

5.1 SUMMARY

This research work was focused on the effect of weather on the occurrence of some common diseases in Zaria. Based on this, the weather induced diseases were identified to be malaria, typhoid, asthma, measles, meningitis and diarrhea. The trend of their occurrence was observed, each disease having similar pattern of occurrence with little variation, which is not significant.

Pearson moment correlation statistics was used to examine the relationship between the diseases and the weather elements, it showed that rainfall and temperature have indirect effects on malaria while relative humidity have direct effect on it. Typhoid fever also showed significant relationship with relative humidity but not with rainfall and temperature. But meningitis showed significant relationship only with temperature.

Asthma had significant relationship with rainfall, temperature and relative humidity this could be related to the nature of the disease. Measles had a significant relationship with relative humidity and non-significant relationship with rainfall and temperature. But pneumonia was not significantly affected by temperature, rainfall and relative humidity, this can also be related to the nature of the disease because it is a disease that can be consciously prevented and its occurrence is not only seasonal but randomly through the year.

Diarrhea is a disease that occurs almost throughout the year but at times its occurrence is higher when relative humidity is very high. This could be why it has significant relationship with relative humidity but no significant relationship with temperature and rainfall.

Furthermore, ANOVA statistics was used to determine whether any relationship existed among diseases in the various hospitals of study area. It was observed that there was significant relationship among all the hospitals in zaria on the occurrence of all the diseases.

5.2 RECOMMENDATION

Haven identified the weather induced diseases, established the trend of their occurrence and the relationship between the diseases and each weather

element, there is a need for recommendation to be made to suggest preventive strategies for both current and future planning purposes. This recommendation will be in three categories for individuals, health planners and researchers.

Firstly, the individuals are advised to study the changes that occur in their bodies during a particular season of the year or fluctuation in weather to be able to identify and avoid certain trigger factors so that they can enjoy good health. They should also not neglect taking vaccination when necessary as this will help them to avoid some of the diseases. And I hope that very soon there will be vaccination for malaria as researchers still hope to come up with one. They should be able to identify when to put on thick cloths and light ones, when to allow cross ventilation and when all doors and windows should be shut. Their physiological comfort should come first in everything they do.

Secondly, health planners should put into consideration the effect of weather on health as they plan for the future. Provisions should be made to prevent the severity of the impact of any disease ahead of time so that its effect can be minimal and manageable. Awareness should also be made for the general populace as the planner's monitors and gets any helpful information.

Thirdly, researchers are advised to put more effort in this field of study so that much can be done to prevent most of the diseases that people suffer from which they can actually avoid. Then we can have less sick people and less death cases, because we would have learnt how to enjoy our weather and stay healthy.

Finally, researchers should be encouraged by making data available to them and sponsorship to aid the speed at which they will work.

5.3 CONCLUSION

The aim of this study was to examine the relationship between rainfall, temperature and relative humidity of Zaria and the occurrence of some common diseases. From the research carried out, It was observed that each of these weather elements had significant relationship with the diseases, except for pneumonia which was not significantly affected by any of the three weather elements.

Thus, It can be said that the weather of Zaria have significant relationship with the occurrence of some common diseases in the land. Hence, attention should be given to changes in the weather from one season to another by individuals, the community and health planners when certain decisions are to be made. Individuals should prepare for these changes as they plan their daily

activities so that they can maintain their health and be efficient at work. Also the community should plan major events for periods when the weather is at the best for health. And lastly, the environmental health workers /planners should create awareness of the implications of any change in the weather for people so that they can take necessary precautions to protect themselves like in case of pneumonia and meningitis. They should also try to make vaccines available for vaccination on time before any outbreak.

REFERENCES

Adefolalu, D.O (1984). On Bioclimatogical Aspects of Harmattan Dust Haze in Nigeria. Arch. Met. Geoph. Biolisci. B33 pp 387-404.

Adewoye. S. O (2004), Basic Statistics for Engineering, Economics and Management.

Akinbobola, A and Omotosho, J.B (2004) "The Relationship between Meteorological Variables and some Common Diseases in some Selected Stations". Department of Meteorology, Federal University of Technology, Akure, Nigeria.

Ati, O.F (2002). Understanding Basic Climatological Terms.Pisteuo Publishers

Ayoade, J.O (1988). Tropical Hydrology and Water Resources. 1st Edition. Macmillan Publishers, London and Basingstoke.

Alkali, I.B (2009). Environmental management and its effect on settlement: an example of Samaru Zaria.

Banzer, M. (2009) "Weather and Our Health" http://www.bbc.co.uk/weather/

Beniston, M. (2002). "Climatic Change: Possible Impacts on Human Health: SWISS MED WKLY 2002, 132:332-337.www.smw.ch.

BetterHealth Channel (2010). "Does the weather affect asthma? Is it better to live in a warm climate? http://www.betterhealth.vic.gov.au/bhcv2/bhcarticles.nsf/ateaf/2377821?open.

Bukhari, T.B (2009) Temperature and Rainfall Variability and Outbreak of Meningitis and Measles in Zaria L.G.A of Kaduna State, Nigeria. B.Sc Dissertation, Department of Geography, A.B.U. Zaria.

Campbell-Lendrum, D and Corvalan, C (2008). "Climate Change and Developing-country cities; Implications for environmental Health and Equity" http://www.pubmedcentral.nih.gov/artiderender.Fcgi?

CDC (2008) "Climate Change and Public Health" http://www.cds.gov/climatechange/effects/default.html.

Climate and Health Resources Room (CHRR, 2008) "Climate and Malaria/Meningitis in Africa. http.//www.iridl.ideo. Columbia. Edu/maproom/health/Regional/Africa/malaria.

Coleman, T (2010) "Forecasting Illness: The Weather-Health Connection". http://www.al-hikmah.org/fore-casting-illness.htm.

Department of Urban and Regional Planning (DURP) Ahmadu Bello University, Zaria (1979). Zaria Master Plan 2000. Zaria: Gaskiya Corporation Limited.

Duncan, J.W.K (1996). "Environmental Health Principles; Planning for Healthy Housing" in Principles and Practice of Public Health in Africa. Vol. I, 2nd Edition. Edited by: Sofoluwe, G.O.; Schram, Rand Ogunmekan, D.A.

Ebdon, D (1977) Statistics in Geography: A Practical Approach. Published by Blackwell. Oxford.

Ericsson, C. (2010) "How does our Cold Weather Affect your Health?" http://www.usatoday.com/weather/health/whealth.htm.

Encarta Dictionary (2008)

Foster, H.D (1992). Health, Disease and the Environment.

Gagge, A.P (1979). "The Role of Humidity during warm discomfort" in INDOOR CLIMATE: Effects on Human Comfort, Performance and Health in Residential, Commercial and Light-Industry Building. Edited by Fanger, P.O and Valbjorn, O.

Greer, A; Victoria, N.G and Fisman, D (2008). "Climate Change and Infectious Diseases in North America: The Road Ahead". CMAJ. March 11,2008.178(6). Canadian Medical Association.

Griffiths, J.F 91976). Applied Climatology: An Introduction 2nd Edition.

Haines, A; Kovats, R.S; Campbell-Lendrum, D and Corvalan, C. 92006). "Climate Change and Human Health: Impacts, Vulnerability and Public Health. Public Health 2006; 120: 585-96.

Hayward, O.F and Oguntoyinbo, J.S (1987). The Climatology of West Africa. (B and N Books; New Jersey).

Healthscout (2010). "Measles-Symptoms, Treatment and Prevention". http://www.Hea;thscout.com/ency/68/732/main.

Hensel, H (1979) " Thermoreception and Human Comfort" in INDOOR CLIMATE; Effects on Human Comfort, Performance and Health in Residential, Commercial and light-Industry Building. Edited by Fanger, P.O and Valbjorn, O.

Hoeprich, P.D (1977). "Acute Bacterial Meningitis" in Infectious Diseases. A Modern Treatise of Infectious Processes. 2nd Edition, Edited by Hoeprich, P.D Published by Harper and row Publishers, Inc.

Hore, P.N (1979) "Weather and Climate" in Journal of Zaria and its regions, Vol. 4 Edited by Mortimore, M.J.

Hornick, R.B (1977). "Typhoid Fever" in Infectious Diseases; A Modern Treatise of Infectious Processes. 2nd Edition, Edited by Hoeprich, P.D. Published by Harper and Row Publishers, Inc.

Ilemona, J.O (1983). A prospective Study of Pneumonia in Under 5 as seen in A.B.U.T.H, Zaria, M.B.B.S. Dissertation, Department of Community Medicine A.B.U. Zaria.

Kaiser, M.(2010)"Bioweather" http://www.manfredkaiser.com/bioweather.html.

Kalamullah, M.S (2002). Study on Endemicity of Tyhoid Fever in A.B.U. Community, Samaru, Zaria. M.B.B.S Dissertation, Department of Community Medicine, A.B.U. Zaria.

Kalkstein, L.S and Valimont, K.M (2008) "Climate Effects on Human Health. http://www.hc-sc.gc.ca/ewh-semt/climat/index-eng.php.

Kanote, M (184). 'Climate of the Sorghum and Millet Cultivation Zones of the Semi-Arid Tropical Regions of West Africa" in Agromet of Sorghum and Millet in the Semi-Arid Tropics. Proceedings of the International Symposium, 5 November 1982, ICRISAT Centre, India.

Kaplan, M (2009) "Biometeorology: it may be the weather, not just in your head". http:www.Weather.com, arches &pains.

Kidshealth,(2010)."Infections;Measles". http://Kidshealth.org/parent/infections/bacterial-viral/measles.html.

Luber and Prudent (2009). " Climate Change and Human Health". Transactions of the American Clinical and Climatological Association, Vol. 120, 2009.

Malek, E. (1999) "The Way Weather Affects your Health". http://www.ciesin.columbia.edocs/001-338/001-338html.

Martens, W.J.M; slooff, R and Jackson, E.K (1997). "Climate Change, Human Health, and Sustainable Development". A Bulletin of the World Health Organization, 1997, 75 (6):583-588.

Matthew, B (2005) "Weather and your Health" USATODAY, a Division of Gannett co. Inc.

Mc Michael, A.J; Patz, J and Kovats, R.S (1998). "Impacts of Global Environmental Change on Future Health and Health Care in Tropical Countries" British Medical Bulletin 1998; 54 (N0.2):475-488.

MedicineNet (2010) "Asthma, Symptoms, Causes, Treatment" http://www.medicinenet.com/asthma/page2.htm.

Miller, (1977). "Malaria" in Infectious Diseases; A Modern Treatise of Infectious processes. 2nd Edition, Edited by Hoeprich, P.D. Published by Harper and Row Publishers, Inc.

My weather and Health Forecast (2010) "Medical Meteorology" http://weatherandhealth. net.

Nicholson, S.E (1981) "The Nature of Rainfall Fluctuation in Subtropical West Africa". Monthly Weather Review, 108 (4), 473-487.

Niniola, W. M. (1999). Awareness of Environmental Problems in Nigeria: A Case Study of Zaria Area. A B.Sc. Dissertation, Department of Geography, A. B. U. Zaria.

Nwosu, N.I (1997). "Methods of correlation analysis" in Elements of Social Science Statistic. Edited by Adedayo A and Nwosu, N.

Ogbaji, E.C (2006). Role of Temperature in the Distribution of Malaria: A Case Study of Zaria and Environs. B.Sc Dissertation, Department of Geography, A.B.U. Zaria.

Ojo .O; Ojo .K and Oni .S (2001). Fundamentals of Physical and Dynamic Climatology. Nigeria; SEDEC Publishers.

Oladipo, E.O (1993). "Some Aspects of the Spatial Characteristics of Drought in Northern Nigeria.

Olaniran, O.J. (2002). Rainfall Anomalies in Nigeria. The Contemporary Understanding. University Press, Unilorin, Ilorin, Nigeria.

Olaniran, O.J. and Summer, G.N. (1989). "A Study of Climate Variability in Nigeria Based on the Onset, Retreat and Length of the Rainy Season". International Journal of Climatology, 9,253-269.

Oshaji, O.B (2000). Effect of Weather in the Distribution of some Diseases. A Case Study of Zaria. B.Sc Dissertation, Department of Geography, A.B.U Zaria.

Park, k. (1997). "Epidemiology of Communicable Diseases", in Park's Texbook of Preventive and Social Medicine. 15th Edition.

Parz, J.A; McGeehin, M.A; Bernard, S.M; Ebi, K.L; Epstein, P.R Grambsch, A; Gubber, D.J; Reiter, P; Romieu I; Rose, J.B; Samet, J.M and Trtani, J. (2000). "The Potentail Health Impacts of Climate Variability and Change for the United States; Executive Summary of the Report of the Health Sector of the U.S National Assessment". Environmental Health Perspectives. Vol. 108, N0.4.

Ray, V. (1970) "Economic Activities in Zaria" in Journal of Zaria and its Region, Vol. 4. Edited by Mortimore, M. J.

Scott-Evans, L.A (2007) "How Climate Affects your Health". http://www.gilbertguide.com/2007/05/20.

ScienceDaily (1998) "Links Between Global Weather Patterns and Infectious Diseases".
http:/www.sciencedaily.com/releases/1998/12/981222081621.htm.

Sutherst, R.W (2004). " Global Change and Human Vulnerability to Vector-Borne Diseases' Clinical Microbiology Reviews. Jan. 2004, P. 136-173, Vol.17, N0.1.

U. S. Environmental Protection Agency (2005). Heat Island Effect: U. S. Environmental Protection Agency http://www.epa.gov/heatisland/index.htm.

Wenner, H.A (1977). "Viral Meningitis" in Infectious Diseases: A Modern Treatise of Infectious Processes. 2nd Edition, Edited by Hoeprich, P.D. Published by Harper and Row Publishers, Inc.

WHD (2008) "How Climate Change Affects World Health" http://www.sustdev.org/index.phh?ption.

Whitney, C.C (2009). 'Weekly Weather and Health Forecast" http://weatherandhealth.net

WHO (2007). "Climate Change and Human Health" http://www.euro.who.int/mediacentre/prl.

WHO (2008) "Protecting Health from Climate" http://www.who.int/global/change/publications/cc-reportWHD2008 /en/index.hml.

WHO (2009). "Measles" http://www.who.int/mediacentrelFactsheets/fs286/en/

WHO (2007). "Putting People and Health Needs on the Map". http://www.mara.org.za.

APPENDIX I

Table 4.1 METEOROLOGICAL DATA

Year ; 1999		Temperature ('C)		Rainfall (mm)	Relative Humidty (%)
Month	Maximum	Minimum	Mean	Rainfall (mm)	Relative Humidty (%)
January	31.3	16.4	23.9	0	30.1
February	28.7	15	21.9	0	24.5
March	34.6	20.1	27.4	0	20.1
April	39	24	31.5	0	40.4
May	35.6	23	29.3	107.6	56.1
June	30.5	21.2	25.9	157.1	73.8
July	28.9	21	25	268	79.6
August	28.4	20.2	24.3	298.4	82.4
September	29.8	20.6	25.2	177.7	78.3
October	31.3	19.8	25.6	63.3	64.1
November	32.4	16.2	24.3	0	32.6
December	29.6	13.5	21.6	0	28.1

Year ; 2000		Temperature ('C)		Rainfall (mm)	Relative Humidty (%)
Month	Maximum	Minimum	Mean	Rainfall (mm)	Relative Humidty (%)
January	30.9	15.1	23	0	31.5
February	34.4	18.2	26.3	0	27.5
March	37.5	22	29.8	0	34.6
April	36.7	23.8	30.3	10.5	41.1
May	35.5	23.3	29.4	7.2	55.3
June	32.1	21.8	27	229.5	72.6
July	28.6	20.9	24.8	245.7	83.3
August	27.9	20.8	24.4	144.7	82
September	29.1	20.5	24.8	268.2	94.5
October	30.9	19.6	25.3	78	69.3
November	32.1	17.5	24.8	0	38.5
December	29.7	14.4	22.1	0	32.3

Year ; 2001		Temperature ('C)		Rainfall (mm)	Relative Humidty (%)
Month	Maximum	Minimum	Mean	Rainfall (mm)	Relative Humidty (%)
January	29.9	12.8	21.4	0	22.8
February	30.7	15.3	23	0	17.4
March	36.2	20.3	28.3	0	18.6
April	34.7	22.3	28.5	99.8	47.9
May	34	22.7	28.4	100.4	64.3

June	30.7	21.4	26.1	189	75.4
July	29	20.6	24.8	255.7	82.4
August	28.3	20.9	24.6	244.9	85.8
September	29.8	20.8	25.3	312.6	82.4
October	32.3	19.3	25.8	0	54.5
November	32.8	16.5	24.7	0	34.5
December	31.6	15.4	23.5	0	30.9

Year ; 2002		Temperature ('C)		Rainfall (mm)	Relative Humidty (%)
Month	Maximum	Minimum	Mean	Rainfall (mm)	Relative Humidty (%)
January	26.8	13.3	20.1	0	22.9
February	32.2	16.5	24.4	0	21.4
March	36	21.5	28.8	26.4	27.7
April	36.4	23.9	30.2	35	51.9
May	36.4	24.4	30.4	10.9	54.4
June	32.2	21.6	26.9	85.9	71.8
July	30.2	21.3	25.8	181.2	78.9
August	29.1	20.8	25	210.2	83.6
September	30.3	20.8	25.6	200.1	81.4
October	30.5	19.6	25.1	128.7	70.8
November	32.2	16.7	24.5	0	39.1
December	30.3	14.5	22.4	0	24.5

Year ; 2003		Temperature ('C)		Rainfall (mm)	Relative Humidty (%)
Month	Maximum	Minimum	Mean	Rainfall (mm)	Relative Humidty (%)
January	31.4	14.7	23.1	0	20.9
February	34.9	18.2	26.6	0	18.4
March	35.4	20.2	27.8	0	18.3
April	36.4	23.5	30	55.7	50.4
May	36.3	22.5	29.4	107.3	50.1
June	31.1	21.5	26.3	74.5	73.1
July	29.8	20.8	25.3	254.3	80.8
August	28.8	20.7	24.8	407.2	84.8
September	29.9	20.7	25.3	238.2	79.4
October	32.4	20.9	26.7	62.5	67.4
November	33	17.6	25.3	0	36.9
December	30.1	14.2	22.2	0	28.4

Year ; 2004		Temperature ('C)		Rainfall (mm)	Relative Humidty (%)
Month	Maximum	Minimum	Mean	Rainfall (mm)	Relative Humidty (%)
January	31	15.3	23.2	0	21.3
February	32	16.5	24.3	0	15.1
March	34.5	20	27	0	15.8

April	37.1	24.3	30.7	34.8	46
May	33.4	22.3	27.9	103.9	68
June	30.9	20.8	25.9	239	77.8
July	29.4	20.7	25.1	284.4	79.1
August	28.2	20.5	24.4	296.9	83.5
September	30.1	20.8	25.5	186.3	79.9
October	32.4	20.2	26.3	23.9	63.4
November	32.8	17.8	25.3	0	41.3
December	31.6	15.6	23.6	0	24

Year ; 2005		Temperature ('C)		Rainfall (mm)	Relative Humidty (%)
Month	Maximum	Minimum	Mean	Rainfall (mm)	Relative Humidty (%)
January	28.6	14.3	21.5	0	20
February	35.8	21	28.4	0	18.8
March	37.4	23.3	30.4	0	18.1
April	37.4	23.7	30.6	28.1	35.6
May	23	20.3	21.7	62.1	62.9
June	21.6	20.2	20.9	179.5	75.8
July	20.7	19.7	20.2	168.7	81.5
August	20.4	19.4	19.9	291.9	84.1
September	21.1	19.2	20.2	85.7	76.8
October	23.3	19.8	21.6	10.7	59.8
November	23.6	17.1	20.4	0	27.5
December	22.1	16.1	19.1	0	23.3

Year ; 2006		Temperature ('C)		Rainfall (mm)	Relative Humidty (%)
Month	Maximum	Minimum	Mean	Rainfall (mm)	Relative Humidty (%)
January	30.2	17.1	23.7	0	20.8
February	33.6	19.9	26.8	0	20.6
March	35.1	21.3	28.2	0	15
April	36.8	23	29.9	1	23.5
May	34.1	22.4	28.3	84.1	65.9
June	30.5	22.2	26.4	125.5	69.6
July	29.3	21.4	25.4	235.2	78.6
August	27.7	21.1	24.4	207.4	82
September	27.5	20.5	24	356	80.9
October	29.1	21	25.1	29.2	68.8
November	31.4	15	23.2	0	30.4
December	30.1	14	22.1	0	23.4

Year:2007		Temperature ('C)		Rainfall (mm)	Relative Humidty (%)
Month	Maximum	Minimum	Mean	Rainfall (mm)	Relative Humidty (%)
January	30.1	14	22.1	0	18.6

February	32.4	17.7	25.1	0	16.1
March	35.4	20.7	28.1	7	18.6
April	36.8	24.1	30.5	44.9	51.4
May	31.3	22.8	27.1	239.6	68.9
June	30.4	21.1	25.8	210.2	75.3
July	29.7	21.1	25.4	213.5	80.4
August	28.5	20.7	24.6	457.8	84.3
September	28.1	21.2	24.7	42.9	77
October	32.1	20	26.1	3.8	58
November	33	18.5	25.8	0	31.1
December	30.6	15	22.8	0	21.9

Year:2008		Temperature (°C)		Rainfall (mm)	Relative Humidty (%)
Month	Maximum	Minimum	Mean	Rainfall (mm)	Relative Humidty (%)
January	29.8	14	21.9	0	20.9
February	33	20	26.5	0	12.9
March	34.7	21.6	28.2	0	18.9
April	35.4	22	28.7	36	33.9
May	35.1	22.9	29	66	60.8
June	30.2	22	26.1	90.1	71.1
July	29.3	20.9	25.1	120.2	77.5
August	28	20	24	250.7	85.4
September	30	20.8	25.4	274	79.1
October	32.2	19.3	25.8	16.1	60.9
November	32.7	16.2	24.5	0	28.5
December	31.5	15.8	23.7	0	28.3

APPENDIX II

TABLE 4.2.1 LIMI HOSPITAL AND MATERNITY,HANWA

Limi Hospital Hanwa

Year	1999	Limi Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	22	8	0	1	2	3	2
February	21	5	2	2	3	2	5
March	14	3	5	2	1	2	3
April	18	5	3	3	0	0	2
May	16	4	4	2	0	1	4
June	28	3	2	0	0	0	2
July	17	7	0	0	0	2	3
August	13	5	1	0	1	1	5
September	28	10	0	1	1	0	3
October	20	2	4	1	0	3	7
November	24	10	2	0	2	4	5
December	23	11	0	1	3	3	4

Year	2000	Limi Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	21	10	2	1	2	3	2
February	19	4	2	1	2	2	3
March	14	6	4	2	1	1	1
April	18	6	4	0	0	0	2
May	22	5	3	3	0	0	6
June	13	8	0	0	0	1	4
July	21	5	0	0	0	2	2
August	15	4	1	0	0	2	7
September	21	6	0	0	0	0	3
October	17	8	0	0	3	1	3
November	9	10	3	0	2	2	3
December	9	8	1	0	1	3	3

Year	2001	Limi Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	33	22	0	0	0	0	2
February	25	19	1	1	1	5	4
March	18	14	2	2	0	4	5

April	29	8	4	4	0	1	2
May	30	5	6	8	0	0	3
June	18	7	0	2	0	0	4
July	18	6	0	0	0	0	5
August	16	9	0	0	5	1	8
September	33	7	1	0	1	7	5
October	29	9	3	0	0	5	3
November	12	6	2	0	1	2	2
December	11	4	0	0	2	3	2

Year	2002	Limi Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	20	11	3	0	2	5	3
February	14	6	4	1	1	4	2
March	10	4	6	3	0	0	1
April	14	5	4	4	0	1	5
May	12	9	3	5	1	2	4
June	25	10	0	2	2	5	8
July	18	4	0	1	1	4	5
August	11	5	1	2	0	5	2
September	18	10	1	1	1	11	3
October	17	6	2	3	2	4	3
November	16	10	3	1	1	12	4
December	10	4	5	0	0	2	1

Year	2003	Limi Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	15	6	4	1	1	3	0
February	14	0	5	4	0	3	3
March	12	2	3	2	1	0	3
April	31	4	3	2	1	2	7
May	21	0	2	5	2	1	1
June	27	3	0	0	0	1	3
July	24	1	0	0	0	1	3
August	18	4	0	0	0	1	0
September	23	3	0	0	0	2	1
October	32	3	1	0	3	3	1
November	17	1	0	0	3	7	1
December	22	2	0	0	6	8	0

Year	2004	Limi Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	23	3	1	2	0	1	7

February	18	3	0	0	1	3	6
March	19	4	4	2	1	0	6
April	25	4	7	7	1	3	4
May	11	3	8	8	0	1	8
June	24	3	1	2	2	1	6
July	15	2	0	0	1	2	5
August	22	5	0	1	0	1	6
September	18	3	0	0	0	1	5
October	13	3	0	0	2	3	6
November	11	2	0	0	0	0	5
December	8	3	0	0	2	3	8

Year	2005	Limi Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	18	1	1	1	1	1	3
February	11	0	1	0	3	2	4
March	9	2	1	2	0	2	4
April	8	0	4	5	0	1	2
May	17	3	6	6	1	4	1
June	19	3	0	1	0	2	4
July	16	2	0	0	0	2	2
August	10	0	0	0	0	0	4
September	16	2	0	0	1	0	3
October	16	3	0	0	0	1	5
November	9	4	0	0	2	1	6
December	7	2	0	0	2	2	8

Year	2006	Limi Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	10	1	0	0	1	0	0
February	12	2	0	0	1	1	1
March	6	2	2	1	0	0	0
April	8	2	4	3	1	2	1
May	7	1	7	5	0	0	1
June	10	1	0	2	0	3	3
July	17	0	0	0	0	4	4
August	6	2	0	0	0	0	0
September	8	4	0	0	1	1	1
October	15	4	0	0	2	3	5
November	5	3	0	0	1	0	4
December	8	1	0	0	0	1	7

Year	2007	Limi Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	10	3	0	0	3	3	0
February	5	0	0	0	2	2	2
March	7	5	1	1	0	0	0
April	10	4	5	3	1	1	1
May	10	4	2	6	0	0	1
June	10	5	0	1	0	2	3
July	12	2	0	0	0	4	2
August	8	7	0	0	0	1	1
September	9	5	0	0	1	0	2
October	10	8	0	1	1	2	6
November	12	9	0	1	0	0	5
December	9	9	1	1	2	1	7

Year	2008	Limi Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	7	8	0	2	2	1	1
February	8	7	0	1	2	1	0
March	10	5	2	2	0	1	1
April	4	1	4	3	1	1	0
May	8	3	6	4	0	0	0
June	6	5	2	0	0	2	1
July	11	6	0	0	0	1	3
August	9	5	0	0	0	1	3
September	14	6	0	1	0	1	2
October	13	3	0	0	0	6	5
November	14	8	0	0	1	4	4
December	6	2	0	0	0	3	6

APPENDIX III

TABLE 4.2.2 ST LUKE'S HOSPITAL

Year	1999	Saint Luke					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	2	4	0	0	0	3	0
February	4	0	0	0	2	1	1
March	5	2	2	1	0	2	0
April	15	3	0	1	0	0	1
May	9	2	0	0	0	0	0
June	16	1	0	0	0	0	0
July	11	2	0	0	0	2	0
August	16	3	0	0	0	1	0
September	14	2	0	0	2	2	0
October	9	1	0	0	0	1	0
November	14	0	0	0	1	1	2
December	5	0	1	0	0	0	2

Year	2000	Saint Luke					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	8	0	0	0	2	1	0
February	4	1	0	0	0	1	0
March	3	2	0	0	0	3	0
April	5	0	0	0	1	2	0
May	9	2	0	0	0	2	0
June	10	1	0	0	0	3	0
July	9	0	0	1	0	5	2
August	15	0	1	0	0	6	1
September	7	0	0	0	0	3	0
October	4	0	0	0	0	1	0
November	4	5	1	0	0	3	3
December	2	2	0	0	0	1	0

Year	2001	Saint Luke					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	2	0	0	0	0	0	1
February	3	0	0	0	0	1	1
March	11	1	0	3	0	3	1
April	14	0	0	1	0	4	0

May	12	0	1	2	0	1	0
June	22	0	0	2	1	5	1
July	15	0	1	0	1	2	0
August	18	2	0	0	1	2	0
September	10	0	0	0	1	2	0
October	16	0	0	0	3	2	2
November	17	1	1	0	1	2	1
December	4	1	0	0	2	0	0

Year	2002	Saint Luke					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	5	2	0	0	0	1	0
February	5	0	1	0	0	4	0
March	10	0	0	0	2	3	1
April	10	0	1	0	0	1	0
May	9	0	1	0	0	0	2
June	8	1	0	0	1	0	0
July	8	2	0	0	0	2	0
August	4	0	0	0	1	0	0
September	11	1	0	1	1	0	0
October	18	0	0	0	2	0	2
November	9	0	1	0	1	0	1
December	3	0	0	0	0	0	0

Year	2003	Saint Luke					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	6	0	0	0	0	0	2
February	11	2	1	0	2	1	3
March	13	5	1	3	3	4	3
April	11	3	0	2	0	3	5
May	14	0	1	1	2	1	1
June	20	3	0	1	0	1	1
July	20	3	0	0	2	3	5
August	26	5	1	1	2	1	4
September	16	0	0	0	3	2	1
October	20	2	0	2	4	6	1
November	14	0	1	1	1	3	6
December	12	3	1	1	1	1	5

Year	2004	Saint Luke				
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	10	0	0	0	2	4	5
February	6	1	0	0	1	4	4
March	14	1	2	1	1	3	1
April	10	0	2	0	1	0	0
May	18	2	0	0	3	3	5
June	27	0	0	0	2	4	3
July	13	2	0	0	1	2	2
August	11	0	0	0	3	3	1
September	24	0	0	1	4	2	1
October	17	1	0	3	0	6	4
November	13	3	0	0	0	2	3
December	11	2	0	0	0	3	5

Year	2005	Saint Luke				
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	6	0	0	0	2	4	2
February	5	2	0	0	1	3	1
March	6	1	1	0	0	0	1
April	4	1	1	3	0	6	3
May	6	2	0	2	0	5	2
June	7	1	2	0	0	5	4
July	7	0	0	1	0	4	1
August	2	2	1	0	0	6	2
September	8	0	0	0	1	4	1
October	6	1	0	1	1	7	5
November	3	2	0	1	1	7	5
December	5	0	0	0	0	3	1

Year	2006	Saint Luke				
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	4	0	0	0	0	5	4
February	2	1	2	0	0	3	2
March	5	0	1	0	0	1	0
April	3	1	0	0	0	2	2
May	6	1	1	0	0	2	1
June	10	0	0	0	0	2	0
July	6	1	0	0	1	3	5
August	9	2	0	0	0	5	2
September	5	0	0	0	0	3	0
October	4	1	0	0	0	0	3
November	5	1	0	0	0	4	0

December	1	1	0	0	0	3	1

Year	2007	Saint Luke					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	13	1	0	0	0	0	0
February	21	2	0	0	1	1	1
March	24	1	1	0	0	0	1
April	19	1	4	0	2	0	2
May	24	7	0	0	0	2	4
June	28	2	3	0	1	5	4
July	17	1	3	0	2	6	4
August	16	2	1	0	1	3	1
September	23	1	2	0	1	3	2
October	43	0	0	0	0	1	4
November	28	3	1	10	4	17	6
December	19	3	1	13	2	1	6

Year	2008	Saint Luke					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	13	1	0	3	3	2	1
February	15	2	0	0	1	0	0
March	26	2	0	1	0	0	0
April	17	8	1	5	0	0	7
May	17	5	0	0	0	0	5
June	27	6	1	0	0	2	4
July	29	8	0	0	0	2	16
August	63	15	0	0	1	1	34
September	18	9	1	0	0	2	7
October	23	9	1	0	0	2	7
November	12	3	0	0	1	4	3
December	10	3	0	0	2	2	3

APPENDIX IV

Table 4.2.3 A.B.U SICKBAY MAIN CAMPUS SAMARU

Year	1999	ABU Sickbay Samaru					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	612	8	0	0	5	2	16
February	658	9	0	3	4	1	9
March	722	13	0	7	2	0	11
April	432	8	0	9	1	0	8
May	941	10	0	10	1	0	13
June	952	16	0	2	2	0	7
July	1011	20	0	0	0	0	11
August	1041	31	0	0	0	1	13
September	801	36	0	1	1	2	18
October	778	20	0	0	2	0	20
November	705	20	0	0	1	0	17
December	596	18	0	0	2	0	15

Year	2000	ABU Sickbay Samaru					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	734	10	0	0	5	5	24
February	878	10	0	9	9	17	32
March	869	17	0	9	5	26	42
April	633	10	0	7	7	9	26
May	1107	12	0	2	1	6	26
June	1157	20	0	2	3	8	36
July	1541	27	0	1	3	4	51
August	1527	47	0	1	10	6	45
September	1312	42	0	1	7	4	49
October	1208	36	0	2	6	3	41
November	1052	20	0	4	8	2	35
December	738	13	0	2	2	3	27

Year	2001	ABU Sickbay Samaru					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	1185	24	0	2	4	2	32
February		**STRIKE**					
March	836	240	0	8	0	0	20
April	420	103	0	6	2	0	3
May	753	122	0	0	1	0	21

June	727	119	0	0	0	0	5
July	711	156	0	2	0	0	32
August	665	267	0	7	2	4	28
September	852	227	0	2	1	5	56
October	848	363	0	0	3	5	54
November	733	267	0	0	4	1	51
December	392	100	0	1	2	0	15

Year	2002	ABU Sickbay Samaru					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	466	31	0	1	4	1	11
February	688	40	0	4	0	1	25
March	906	74	0	8	2	0	19
April	768	97	0	3	1	0	43
May	1134	121	0	2	1	0	43
June	1177	94	0	0	0	0	34
July	1374	130	0	0	0	0	32
August	1092	99	0	0	1	0	31
September	1048	83	0	0	0	0	21
October	1263	128	0	2	3	0	40
November	973	105	0	8	3	0	26
December	420	28	0	4	2	0	21

Year	2003	ABU Sickbay Samaru					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	767	46	0	10	3	0	31
February	389	29	0	3	2	0	7
March	423	26	0	5	0	0	9
April	265	40	0	0	1	0	3
May	432	66	0	0	0	0	4
June	749	67	0	1	0	0	13
July	1434	104	0	2	0	0	11
August	1196	112	0	0	0	1	7
September	1135	88	0	1	1	0	10
October	1082	125	0	0	2	0	13
November	595	116	0	1	1	0	8
December	404	27	0	1	3	0	8

Year	2004	ABU Sickbay Samaru					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	939	15	0	0	5	1	12
February	684	66	0	0	2	2	12
March	718	145	0	0	1	1	12

April	746	122	1	0	0	0	11
May	812	112	0	2	1	0	14
June	1176	86	0	1	1	0	5
July	1439	116	0	0	0	1	26
August	860	138	0	0	0	0	11
September	857	133	0	1	1	1	6
October	876	85	0	4	3	2	13
November	820	86	0	5	0	0	7
December	647	59	0	9	1	0	12

Year	2005	ABU Sickbay Samaru					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	645	51	0	13	0	3	5
February	1046	24	0	13	0	0	9
March	1208	52	0	19	0	0	16
April	1188	64	0	10	0	0	8
May	1109	41	0	0	1	0	5
June	1301	58	0	4	0	0	18
July	1727	47	0	1	0	0	3
August	1421	103	0	6	1	0	3
September	1568	79	0	1	1	0	11
October	1092	92	0	0	0	0	5
November	797	45	0	0	0	0	15
December	670	140	0	1	0	0	14

Year	2006	ABU Sickbay Samaru					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	855	104	0	0	3	2	21
February	1010	56	0	0	5	1	28
March	921	79	1	0	2	0	33
April	971	29	0	1	1	0	10
May	987	66	0	0	0	1	27
June	1387	75	0	0	2	1	17
July	1387	75	0	0	2	1	17
August	1219	30	0	0	1	0	12
September	981	40	0	1	4	2	6
October	971	38	0	1	7	1	11
November	671	51	0	0	1	0	9
December	425	80	0	1	3	0	13

Year	2007	ABU Sickbay Samaru					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	721	42	0	3	3	4	18

February	978	36	0	0	0	6	20
March	1081	47	0	1	0	1	24
April	998	58	0	2	1	0	20
May	922	49	0	4	0	0	21
June	1191	30	0	0	0	0	28
July	1311	37	0	0	0	1	34
August	1414	78	0	0	1	2	50
September	1319	61	0	0	0	2	45
October	1212	82	0	1	0	0	39
November	1121	50	0	0	0	1	33
December	909	71	0	0	1	3	28

Year	2008	ABU Sickbay Samaru				
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	696	20	0	0	1	1	20
February	1012	41	0	1	0	0	26
March	1060	55	0	1	1	1	26
April	1001	49	0	2	0	0	24
May	946	43	0	1	0	0	30
June	1147	38	0	0	0	0	27
July	1259	70	0	0	0	1	33
August	1362	77	0	0	0	0	29
September	1379	69	0	0	1	1	32
October	1286	60	0	0	0	0	32
November	1177	60	0	0	0	0	25
December	1016	54	0	0	0	1	27

APPENDIX V

Table 4.2.4 AFUWA SPECIALIST HOSPITAL

Year	1999	Afuwa Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	1	0	0	0	1	0	0
February	5	2	1	0	0	0	2
March	16	0	1	0	0	1	3
April	11	4	0	0	0	2	7
May	8	1	0	0	1	2	1
June	12	1	0	0	2	0	5
July	15	5	0	0	0	1	1
August	12	2	0	0	0	0	5
September	12	4	0	0	2	4	6
October	13	2	0	0	0	0	1
November	8	1	0	0	1	0	1
December	5	1	0	0	2	1	1

Year	2000	Afuwa Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	6	2	0	0	3	3	4
February	7	1	0	0	1	1	1
March	9	4	0	0	1	0	4
April	5	0	0	0	1	0	1
May	8	2	0	0	1	0	5
June	9	1	0	0	0	1	5
July	13	2	0	1	0	1	5
August	7	2	0	0	0	0	0
September	9	1	0	0	0	0	2
October	7	3	0	1	0	0	4
November	10	0	0	1	0	1	2
December	7	1	0	0	1	0	1

Year	2001	Afuwa Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	10	2	0	0	0	2	2
February	5	0	0	0	0	0	0
March	5	1	0	0	0	1	3
April	5	2	0	0	0	0	0
May	13	2	0	0	0	1	4

June	17	3	0	0	0	3	6
July	9	3	0	0	1	1	2
August	7	1	0	1	1	1	3
September	7	1	0	0	4	2	1
October	7	0	0	0	1	2	0
November	7	2	0	0	3	0	2
December	6	3	0	0	1	1	1

Year	2002	Afuwa Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	9	1	0	0	0	1	1
February	7	1	0	0	0	0	1
March	8	1	1	0	1	1	2
April	13	1	1	0	0	0	1
May	11	2	2	1	0	0	1
June	6	2	0	0	1	0	3
July	6	0	0	1	2	0	2
August	11	2	0	0	1	0	1
September	9	5	0	0	4	0	1
October	6	0	0	0	1	0	3
November	7	0	0	0	2	0	4
December	7	0	0	0	0	2	2

Year	2003	Afuwa Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	3	0	0	1	0	0	1
February	2	0	0	1	0	0	0
March	6	1	1	1	0	1	1
April	7	0	2	2	0	0	2
May	7	2	0	0	0	0	2
June	7	2	0	0	0	0	2
July	8	3	0	0	0	0	4
August	5	2	0	0	2	0	1
September	6	2	0	0	1	0	3
October	4	0	0	0	0	0	3
November	4	0	0	0	0	0	1
December	3	1	0	0	0	0	3

Year	2004	Afuwa Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	5	2	0	0	1	1	2
February	5	2	0	0	1	0	2
March	7	0	0	0	0	0	0

April	5	1	1	0	0	0	4
May	6	0	1	0	0	0	0
June	4	0	0	0	0	0	1
July	5	2	0	0	0	1	0
August	4	3	0	0	1	0	2
September	3	0	0	0	1	1	1
October	5	1	0	0	1	1	2
November	6	0	0	0	0	0	2
December	4	1	0	0	1	0	1

Year	2005	Afuwa Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	5	0	0	0	0	2	2
February	3	1	0	0	1	1	2
March	4	0	0	0	1	0	3
April	5	0	2	0	0	0	0
May	7	0	0	0	0	0	0
June	5	0	0	0	0	1	1
July	6	1	0	0	1	0	3
August	3	0	0	0	0	2	1
September	6	1	0	0	1	0	0
October	5	2	0	0	1	0	0
November	3	1	0	0	0	1	1
December	3	2	0	0	1	1	0

Year	2006	Afuwa Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	7	2	0	0	1	2	1
February	5	1	0	0	0	0	1
March	6	2	1	0	1	0	2
April	4	2	3	1	0	0	0
May	6	1	1	1	1	0	1
June	7	1	0	0	1	0	1
July	4	1	0	0	0	1	1
August	6	1	0	0	1	0	1
September	6	3	0	0	1	0	2
October	4	1	0	0	1	0	0
November	3	0	0	0	0	0	0
December	2	2	0	0	0	1	1

Year	2007	Afuwa Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	9	3	0	0	1	2	2

February	6	4	0	0	0	0	1
March	6	0	2	0	0	1	0
April	7	1	1	0	0	1	0
May	3	0	1	2	0	0	2
June	3	0	0	1	0	0	0
July	5	0	0	0	1	0	0
August	3	1	0	0	0	0	1
September	5	2	0	0	1	0	3
October	5	1	0	0	0	0	0
November	3	2	0	0	0	0	1
December	4	1	0	0	0	0	3

Year	2008	Afuwa Hospital				
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	5	3	0	0	1	1	3
February	4	2	0	0	1	0	2
March	3	1	0	0	0	0	0
April	7	0	0	1	0	0	1
May	7	0	0	1	0	0	2
June	5	1	0	0	0	0	1
July	5	2	0	0	1	1	3
August	3	1	0	0	0	1	2
September	5	2	0	1	0	0	1
October	5	1	0	0	1	0	0
November	4	2	0	0	0	0	2
December	4	2	0	0	1	0	3

APPENDIX VI

TABLE 4.2.5 MAYFAIR HOSPITAL

Mayfair Hospital Sabon Gari

Year	1999	Mayfair Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	12	5	0	0	3	5	6
February	10	4	0	1	1	3	5
March	9	3	1	2	0	2	5
April	7	3	4	4	0	1	4
May	8	6	6	7	0	1	3
June	13	7	1	1	1	2	2
July	14	5	0	0	0	1	4
August	12	8	0	0	1	2	7
September	10	9	0	0	0	3	8
October	14	7	0	0	0	1	6
November	10	6	0	0	1	2	4
December	8	5	0	0	2	4	3

Year	2000	Mayfair Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	7	8	0	2	4	3	3
February	6	7	0	2	2	1	4
March	8	5	1	3	0	0	3
April	7	3	3	4	0	1	5
May	9	4	4	5	0	0	7
June	6	5	2	0	0	2	8
July	10	6	0	0	0	2	6
August	8	5	0	0	1	1	3
September	12	6	0	1	0	2	8
October	11	3	0	0	0	3	9
November	12	8	0	0	1	2	10
December	8	2	0	0	2	4	7

Year	2001	Mayfair Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	10	2	0	0	3	1	4
February	12	3	0	1	2	1	4
March	6	2	2	1	0	0	3
April	8	3	3	3	1	1	2

May	7	4	7	4	0	0	5
June	9	2	0	2	0	2	6
July	14	0	0	0	0	3	7
August	10	1	0	0	0	0	6
September	8	4	0	0	1	2	5
October	11	3	0	0	2	3	7
November	7	2	0	0	1	0	8
December	6	2	0	0	3	2	9

Year	2002	Mayfair Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	12	3	0	0	4	3	4
February	13	1	0	2	2	2	6
March	7	4	1	1	0	0	4
April	10	4	4	3	1	0	5
May	8	4	3	5	0	0	3
June	11	5	0	2	0	2	7
July	13	2	0	0	0	1	8
August	7	3	0	0	0	2	5
September	8	5	0	0	2	0	6
October	10	9	0	1	1	2	6
November	12	8	1	1	1	1	7
December	7	7	0	0	1	3	9

Year	2003	Mayfair Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	10	8	0	2	3	4	5
February	8	7	1	1	2	2	5
March	10	5	2	2	1	1	3
April	6	2	4	4	0	1	4
May	7	3	5	6	0	0	7
June	8	4	2	0	0	2	8
July	11	6	0	0	0	2	7
August	9	6	0	0	0	1	6
September	12	5	0	1	0	1	9
October	11	3	0	1	0	5	10
November	12	7	0	0	1	3	8
December	9	2	0	0	2	3	5

Year	2004	Mayfair Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	10	5	0	0	4	6	7
February	13	5	1	0	3	3	5

March	15	4	4	1	2	2	3
April	16	3	6	2	0	0	1
May	18	7	7	4	0	0	1
June	17	6	2	2	1	0	4
July	12	9	0	0	2	1	5
August	13	8	0	0	0	2	8
September	18	10	0	0	0	0	7
October	20	11	1	0	1	1	3
November	18	9	0	1	1	0	6
December	16	7	0	0	3	2	8

Year	2005	Mayfair Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	16	15	0	0	5	4	7
February	14	4	2	0	3	3	5
March	12	6	3	2	2	2	5
April	13	7	9	4	1	1	8
May	17	8	20	7	0	0	9
June	19	11	10	1	0	0	10
July	15	9	7	0	2	1	13
August	16	10	0	0	0	3	12
September	20	14	0	0	1	1	11
October	17	12	0	1	0	1	12
November	15	8	0	0	1	2	10
December	11	5	0	0	2	3	13

Year	2006	Mayfair Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	17	7	0	0	3	5	4
February	14	6	1	0	2	3	5
March	15	4	4	1	1	1	3
April	20	5	3	3	0	0	6
May	21	8	3	2	0	0	8
June	17	6	1	2	0	0	7
July	13	11	0	0	0	2	5
August	16	10	0	0	2	3	11
September	20	12	1	1	0	0	13
October	23	14	1	1	0	1	15
November	18	10	0	0	2	0	18
December	14	11	0	0	4	2	20

Year	2007	Mayfair Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea

January	22	9	0	0	4	5	6
February	20	5	1	1	2	3	5
March	16	7	4	3	2	4	8
April	15	9	9	7	1	1	4
May	14	10	10	10	0	0	10
June	20	14	4	3	3	4	12
July	17	15	0	0	1	3	15
August	18	13	0	0	0	6	14
September	20	19	1	0	1	2	13
October	24	15	0	1	1	1	14
November	13	10	0	1	2	4	14
December	18	11	0	0	3	3	15

Year	2008	Mayfair Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	13	8	1	1	3	4	11
February	15	7	2	0	4	7	12
March	16	9	3	0	1	6	18
April	21	10	7	8	0	4	20
May	22	11	10	9	0	4	24
June	20	10	0	1	0	9	18
July	17	11	0	3	3	11	19
August	19	9	0	0	0	4	22
September	23	13	0	1	0	6	23
October	25	10	0	0	0	8	20
November	16	8	0	0	2	2	21
December	18	120	0	0	1	1	20

APPENDIX VII

TABLE 4.2.6 HAJIA GAMBO SAWABA GENERAL HOSPITAL

Year	1999	Gambo Sawaba General Hopital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	36	9	2	5	7	15	8
February	32	7	4	7	3	7	3
March	31	6	7	6	2	1	4
April	48	8	17	26	1	2	12
May	37	7	18	21	3	5	7
June	31	21	0	13	1	5	8
July	34	12	0	3	5	0	5
August	18	10	6	4	4	2	6
September	41	41	0	0	0	3	14
October	24	39	1	0	1	2	8
November	16	23	0	0	4	1	5
December	15	18	2	0	8	6	12

Year	2000	Gambo Sawaba General Hopital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	32	3	1	2	9	8	7
February	17	2	3	1	4	8	5
March	23	4	8	3	2	7	8
April	36	1	12	14	3	6	12
May	23	8	9	15	3	6	9
June	28	10	4	13	2	13	15
July	34	6	4	5	5	0	4
August	55	17	7	6	1	3	13
September	35	23	12	21	0	11	26
October	7	6	2	5	2	7	5
November	18	9	1	6	2	6	16
December	18	9	0	9	5	10	18

Year	2001	Gambo Sawaba General Hopital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	64	2	1	4	16	8	6
February	7	1	7	7	5	5	4
March	51	7	2	6	1	1	4
April	63	5	18	31	0	11	13
May	23	8	9	32	3	15	8

June	21	9	0	15	3	13	15
July	23	3	0	3	4	0	7
August	21	11	5	9	6	7	7
September	72	6	0	4	0	4	6
October	61	10	2	0	1	2	37
November	32	9	0	0	2	2	26
December	22	1	3	2	6	2	23

Year	2002	Gambo Sawaba General Hopital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	20	7	4	1	10	4	3
February	32	3	2	1	9	0	7
March	17	2	12	3	3	2	4
April	8	3	8	0	4	0	17
May	11	2	2	2	2	0	21
June	33	5	5	2	4	4	20
July	37	8	2	2	3	4	126
August	98	10	1	2	4	7	177
September	78	19	1	5	0	5	109
October	60	9	0	3	3	7	98
November	63	17	0	4	3	3	51
December	17	3	6	0	7	2	36

Year	2003	Gambo Sawaba General Hopital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	44	0	1	23	14	1	47
February	49	2	11	27	7	3	26
March	61	3	107	41	5	5	37
April	76	10	49	65	5	6	41
May	51	24	31	33	4	8	52
June	52	20	5	11	10	10	76
July	58	11	4	0	6	1	124
August	44	14	2	0	4	1	76
September	47	2	0	0	0	3	79
October	42	8	0	0	0	11	59
November	59	2	7	0	1	9	63
December	47	1	7	0	4	19	45

Year	2004	Gambo Sawaba General Hopital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	32	7	4	14	14	3	52
February	54	17	2	23	10	7	38
March	50	10	43	35	11	14	64

April	63	8	10	4	5	13	41
May	40	6	11	4	3	8	49
June	81	34	11	5	7	12	56
July	120	12	2	5	2	11	59
August	106	10	2	1	4	19	98
September	105	53	2	13	5	15	120
October	123	49	5	19	0	6	90
November	151	32	9	40	0	8	123
December	101	41	3	105	4	26	143

Year	2005	Gambo Sawaba General Hopital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	108	37	11	56	4	2	66
February	158	11	10	63	1	22	56
March	201	80	16	89	0	22	96
April	166	50	11	56	5	27	65
May	212	77	13	25	3	19	75
June	336	150	10	34	7	36	287
July	237	100	2	4	2	22	123
August	270	131	13	3	3	30	110
September	246	120	6	3	0	62	65
October	245	94	1	2	3	22	44
November	263	141	7	3	4	44	85
December	126	84	5	1	5	17	36

Year	2006	Gambo Sawaba General Hopital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	165	89	6	0	7	35	46
February	190	55	21	2	9	20	52
March	152	43	30	0	4	17	53
April	230	86	12	0	7	32	59
May	206	68	10	3	5	15	38
June	333	153	4	0	14	12	143
July	320	131	6	0	6	28	139
August	249	106	4	0	3	31	144
September	162	81	7	1	5	15	114
October	149	90	4	1	3	17	94
November	167	93	4	0	0	12	93
December	121	46	3	0	4	7	52

Year	2007	Gambo Sawaba General Hopital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	162	40	1	0	17	54	54

February	173	59	2	1	14	52	78
March	157	70	5	0	19	26	72
April	164	63	8	3	3	15	102
May	224	77	5	2	18	22	109
June	356	126	12	5	14	13	69
July	405	150	5	3	11	13	68
August	349	205	14	5	19	40	76
September	303	111	7	9	14	38	94
October	404	170	3	10	17	67	141
November	271	73	1	723	7	57	182
December	203	82	1	199	5	55	229

Year	2008	Gambo Sawaba General Hopital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	413	120	10	154	18	95	212
February	297	98	8	121	21	56	86
March	282	96	12	55	17	70	88
April	462	135	26	33	10	54	131
May	467	153	25	23	4	57	158
June	446	172	28	3	3	13	147
July	491	112	25	0	8	35	181
August	178	68	36	0	6	26	180
September	413	127	35	4	4	35	200
October	351	129	8	4	1	33	143
November	300	48	2	2	0	11	80
December	202	66	5	0	5	16	104

January	22	9	0	0	4	5	6
February	20	5	1	1	2	3	5
March	16	7	4	3	2	4	8
April	15	9	9	7	1	1	4
May	14	10	10	10	0	0	10
June	20	14	4	3	3	4	12
July	17	15	0	0	1	3	15
August	18	13	0	0	0	6	14
September	20	19	1	0	1	2	13
October	24	15	0	1	1	1	14
November	13	10	0	1	2	4	14
December	18	11	0	0	3	3	15

Year	2008	Mayfair Hospital					
Month	Malaria	Typhoid	Meningitis	Measles	Asthma	Pneumonia	Diarrhea
January	13	8	1	1	3	4	11
February	15	7	2	0	4	7	12
March	16	9	3	0	1	6	18
April	21	10	7	8	0	4	20
May	22	11	10	9	0	4	24
June	20	10	0	1	0	9	18
July	17	11	0	3	3	11	19
August	19	9	0	0	0	4	22
September	23	13	0	1	0	6	23
October	25	10	0	0	0	8	20
November	16	8	0	0	2	2	21
December	18	120	0	0	1	1	20