COMPLETENESS OF MALARIA CASE NOTIFICATION AND SURVEILLANCE INFRASTRUCTURE AT HEALTH FACILITIES IN AKINYELE AND IBADAN NORTH LOCAL GOVERNMENT AREAS, OYO STATE, NIGERIA

BY

FolukeAdetola OGUNYEMI
B.Sc Microbiology (Ibadan)
MATRIC NO: 111237

A DISSERTATION IN THE DEPARTMENT OF EPIDEMIOLOGY AND MEDICAL STATISTICS SUBMITTED TO THE FAULTY OF PUBLIC HEALTH, COLLEGE OF MEDICINE, IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF MASTER OF PUBLIC HEALTH (FIELD EPIDEMIOLOGY)DEGREE OF THEUNIVERSITY OF IBADAN

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CERTIFICATION

I certify that this work was carried out under my supervision by Foluke Adetola OGUNYEMI, of the department of Epidemiology and Medical statistics, Faculty of Public Health, College of Medicine, University of Ibadan.

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DEDICATION

This book is dedicated to Late OladosuAkinolaAdegbile; having a place to visit during the holidays and knowing you always believed I will succeed strengthened my hope to reach for the skies. Also to ItunuoluwaOluwafifehanmiMolabowale; your arrival gave wind to my wings.

ACKNOWLEDGEMENT

I acknowledge the kind help and supportive supervision of Dr Funmilayo Fawole and Dr Akinola Fatiregun whose encouragement was constant from the first day I resumed for MPH Field epidemiology.

Professor E. Bamgboye for his fatherly support and cheer at all times.

Dr. Babatunde Adedokun for tutoring and mentorship; thank you.

Mrs. Isamotu of Ojoo Primary Health Care center and the District Surveillance & Notification Officers of Akinyele and Ibadan North LGA- Thank you.

Mr. 'Dotun Olusanya Elder indeed! God bless you

Mr. Moses Adeleke Ogunyemi for your limitless love and encouragement, you are the best dad any girl can have in the whole world.

Mrs Felicia Ogunyemi-Mummie, thank you. You rock everytime!

Damola Ogunyemi for helping with my dissertation, thank you and all my siblings-I appreciate your love.

Mrs. Taiwo Ojelabi- Mum, for being there all the way, I am grateful.

Mr. Olusola Ojelabi- Thank you for your fatherly support.

Temitope Oginni, Dr Christopher Enakpenethanks for being my study buddies-see I finally made it!

Oluwafisayom I. Opeyemi Ojelabi- Through all the years...well, what can I say "a threefold cord is not easily broken"! Thank you.

Jehovah Elshaddai-Lord God Almighty, immortal invisible the only wise God YOU made this happen in my lifetime, thank you LORD.

ABSTRACT

Integrated Disease Surveillance and Responsepolicy was adopted in 2002 to strengthen disease notification and surveillance in Nigeria. An efficient surveillance system for malaria constitutes an essential activity for planning evidence-based control measures and monitoring these interventions. However, there is paucity of reports on the completeness of malaria case notification and the adequacy of the surveillance system currently in place thus this study was designed to compare available surveillance infrastructure, and estimate the completeness of malaria case-notification from public Health Facilities (HFs) in two Local Government Areas (LGA) of Ibadan.

A comparative cross-sectional study design was employed. Stratified random sampling technique was used to select two of the 11 LGAs in Ibadan metropolis-Akinyele (AKY) and Ibadan North (IBN). All public HFs and surveillance units in these LGAs were visited. An interviewer administered questionnaire containing variables on socio-demographics and a 10-point knowledge scale on malaria case notification was used to obtain data from all surveillance focal persons present in these HFs; 102 in AKY and 63 in IBN respectively. A facility checklist was used to collect data on available surveillance infrastructure. Malaria surveillance registers from January to June 2008 at the HFs and LGA surveillance units were reviewed and relevant information extracted for comparison using a proforma. The Lincoln-Peterson capture-recapture technique was used to estimate total number of malaria cases expected for each LGA within this period. Reporting completeness was calculated as a proportion of total number of malaria cases reported to the LGA by HFs to number estimated by the capture-recapture method. Data were analyzed using descriptive statistics, t-test, Fisher's exact and Chi-square tests.

Mean age of the focal persons was 39.8±0.7years and majority was female (64.6%). Average years of work experience were 11.6±0.6years in IBN and 12.3±0.8years in AKY. Respondents who had ever attended training on malaria surveillance were, 4.0% (AKY) and 17.0% (IBN) ($p<0.05$). Mean knowledge score was 6.2± 1.6 (AKY) and 6.4± 1.6 (IBN). Eight percent (AKY) and none (IBN) of the focal persons reported receiving feedback from the LGA ($p<0.05$). Proportions of HFs that complied with stipulated reporting intervals were 100.0% (AKY) and 42.0% (IBN). Available surveillance infrastructure were; Case registers 55.0% vs 56.5%, reporting forms 21.0% vs. 23.0%, computers 3.0% vs 9.0% ($p<0.05$), calculators 27.0% vs 32.0% and laboratory equipments 37.0% vs. 52.0% ($p<0.05$) AKY and IBN respectively. Of the expected 22080 malaria cases, 19531 malaria cases were recorded at the health facilities, the overall completeness of reporting malaria casesfromHFsto LGA was 87.1% (95% CI: 70.9-71.8%) and 17.7% (95% CI: 27.6-27.9%) AKY and IBN LGAs respectively ($p<0.05$)

Under-reporting of malaria cases in Ibadan North, an urban LGA was higher than in Akinyele a rural LGA. In addition, surveillance infrastructure was inadequate in both local government areas. Training and provision of reporting infrastructure is needed to address under-reporting of malaria cases in both local government areas.

Keywords: Malaria notification, Reporting completeness, Surveillance infrastructure
Word Count: 475

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LIST OF ABBREVIATIONS

ACTs:	Artemisinin-Combination Treatments
AMREF:	African Medical Research Foundation
CDC:	Centers for disease control
DSNO:	District Surveillance and Notification Officer
FMOH:	Federal Ministry of Health
GMAP:	Global Malaria Program
IDSR:	Infectious Disease Surveillance and Response
ITNs:	Insecticide-Treated Nets ,
HMIS:	Health Management Information Systems
LGA:	Local Government Area
NHMIS:	National Health Management Information System
NMCP:	National Malaria Control Program
PHC:	Primary health care
RBM:	Roll Back Malaria
RDT:	Rapid-Diagnostic test
WHO:	World Health Organization

CHAPTER ONE

INTRODUCTION

1.0 Background of the Study

Global malaria surveillance started as part of efforts to control malaria infection, morbidity and mortality. The World Health Organization (WHO) first defined malaria surveillance as "that part of a malaria eradication program designed to discover evidence of any continuation of transmission, to establish its nature and causes, to eliminate residual foci, to prevent or cure such residual or imported malaria infections in man that would delay the ending of transmission or threaten its resumption in a given area and to substantiate the fact that eradication has been achieved" (Kaiser, 1966).

Over the past decade there has been a massive scale-up of antimalarial interventions globally which include the use of Insecticide-Treated Nets (ITNs), Artemisinin-Combination Treatments (ACTs), and Rapid-Diagnostic Tests (RDTs), and in selected areas, Indoor Residual Spraying. This scale-up is beginning to have a significant impact on the burden of malaria in many areas worldwide. The World Malaria Report 2010 estimated that in 2010 there was an 8% decrease in the number of cases (compared with 2005) and a 21% decrease in the number of deaths (compared with 2000) (WHO, 2010). Against this backdrop of rapidly changing epidemiology, good monitoring, surveillance, and robust methods for estimating malaria burden are essential for documentation of program success as well as the identification of problem areas (Mueller et al, 2011).

While progress towards more effective surveillance can be achieved with current tools, further refinement of "surveillance as an intervention" to support malaria elimination will require improved tools and strategies such as more sensitive field-ready diagnostic

tools, improved information systems, linkage of mapping with real-time surveillance data, and identification of optimal, swift, and locally appropriate, integrated response strategies (Mueller et al, 2011).

1.1 Statement of the Problem

The WHO's Global Malaria Program (GMAP)has developed guidelines on malaria surveillance and the indicators that can be derived from routine information systems. Although other guidance on malaria surveillance indicators exists, (the Integrated Disease Surveillance and Response (IDSR) guideline for the WHO AFRO region and the monitoring and evaluation toolkit of the Global Fund to Fight AIDS, Tuberculosis and Malaria, which has about 17 surveillance indicators),the Global Fund's malaria program suggests that malaria surveillance should fit into the Health Management Information Systems (HMIS) of malaria endemic countries and should be consistently measured across countries and over time (WHO EMRO, 2010).Knowing the number of malaria cases that occur annually in any country is an essential component of planning national health services and evaluating their effectiveness (Cibulskis et al., 2011). Almost every country in the world where malaria cases have been reported has instituted at least one system for notification of malaria cases thus including malaria in the list of diseases under surveillance in all these countries (Howard et al., 1990).

In Nigeria, the national guidelines on malaria control were adapted by the Federal Ministry of Health through the malaria vector control division as an integrated part of the primary health care scheme in 1989 (FMOH, 1989)the fulcrum for this guideline was malaria management and prevention beginning from the home with a care giver and then a prompt referral to the PHC thus malaria surveillance which begins from the PHC level

will miss out on cases successfully managed at the home level or at the patent medicine stores. Sound monitoring and evaluation of the malaria response at country level is critical if the malaria community is to demonstrate progress in achieving outcomes and impact in control efforts. A common, comprehensive and coherent monitoring and evaluation (M&E) system for malaria control programs which includes malaria surveillance has several advantages. Importantly, it contributes to more efficient use of data and resources by ensuring that indicators and sampling methodologies are comparable over time and by reducing duplication of effort. Such system encourages coordination and communication between different groups involved in the national response to malaria and helps collaboration among other national disease control efforts, such as with HIV/AIDS and Tuberculosis (FMOH Uganda, 2007).Malaria control activities in Nigeria are planned and implemented through the first level of health care--Primary Health Care centers (PHC) which have been recognized to be the key to achieving the nation's health sector objective to bring health care closer to the grassroots (FMOH,1997). However, the paucity of PHC facilities and community health workers in rural areas and the wide proliferation of private health facilities whose activities are not integrated with the PHC system or regulated by the Local Government health department in the urban areas continues to affect malaria surveillance and a successful implementation of the malaria control system in Nigeria (Carter Center, 2013).

1.2 Justification

After a lapse of almost 40 years, malaria eradication is back on the global health agenda, inspired by the Gates Malaria Forum in October 2007 (Tanner M. et al 2008). Thus information on the population at risk of malaria and incidence of disease is critical for malaria program design and implementation. The Roll Back Malaria initiative launched

by the WHO in 1998 and the subsequent Abuja declaration of 2000 have defined progressive intervention coverage targets to eliminate malaria as a public health problem. The initiatives also emphasize that effective malaria surveillance can only be achieved through vastly strengthened local health systems.

Studies to assess, evaluate and monitor malaria surveillance practices through the IDSR mechanism have been carried out in the United Kingdom (Muentener et al 1999), United states of America (Hwang et al., 2009, Sonja et al., 2011), Trinidad (Najera et al., 2011), Taiwan (Najera et al., 2011) and sub Saharan African countries like Uganda, Tanzania, Kenya and Ghana. These studies helped to improve malaria surveillance practices, the infectious disease surveillance and response mechanism and the Health Information Management Systems (HMIS) thereby impacting positively on the malaria control program in place The studies have also noted the inadequacy of current data as a basis for developing estimates and measuring the impact of malaria interventions globally thus more studies are needed to support malaria surveillance as part of malaria control activities (Franco et al., 2006). In September 1998, the 48th Member States of the World Health Organization's Regional Committee for Africa through resolution AFRO/RC48/R2, adopted the Integrated Disease Surveillance and Response (IDSR) as a regional strategy for strengthening weak national surveillance systems and efficacious response to priority communicable diseases within the African region (IDSR Technical guidelines, 2001).Subsequently, Nigeria started implementing the strategy from 2002. The Local Government Area level is the focus for integrating surveillance functions; it is the first level in the health system with full-time staff dedicated to all aspects of public health such as monitoring health events in the community, mobilising community action, encouraging national assistance and accessing regional resources to protect the health of

the population in the district. All surveillance activities at the LGA level in Nigeria should be co-ordinated and streamlined. Rather than using scarce resources to maintain separate vertical activities, resources shouldbe combined to collect information from a single focal point at each level (FMOH, National Technical Guideline for IDSR, 2005).

Very few studies have been carried out in Nigeria on malaria surveillance, the methods involved, uses of malaria surveillance data, limitations of the current malaria surveillance activities and benefits etc.This study will attempt to assess malaria surveillance activities in a rural and an urban district within the rainforest region of Nigeria where malaria is endemic all year round and determine through comparison if urban locations have better incorporated malaria surveillance into the malaria response than the rural areas and vice versa.

Findings from this research which will focus on the current level of knowledge and practice of malaria surveillance and the adequacy of available malaria surveillance infrastructure among other factors will help improve the awareness and practice of malaria surveillance activities in Nigeria.

1.3 Significance of the Study

The initial goal of the Roll Back Malaria partnership to reduce by half the global malaria burden by 2010 spurred increased resources for malaria control programs through a number of donor agencies such as the Global Fund to fight AIDS, Tuberculosis and Malaria, the World Bank's booster program, the United States President's Malaria Initiative and many others.

The global objectives of the Roll Back Malaria initiative were (50% reduction of malaria morbidity by 2010 and 75% by 2015 and zero mortality by 2015) and the malaria-related

target of the Millennium Development Goals (Goal 6 Target 8—to have halted, by 2015, and begun to reverse the incidence of malaria).Globally, it gradually became obvious that finally the pages have turned for malaria intervention and malaria elimination returned to the table (Sharm, 2010). The call for elimination/eradication of malaria and the programs set up for malaria elimination/eradication further imply the need for effective and adequate malaria surveillance strategies which is a challenge for health systems in Africa (Jobin, 2010).The World Health Organization (WHO) and other Global Health and Development agencies and institutions recommend that number of malaria cases and malaria-attributeddeaths should be used as core indicators by all malaria-endemic countries (Hay et al, 2010). Data on changes in disease incidence and mortality are needed to judge the success of program implementation and to determine whether programs are performing as expected or whether adjustments in the scale of or blendof interventions are required (Richard et al., 2007).

WHO/RBM (2012) noted that cases reported to malaria surveillance systems represent an incomplete sample of all patients with fever or malaria. In most malaria-endemic countries, less than half of all fever cases attend public health facilities- where the majority of malaria surveillance reports are derived. The data reported may also be incomplete because not all febrile patients receive a diagnostic test or because health facilities do not register all patients or submit monthly reports. Not only do health facility surveillance reports represent only a fraction of all fever and malaria cases occurring in the community, but they may also represent a biased sample, in that health facility attendees may live closer to the facilities and have better access to medicines and a range of government services and economic opportunities. Therefore, it is possible that trends observed in health facilities are not representative of broader trends in the community

(WHO/RBM, 2012).While many countries still struggled to control malaria, four countries in regions heavily affected by malaria (Brazil, Eritrea, India, and Vietnam) were able to successfully reduce their malaria burden thus offering hope to other countries that control of malaria is possible with available tools. These countries invested in improving their malaria surveillance systems, laboratory capacity was strengthened and case reporting was streamlined, integrated, and computerized (Barat, 2006). As malaria elimination effort increased, countries in different stages of malaria control and elimination had different approaches for malaria surveillance and monitoring and evaluation systems (WHO EMRO, 2010). At the current defining moment in the global malaria response, there are currently six malaria elimination countries in Africa-Botswana, Cape Verde, Namibia, São Tomé and Principe, South Africa, and Swaziland.

It is expected that this study will help improve malaria surveillance for malaria control through better case notification and data analysis. This study will be very significant if Nigeria aims to strengthen malaria surveillance within the national malaria control/elimination program.

1.4 Research Questions:

1. What is the level of knowledge and awareness among health facility and laboratory personnel about the Integrated Disease Surveillance and Response techniques for Malaria surveillance?

2. What infrastructure and tools are available for malaria surveillance activities at the local government level?

3. Are the malaria surveillance infrastructure/tools available at the local Government level adequate and functional?

4. Does the malaria surveillance data reported at the local government area appropriately represent the malaria cases in the state?

5. How sensitive is the surveillance for malaria cases in the LGAs for capturing every case of malaria that occurs?

1.5 General Objective:

The main objective of this study is to compare the adequacy of the infrastructure available for Malaria surveillance in two LGAs (an urban and a rural LGA), determine the completeness of malaria case notification to the LGA district surveillance and notification units over a period of six months January-July 2008.

1.5.1 Specific Objectives:

1. To assess the knowledge and awareness of health workers at the local government level on malaria surveillance within the Integrated Disease Surveillance and Response mechanism.

2. To compare the adequacy of infrastructure for identifying, reporting, analyzing, and providing feedback for Malaria cases in an urban and a rural district.

3. To determine the completeness of malaria cases reported by Health facilities to the two districts during the period under study

1.6 Hypotheses

H0: there is no significant difference in the practice of malaria surveillance according to the IDSR guidelines at the local government level in both urbanand rural areas.

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CHAPTER TWO

LITERATURE REVIEW

2.0 INTRODUCTION

Surveillance is a watchful vigilant approach to information gathering that serves to improve or maintain the health of a population (FMOH Nigeria, 2002).The Center for Disease Control (CDC) defines surveillance as the ongoing systematic collection analysis and interpretation of health data essential to the planning, implementation and evaluation of public health practice. It is closely integrated with the timely dissemination of these data for disease prevention and control. Simply put, surveillance means keeping a careful and continuous watch over a particular subject (CDC, 1980; MMWR, 1982). A well-functioning disease surveillance system therefore provides information for planning, implementation, monitoring, and evaluation of public health programs. It includes case detection and registration, case confirmation, data reporting, data analysis, outbreak investigation, response and preparedness activities, feedback, and communication. Health authorities must also provide appropriate supervision, training, and resources for the surveillance system to operate properly. By placing health/disease surveillance within the broader health context of country/ developing states, linkages are achieved between development goals, poverty reduction initiatives and improved health outcomes (WHO, 1963).

The review of existing literature on malaria surveillance will be in parts under the headings:Epidemiology of malaria, Malaria Surveillance, Integrated Disease Surveillance and Response (IDSR) and Health Management Information Systems (HMIS) in Nigeria's malaria surveillance strategy, Malaria control in Nigeria; the Roll

Back Malaria Partnership and the role of surveillance in malaria control in Nigeria, Funding, infrastructure and problems associated with malaria surveillance activities in Nigeria and Methods used to assess completeness of surveillance data

2.1 Epidemiology of Malaria

The incidence of malaria worldwide is estimated to be 300-500 million clinical cases each year with about 90% of these occurring in sub Saharan Africa. Deaths from malaria in countries outside sub Saharan Africa occur principally in non-immune persons who become infected with *P.falciparum* (Parks, 2005). There are at least 900,000 deaths per year in Africa from Malaria mostly in children under the age of 5 and pregnant women. While malaria transmission is highly seasonal in some areas in African countries, it is perennial in Nigeria. In Nigeria, malaria is by far the most important cause of morbidity and mortality in infants (38% and 28%) and in young children (41% morbidity and 30% mortality) respectively. About 75% of malaria deaths occur in children under 5 years old and malaria accounts for about 11% of maternal deaths especially for first time mothers. It contributes largely to neonatal and perinatal mortality as well as anaemia in young children, thus undermining their growth and development. It is estimated that 50% of the population has at least one episode of malaria each year whereas children less than age five suffer two to four attacks a year. In addition to all these, malaria exacerbates poverty by diminishing productivity and household income which further affects child health and well-being (NCP, 2005).

Malaria constitutes a serious public health problem in Nigeria. It is second on the list of diseases of public health importance for integrated disease surveillance and response. The case definition for malaria has five categories and routine laboratory confirmation for malaria is also required (IDSR, 2002).

2.2 Malaria Surveillance: The primary goal of a surveillance system is to collect representative data on the occurrence of a particular disease within a population and this data should enable public health officials to make decisions on what interventions are needed to meet their objectives for prevention and control(CDC 1998). Aftera lapse of almost 40 years, malaria eradication returned to the global health agenda a little over a decade ago. The aim to eliminate or eradicate malaria further implies the need for effective surveillance strategies to monitor progress as health systems aim to bring an end to malaria (Tanner,2010).

Malaria surveillance in control programs: Ongoing, systematic collection, analysis and interpretation of disease-specific data for use in planning, implementing and evaluating public health practice (PAHO,1969; Mueller, 2011).

Malaria surveillance in elimination programs: That part of the programme designed for the identification, investigation and elimination of continuing transmission, the prevention and cure of infections and final substantiation of claimed elimination (PAHO, 1969; Mueller, 2011).

2.2.1 Global Malaria Surveillance

A malaria surveillance system consists of the tools, procedures, people and structures that generate information on malaria cases and deaths, which can be used for planning, monitoring and evaluating malaria control programs. In high- and moderate-transmission areas, monthly counts of malaria cases, inpatients and deaths can be used to determine trends over time and the geographical distribution of malaria (Newman, 2012). Almost every country in the world where malaria cases have been reported has instituted at least one system for notification of malaria cases thus including malaria in the list of diseases

under surveillance in all these countries. The WHO definition of malaria surveillance stated earlier (Kaiser, 1966) clearly places total responsibility on the surveillance mechanisms for providing the quantity and quality of data and for the consolidation and evaluation of these data to guide the control measures put in place.

Malaria was one of 40 diseases included in the WHO recommended surveillance standards, published in 1999 and in 2007–2008, WHO released three documents on malaria elimination that provided guidance on surveillance. (WHO/RBM,2012) According to Robert Newman (2011), surveillance data should be the principal source of information in endemic countries at all levels to: monitor burden and trends of malaria, evaluate impact of intervention, respond to increases in transmission, and track availability and use of malaria commodities as we cannot control and ultimately eliminate malaria without timely and complete malaria surveillance at all levels of the health care system.

Phillip-Howard et al., (1990) in validating malaria surveillance case reports in the United Kingdom using patient recall method concluded that there is a need for research units to testthe quality of their surveillance data before embarking on analyticalstudies used to generate health policy guidelines.

WHO Malaria Surveillance Terms and Definitions:

Annual blood examination rate: The number of examinations of blood slides for malaria bymicroscopy per 100 populations per year.

Case-based surveillance: Every case is reported and investigated immediately (and also included in the weekly reporting system.

Case definition for malaria control programs

Confirmed malaria: Suspected malaria case in which malaria parasites have been demonstrated in a patient's blood by microscopy or a rapid diagnostic test.

Presumed malaria: Suspected malaria case without a diagnostic test to confirm malaria but nevertheless treated presumptively as malaria.

Suspected malaria: Patient with illness suspected by a health worker to be due to malaria. The criteria usually include fever. All patients with suspected malaria should receive a diagnostic test for malaria, by microscopy or a rapid diagnostic test.

Although WHO now recommends that all suspected cases of malaria be confirmed with a diagnostic test before treatment, this is not yet the practice in all settings, either because access to diagnostic testing is not yet available or because of stock-outs of RDTs or the materials necessary to prepare and examine blood films by microscopy (Newman, 2012).

2.2.2 Integrated Disease Surveillance And Response (IDSR) And Health Management Information Systems (HMIS) in Nigeria's Malaria Surveillance Strategy

Malaria surveillance is carried out within the confines of the National Health Management Information System (NHMIS) in conjunction with the epidemiology division of the department of public health, Federal Ministry of Health. Data is generated from health facilities in all Local Government Areas through the disease surveillance and notification system. The National Malaria Control Program (NMCP) also has fourteen sentinel sites located throughout the geopolitical zones of the country. These are being repositioned not only to serve as research centers for drug efficacy trials and Parasite and

vector resistance monitoring centers; but as malaria surveillance centers (FMOH/NMCP, 2008).

The IDSR is an integral part of the overall National Health Management Information System (NHMIS). Data on disease surveillance shall be fed into the NHMIS system for effective health planning, implementation, monitoring and evaluation of programs, policy formulation, evidence based decision making and research. For diseases of public health importance such as malaria, NHMIS expects biannual data submission by the states. The NHMIS is to collate and analyze all IDSR data on a national basis, monitor progress towards stated goals and targets of the IDSR and provide feedback to other levels. It is also to coordinate with the federal epidemiology division to avoid duplication of efforts.

It is expected that in developing countries, successful implementation of an Integrated Disease Surveillance and Response system (IDSR) should result in local level health staff being capable and motivated to collect and use surveillance information for public health decisions and actions in both outbreak and routine situations (Posner, 2006).

The IDSR goals for malaria surveillance are:

- To detect malaria epidemics promptly especially in areas with seasonal epidemic transmission of with a large population at risk.
- To improve the percentage of malaria cases confirmed microscopically
- To monitor anti-malarial resistance of sporadic cases and outbreak related cases using sentinel population in selected sites for monitoring and evaluating drug efficacy.

The IDSR recommended case definitions for malaria are:

Uncomplicated Malaria: Any person with fever or fever with a headache, back pain, chills, sweats, myalgia, nausea and vomiting diagnosed clinically as malaria.

Confirmed Uncomplicated Malaria: Any person with fever or fever with headache, back pain, chills, sweats, myalgia, nausea and vomiting with laboratory confirmation of diagnosis by malaria blood film or other diagnostic test for malaria parasites.

Malaria with Severe Anemia: Any child aged 2months to 5 years with malaria and with severe palmar pallor- if an outpatient or with a laboratory test confirming severe anemia if an inpatient.

Severe Malaria: Any person hospitalized with a primary diagnosis of malaria and confirmed by a positive blood smear or other diagnostic test for malaria, any febrile child unable to eat or drink, dehydrated or anemic.

Malaria in Pregnancy: A pregnant woman with fever, headache, weakness, pallor (anaemia<11g/dl) in a malaria endemic area.

IDSR Simplified Case Definition for Malaria: Any person who has an illness with fever *(often used in rural areas especially for referral to the next level of clinical care)*

WHO Terms For Malaria Surveillance That Are Not Compulsory For IDSR:

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The IDSR responds to unusual increase in number of new malaria cases or death compared to the same period in previous non-epidemic years by:

1. Reporting suspected epidemic to the next level (e.g. from LGA health department to State ministry of health or from State to Federal Ministry of Health)
2. Treating with appropriate anti-malarial drugs according to national program recommendations
3. Investigating the cause of increase in new cases
4. Making sure new cases in children age 2months up to 5 years are managed according to Integrated management of childhood illnesses (IMCI) guidelines
5. Conducting community education for prompt detection of cases and access to health facilities

6. Treating all pregnant women in the region with intermittent preventive treatment (IPT) with sulphadoxine-pyrimethamine from the second trimester (>16 weeks) (WHO/MAL/98. 1084).

2.3 Knowledge Of Malaria Surveillance And Other Notifiable Disease Reporting Among Health Care Workers In Nigeria

Studies globally have shown very poor knowledge of malaria and other notifiable disease reporting among health care workers (FMOH, 2012). The study by Mc Clean et al (2010) in the United States of America on disease reporting among Georgian state physicians, reported that only 37% of respondents in a study population of 177 (65 physicians) were knowledgeable about overall notifiable disease. Nader and Askrian in their 2009 study of disease reporting among Iranian physicians also found poor knowledge of the list of notifiable diseases with a mean knowledge score of 17.0±7.4 out of 45 knowledge scale of notifiable disease reporting. (Nader and Askrian, 2009). Similarly in the African region, AbdoolKarim and Dilraj (1996) in South Africa reported poor knowledge of notifiable disease reporting among health care workers with respondents having a mean knowledge score of 5.7±2.6. In Nigeria, Bawa et al, 2003 in their study found that only 38.2% of 144 health care workers assessed in Yobe state, Nigeria were aware of the national disease surveillance and notification system and the notifiable diseases. Studying disease notification among physicians in a tertiary health facility in northern Nigeria, Abdulraheem et al (2006) reported a poor knowledge of notifiable disease reporting among respondents (14.2% out of 125 physicians assessed). In the southern region of Nigeria, a study of knowledge of notifiable diseases among doctors by Ofili et al (2003), found that only 11.9% of 134 respondents have a good knowledge of notifiable disease reporting. Malaria morbidity and mortality are measured through

routine reports from health facilities through the collation of malaria-specific data and Health Management Information System (HMIS) operated from the community level to the federal ministry of health. However, the majority of malaria cases and deaths are not reported through the health facilities. Also most malaria cases registered in the private health facilities are not included in the data submitted to the DSNO; thus the malaria data available at the health departments of the local, state and federal give an incomplete and under-represented picture of the true malaria burden in the country (Ajumobi et al, 2010).

Malaria surveillance focal persons at the health facilities could be of any health care profession but trained to carry out malaria surveillance data collection and collation[1]. In the IDSR strategy, malaria surveillance data as well as the other ten diseases of public health importance are collected and collated through various levels of health services from district to national as shown in the diagram below: *(Malaria surveillance data and information is expected to flow in both directions across all levels of program implementation).*

Information Flow Within The Levels Of Health Services In Nigeria

FEDERAL (National Malaria Control Program M&E unit)

STATE (State Malaria Control Program HMIS/PHC Officers)

LOCAL GOVERNMENT AREA (District Surveillance and Notification Officers) (Monthly summary to be received from health facilities latest 8th day of new month. DSNOs, Malaria Control Focal Officer and PHC M&E Officers involved)

HEALTH FACILITY (Weekly Summary to be submitted to next level latest 3 days into new week)

COMMUNITY (Daily Submission of data collected)

An important indicator of quality malaria surveillance is the timeliness and completeness of data reported. Using a monitoring tool such as a record of reports received to assess timeliness and completeness of reporting at the LGA level should be a routine exercise for the surveillance focal point to monitor its malaria surveillance activities.

2.3.1 Completeness of Malaria and Other Notifiable Disease Surveillance and Notification

IDSR data timeliness and completeness can be assessed using a supervisory form to gather information on the two indicators and applying a simplified formula to determine percentage timeliness and completeness. Bill Jobins (2012) documented in the malaria journal-A new world malaria map. that "it is unfortunate that we have recently seen a great deal of confusion about the amount of malaria in Africa." And he further explained the disparity of malaria surveillance data by WHO and other partners stressing the need for completeness of malaria surveillance data.

Richard Cibulskiset al in2011 compared different methods of estimating the total number of malaria cases. One is the surveillance-based method used by the WHO Global Malaria Program, which estimates malaria incidence from routine surveillance reports of malaria cases compiled by Health Ministry's (adjusted for reporting completeness, the prevalence of malaria infection among suspected cases, and the extent to which patients use public sector health facilities). The other approach uses cartographic methods as exemplified by the Malaria Atlas Project (MAP) (Guerra et al, 2008, 2009 and Hays et. al, 2010). Cartho graphic methods combine survey data reporting malaria prevalence with case incidence from selected locations to generate global risk maps. Both methods are subject to numerous uncertainties that affect estimates and are highly dependent on the quantity and quality of the available data. Model-based, cartographic approaches can estimate burden in areas where (routine) surveillance is of poor quality and/or coverage e.g., where most fever cases are treated in the private sector. The two methods thus have their unique strengths and weaknesses, and rather than seeing them as competing approaches, they should be synergistically combined (Mueller, 2011).

To determine the usefulness of a surveillance system there is the need to assess the quality of the data and completeness of ascertainment (IWGDMF, 1995). The number of individuals with a certain condition (i.e. cases) or events in a population can be ascertained directly, by counting every single person or event as attempted in a census, or indirectly, by obtaining sufficient information to estimate prevalence (i.e. the number of cases at a specific point in time) or incidence (i.e. the number of new cases during a specific period of time), as attempted in a survey (active case-finding) or by notification (passive case-finding)(Hardy et al 1987, Drucker and Vermond 1989). An indirect technique that estimates completeness of ascertainment of surveys and registers used in epidemiological studies is capture-recapture analysis (Modesitt et. al, 1990, Nan Haastrecht et al, 1991). Silk and Berkelman in 2005

reviewed the strategies for enhancing the completeness of notifiable disease reporting but did not adopt the capture recapture method. From all the review of published literature for this study, the capture-recapture method has been applied to determine completeness of disease notification for several infectious diseases including malaria in different parts of the world however studies using capture recapture to estimate malaria notification completeness in Nigeria and other malaria endemic countries in sub Saharan Africa were not found. Ajumobi et al 2010 reported a study evaluating the malaria surveillance system in Nigeria from 2001-2009, using the simplified IDSR formula to calculate completeness of malaria case reporting, completeness of monthly report submission and timeliness of reporting.

Capture-recapture methods were pioneered in ecology and derive their name from censuses of wildlife in which several animals are captured, marked, released, and subject to recapture. In epidemiology the technique examines the degree of overlap between two (or more) methods of ascertainment and uses a simple formula to estimate the total size of the population (Spoor et al, 1996). Applications of capture-recapture procedures go back to at least 1896, to the work of Petersen [1896] and Lincoln [1930] (Herzog, 2004) and have subsequently being modified and adapted in various forms by many scientists-(Sekar and Deming.1949; Chapman, 1951, Bishop, Fienberg, and Holland, 1975, Seber, 1982, Hook and Regal, 1995;Borchers, Buckland and Zucchini, 2002). Most of the applications of capture-recapture in epidemiology have been instances where investigators have available only a few data sources known to be incomplete and the derived estimates are subject to some sampling error that may be considerable. More recently however, these methods have been applied to human populations in epidemiology-Verstraeten et al. 2001; Gallay et al. 2000; Chao et al. 2001 and Carrao et al. 2000. (Brittain et al, 2009). Deparis X et al in 1997 used the Capture-recapture method to evaluate the annual incidence of malaria in the French armies in 1994 on the basis of the incidence derived from two regulatory systems (passive

and exhaustive), of epidemiological surveillance. Wang et al in china (2007) explored the feasibility of using the capture-recapture method for national malaria sentinel surveillance program evaluation and to evaluate the malaria prevalence at those points. In comparing the national malaria surveillance system with the national notifiable diseases surveillance system in the United States, Hwang J et al adopted the Chandra-Sekar-Deming method to estimate completeness of reporting from 2001-2005.

In Nigeria, the capture-recapture technique has been applied in estimating the prevalence of disabled leprosy patients in four States in Northern Nigeria (Jaques van den bock et al, 2001) and in the U.S, Barat et al 1995 applied the Lincoln-Petersen technique to evaluation of malaria surveillance. The Lincoln-Petersen capture recapture method for dual systems estimation as used in this study compares the number of cases of a single disease identified by two or more distinct surveillance systems to generate an estimate of the total number of cases of the disease in a population. The percentage of total estimated cases identified by the malaria surveillance system is then calculated by dividing the number of cases identified by each data source by the calculated number of probable cases in the population. (Barat et al, 1995).

According to Brittain and Bohning (2008) the more matching criteria that is used in identifying data from two sources when using the Lincoln Petersen dual systems estimation, the more likely we are to achieve perfect matching between sources thus identifiers to be adopted for matching the data in the facility case registers with the data available at the LGA for this study are:

1. Type of malaria diagnosis reported (Uncomplicated malaria, sever malaria and malaria in pregnancy)

2. Age classification for malaria cases

3. In patient/Outpatient treatment of cases

Hook and Regal (1992) in supporting the theory by Wittes (1974) on pooled data sources for dual systems estimation proposed that occasionally there is an advantage to pooling various types of data sources and treating their union as a single source. This will be applied in this study pooling malaria cases identified at the public health facility registers as one source, and the data at the LGA as one source.The IDSR guidelines include a formula for calculating timeliness of reporting and completeness of reporting coverageby the health facilities to the DSNOs, this formula will be adopted for this study.

Timeliness of the reports (100*T/N);

Completeness of data reporting (100*(N-W)/N) *where*

T=Total number of reports sent on time from the health facilities to the LGA DSNO unit

N= Total Number of reports expected from all health facilities in the LGA for the period

W= Total number of reports not received.

2.3.2 Funding, Infrastructure And Other Support Provided For Malaria Surveillance Activities In Nigeria

According to Tanner Marcel et al., (2011) The global financial input to malaria control in the past five years averaged S$ 250 million per year, the main sources being the Global Fund to fight AIDS, Tuberculosis and Malaria and, to a lesser extent, the United States President's Malaria Initiative and the World Bank's Booster Program. These funds still fall short of the estimated requirements for malaria control globally.

From the programmatic GAP analysis results of the National Malaria Program in 2014, Nigeria continues to suffer inadequate funding for all its malaria control programs at the

federal, state and local district levels without bringing to bare the issues of financial corruption and mismanagement of funds.The 2002 IDSR guidelines states that surveillance systems consist of the tools, procedures, people and structures required to generateinformation for planning, monitoring and evaluating malaria programs.

- The tools include: report forms, tally sheets, registers, patient cards, computer hardware and software, documentation and training materials. Infrastructure such as laboratories for case detection and diagnosis are also necessary but not compulsory for malaria. Rapid test kits can be utilized for diagnosis of positive smears.
- Procedures include: case definitions, reporting frequency, pathways of information flow, data quality checks, incentive schemes, data analysis, mechanisms for review of performance, methods for disseminating results, using data for making decisions, supervision and planning.
- The people include: decision-makers both inside and outside the health service who use data from surveillance systems, the health staff who gather or use the data and the community whose details are registered.
- The structures include the way staffs are organized to manage, develop and use the system.

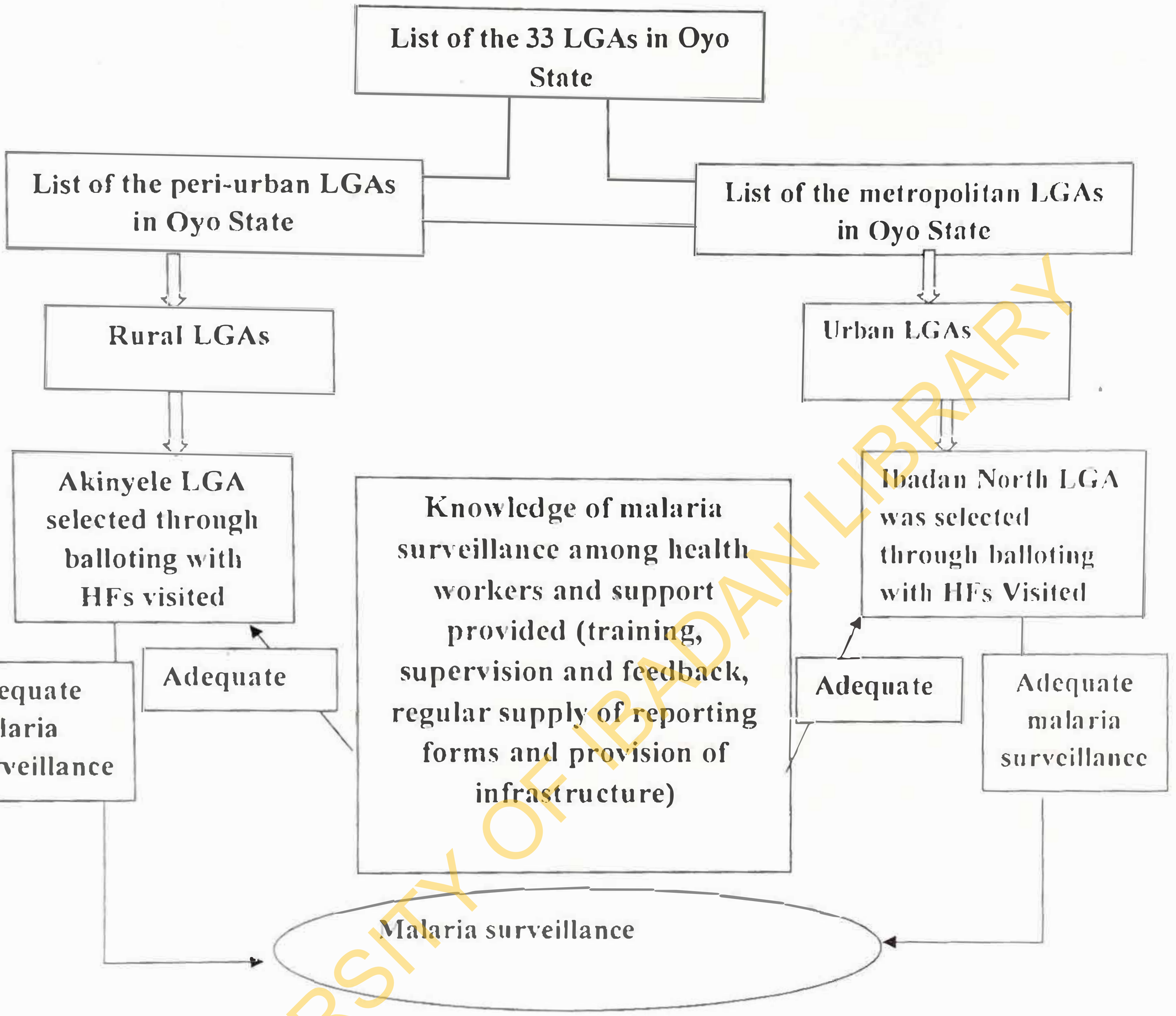
Deficiencies in any of these components can limit the capacity of a malaria control program to undertake disease surveillance effectively. The building of a functioning, sustainable surveillance system must usually address each of these areas (IDSR Guidelines, 2002) Problems such as delayed submission of monthly malaria data due to many reasons such as health workers inability to access transportation, health workers strike action, non-identification of specific data focal persons, absence of feedback between levels, lack of

reliable supply of reporting forms, duplication of efforts e.g. Filling out multiple HMIS forms and IDSR forms for the same disease etc (IDSR, 2002).

Conceptual Framework For The Study

A unified conceptual framework for the public health system performance measurement as proposed by Arden et. al, 20011 was adopted for this study and modified by the principal investigator. This conceptual framework for the public health system links structures, processes, outputs, and outcomes in a model for quality assessment and systems monitoring. Based on the theoretical and empirical review of literature we assumed that the wide disparity in malaria reporting and underreporting in Nigeria might be associated the local government level where data is first collated for reporting, also the variation in knowledge and awareness of malaria surveillance methods among health workers in different LGAs and differences in infrastructural support provided such as training on malaria surveillance, regular supply of reporting forms to health workers and provision of incentives and feedback to health workers. The conceptual framework was based on the hypothesis that malaria surveillance activities are the same in both local government areas and not affected by rural or urban location of the local government area.

CONCEPTUAL FRAMEWORK FOR THE STUDY



CHAPTER THREE

METHODOLOGY

Study Areas: The study was conducted in Akinyele and Ibadan North Local Government Areas of Oyo state.Akinyele LGA has gradually become peri-urban but is still classified as a rural LGA made up of 12 political wards and further divided into 25 major settlements majority of which are rural. All public health facilities registered with the LGA health department were visited for this study however, only data from facilities submitting data to the District Surveillance and Notification Officers for the twelve months preceding this study and for the study duration was utilized. At the time of this study, Akinyele LGA had thirty five primary health care centers PHCS (eleven health post/dispensaries had recently being upgraded to PHCs) of which twenty five were submitting data to the DSNO in addition to two secondary health facilities, and one non-governmental health care center. Ibadan North LGA had twenty one registered PHCs (eleven HCs were submitting data to the DSNO) and one secondary health facility.

Study Design: The study was cross-sectional comparative, evaluating malaria surveillance in a rural and an urban area of Oyo state between Nov 2008 and May 2009. The tools adapted in this study for data collection were based on monitoring and evaluation indicators and procedures from the 2002 IDSR national technical guidelines.

Study Population: Malaria surveillance focal persons in this study are designed as any health worker designated by the health facility to collate and report malaria data to the DSNO at the LGA.A total of 165 available and consenting malaria surveillance focal persons participated in this cross sectional study; 76 were from 25 health facilities in Akinyele (rural) LGA and 89 were from 12 health facilities in Ibadan North (urban) LGA.

Sampling Technique: A stratified random sampling technique using ballots was used to select Akinyele and Ibadan North LGA among the six-rural and five-urban LGAs in Ibadan Metropolis. All the public health facilities and the district surveillance and notification units in both LGAs were selected for the study.

Data Collection (Instruments and Methods):

- A pre-tested self-administered questionnaire on malaria surveillance awareness, knowledge, practices and availability of infrastructure for respondents at the health facilities; the knowledge assessment scale was contained in this questionnaire.
- The IDSR data extraction form and IDSR checklist for surveillance infrastructure was used to interview the health facility malaria surveillance focal persons.
- Self-verification of reported surveillance infrastructure and observation of data collation process by the researcher using the IDSR surveillance infrastructure list.

The pre-tested, semi structured, self-administered questionnaire was used to collect data from respondents. The questionnaire was adapted from monitoring and evaluation questions in the 2002 IDSR national guideline and pretested at Ibadan North East LGA among fifteen health surveillance focal persons in six primary health care centers, one secondary health care center and the district surveillance and notification officer. Observations, corrections and suggestions from the pre testing were used to adjust the questionnaire. There were five sections in the questionnaire:

Section A: Identification details for the health facility (Name, type of health facility and LGA in which facility is located)

Section B: (Questions 1-5) focused on the socio demographic characteristics of the respondents-age, sex, marital status, ethnic group, profession, years of experience and highest level of education.

Section C: (Questions 6-26) focused on awareness, knowledge and practice of malaria surveillance using the Integrated Disease Surveillance and Response guidelines. (This section contained the knowledge assessment scale with maximum possible score of 10)

Section D: Questions 27-42) focused on adequacy of infrastructure for available for malaria surveillance activities and suggestions on policy decisions for malaria surveillance

The IDSR facility checklist for surveillance infrastructure was adapted to assess adequacy/availability of infrastructure available for malaria surveillance at the facilities

The data extraction forms in the IDSR technical guideline were used as a proforma to guide information extraction for number of malaria cases reported and number of cases recorded at the health facilities (IDSR technical guideline, 2002).

The IDSR template for measuring timeliness of data submission from facility to LGA and completeness of reports submitted was used to determine timeliness of submission and completeness of reports submitted from health facilities to the LGA (IDSR technical guideline, 2002).

Data Management and Analysis

Data from the questionnaire was collated, entered, cleaned and analysed using Statistical Package for Social Sciences (SPSS) version 14. Descriptive statistics, the association between categorical variables, quantitative variables and multiple variables were compared between both LGAs using tabulation. Bivariate analysis using Chi-square statistical test was used to determine the statistical significance of association between various socio-

demographic variables, variables on training and feedback received for malaria surveillance and practice of malaria surveillance within the six months of the study with level of significant association set at p =0.05 for each LGA.

The responses for knowledge given by the respondents were scored as one for every correct response and zero for every wrong response. A ten-point knowledge scale was used in the assessment of respondents knowledge of malaria surveillance. Scores from 6-10 were graded as good knowledge of malaria surveillance, 0-5as poor knowledge of malaria surveillance. The result obtained was used to compare the overall knowledge score for the rural and urban LGA.

Completeness of Notification/Reporting for Malaria Cases: The percentage of total estimated cases identified by the surveillance system in both LGAs was determined using the Lincoln Petersen capture-recapture technique for dual systems to calculate completeness of notification for malaria surveillance data in both Akinyele and Ibadan North LGAs.

First, the total number of malaria cases recorded in health facility registers for the period of the study in both LGAs were pooled. To ensure accuracy, data given by the health facilities were verified by the researcher using the registers at the health facility and then pooled using Microsoft excel algorithm. Data from the DSNOs in both LGAs for the same period were also verified, pooled and then compared with number of malaria cases found in the health facility registers.

To eliminate double counting, cases at the health facility were matched with the DSNO data for accuracy. Identifiers used for matching the data in the facility case registers with the data available at the LGA were: type of malaria diagnosis recorded and reported, (Uncomplicated malaria, sever malaria and malaria in pregnancy); age of patient,in-patient/out-patient treatment of malaria cases. To increase confidence in the matching of cases, a second

matching algorithm was applied using the same identifiers and date of patient visit to the health facility.

STUDY LIMITATIONS:

Assessing the knowledge of respondents on malaria surveillance through a questionnaire interview is subject to recall bias and participants may overestimate or underestimate when responding to questions. From the sampling frame of all registered health facilities in both LGAs, private health facilities were the majority; this underscores the importance of carrying along the private health facilities and their staff in all health programs and initiatives of public health significance. This study is also limited by the coverage area which is just two LGAs in a state with 33 LGAs. Further studies need to be carried out on a large scale to evaluate malaria surveillance in Nigeria. The use of use of two source capture recapture estimate in this study is also subject to assumptions which can be affected by the entry and exit of persons into the population of both LGAs at different times during the study duration.

TABLE 3.1 Representation Of The Two Source Capture-Recapture Model For Estimating Malaria Cases In A Two By Two Table

		'ases ascertained by secondary data (source review of hospital records)		otal
		YES	**NO**	
'Cases Ascertained by Primary Source (Review of SNO Records)	ES	A (cases ascertained by oth sources—HF and DSNO)	C(cases sertained by rimary source)	+ C
	NO	B(cases ascertained ysecondary source)	D (cases not sertained by either sources)	+ D
TOTAL		= A + B	=C + D	(Estimated otal incidence ises)

A = Malaria cases ascertained by both the health facilities and the DSNO records at the LGA
B = Malaria cases ascertained by the DSNO records at the LGA
C = Malaria cases ascertained by the health facilities
D = Missed malaria cases within the population not captured byboth sources above
R = Malaria cases ascertained by both the health facilities and the DSNO records at the LGA + Malaria cases ascertained by the DSNO records at the LGA
S = Malaria cases ascertained by the health facilities + Missed malaria cases within the population not captured byboth sources above
N = Complete number of malaria cases in the population

The Lincoln-Petersen Formula for dual systems estimation:

N= [(R+1)*(S+1)/C+1]-1

% Completeness of notification=R/N*(100) (Barat et al, 1995).

Where N= number of malaria cases in the population,

R = Number of malaria cases reported to the DSNO at the LGA,

S = Number of malaria cases recorded in health facility registers (pooled),

C= Number of malaria cases identified by both methods.

The 95% confidence interval for completeness of reporting coverage obtained above was also determined.

Adjusting for multiple ascertainment of cases, the maximum likelihood estimate of missed malaria cases in the population i.e malaria cases not identified at the health facilities or at the LGA was calculated using the formula: $d_{MLE}=bc/a$

The corresponding estimate of total population is calculated using the formula:

P= [(a+b+1)(a+c+1)/(a+1)]-1 *or (p=a+b+c+d)*

Timeliness and Completeness of Reporting Coverage in both LGAs was calculated using the IDSR formula:

Timeliness of the reports (100*T/N);

Completeness of data reporting (100*(N-W)/N) *where*

T=Total number of reports sent on time from the health facilities to the LGA DSNO unit

N =Total Number of reports expected from all health facilities in the LGA for the period

W =Total number of reports not received

Adequacy of Malaria Surveillance Infrastructure:

The IDSR check list for evaluation of malaria surveillance infrastructure was adopted for the assessment of available tools sighted in all health facilities visited in both LGAs. Malaria surveillance infrastructure includes tools such as case registers, reporting forms, computers, calculators, laboratory equipment/ rapid diagnostic procedures and staff to carry out the activities, structures such as laboratory and transportation vehicles. From the check-list, percentages of available tools were calculated based on total number of facilities within the LGA where the tools were found and Pearsons Chi square used for comparison between both LGA.

CHAPTER FOUR

RESULTS

A total of 165 malaria surveillance focal persons were interviewed at the health facilities visited in both LGAs; 76 health workers in Akinyele LGA and 89 in Ibadan North LGA. Primary health care center surveillance focal persons were44 in Akinyele (57.9%) and 35 (40.0%) in Ibadan North LGA Bothe LGAs had two secondary health facilities, Akinyele LGA did not have a tertiary health facility however 19 participants (21.4%) were from the tertiary health facility present in Ibadan North LGA.

4.1 Socio-Demographic Characteristics of Respondents:

Respondents were mainly female, 54 (71.1%) in Akinyele and 61(68.5%) in Ibadan North. The mean age of respondents was 37.7 years and 38.3 yearsin Akinyele and Ibadan North LGAs respectively with standard deviation of 11.6. 73 respondents (44.0%) were between 30-39 years and 53 respondents (32.0%) were between 40-49 years. Most respondents were married 41(53.0%) in Akinyele and 44 (49.0%) in Ibadan North LGA while the major ethnic group of respon0dents was Yoruba- 61(80.0%) in Akinyele and 68 (76.0%) in Ibadan North LGA. Respondents with diploma as highest educational status were the majority 38(50.0%) in Akinyele and 44(49.0%) in Ibadan North, few had the higher national diploma 19(25.0%) and 25(28.1%) or a university degree 11(14.5%) and 19(23.1%).

The socio-demographic characteristics of respondents are shown in Table 4.1:

Table 4.1: Socio-demographic Characteristics of Respondents in Akinyele (AKY) and Ibadan North (IBN) LGA:

Variable	AKY N=76 (%)	IBN N=89(%)	p-value
Sex	22 (28.9)	28 (31.5)	0.763
Male	54 (71.1)	61 (68.5)	
Female			
Age			
<20	1 (1.3)	0 (0)	0.011*
20-29	9 (11.8)	13 (14.6)	
30-39	36 (47.4)	37 (41.6)	
40-49	23 (30.3)	30 (33.7)	
>50	7 (9.2)	8 (10.1)	
Marital Status			
Never Married	26 (35.7)	37 (41.8)	0.020*
Currently Married	41 (53.1)	44 (49.3)	
Others	9 (11.2)	8 (8.9)	
Ethnic group			
Yoruba	61 (80.7)	68 (76.6)	0.21
Others	14 (19.3)	21 (23.4)	
Educational status			
University degree	11 (14.5)	19 (21.3)	0.870
Higher diploma	19 (25.0)	25 (28.1)	
Diploma	38 (50.0)	44 (49.4)	
SSCE/NCE	8 (10.5)	1 (1.2)	

Significant at p<0.05

4.2 Respondents Profession and Years of Work Experience:

Table 4.2 below shows respondents profession and years of experience. Nurses were the majority of respondents at the facilities, 23(30.3%) and 25(28.1%) in Akinyele and Ibadan North LGA respectively followed by community health extension workers-16(22.0%) and 13(14.1%) and community health officers---14(18.4%) and 13(14.6%).

Mean years of experience among respondents in both LGAs was 12 years, modal years of experience ranged between 11-15 years-26 (34.0%) in Akinyele and 32 (36.0%) in Ibadan North LGA

Table 4.2 Respondents Profession and Years of Work Experience

Variable	AKY N=76 (%)	IBN N=89(%)	p-value
Profession			
Nursing	23 (30.3)	25 (28.1)	0.08
Community Health Extension Worker	16 (22.0)	13(14.1)	
Community Health Officer	14 (18.4)	13 (14.6)	
Environmental Health Officer/Records officer	7 (8.3)	15 (18.9)	
Doctor	5 (6.6)	10 (11.2)	
Auxillary or trainee nurse	4 (5.3)	2 (2.2)	
Laboratory Scientist/technologist	3 (3.9)	7 (7.9)	
Pharmacy Technician	2 (2.6)	1 (1.1)	
District surveillance/Notification Officer	1 (1.3)	2 (2.2)	
Pharmacist	1 (1.3)	1 (1.1)	
Years of experience of respondents			
1-5	17 (22)	19 (22.1)	0.049*
6-10	21 (27.6)	25 (28.1)	
11-15	26 (34.2)	32 (36.0)	
16-20	8 (10.5)	10 (11.1)	
>20	4 (5.3)	3 (2.7)	

Significant at p<0.05

4.2.1 Awareness of malaria surveillance activities and malaria surveillance guidelines at the health facilities

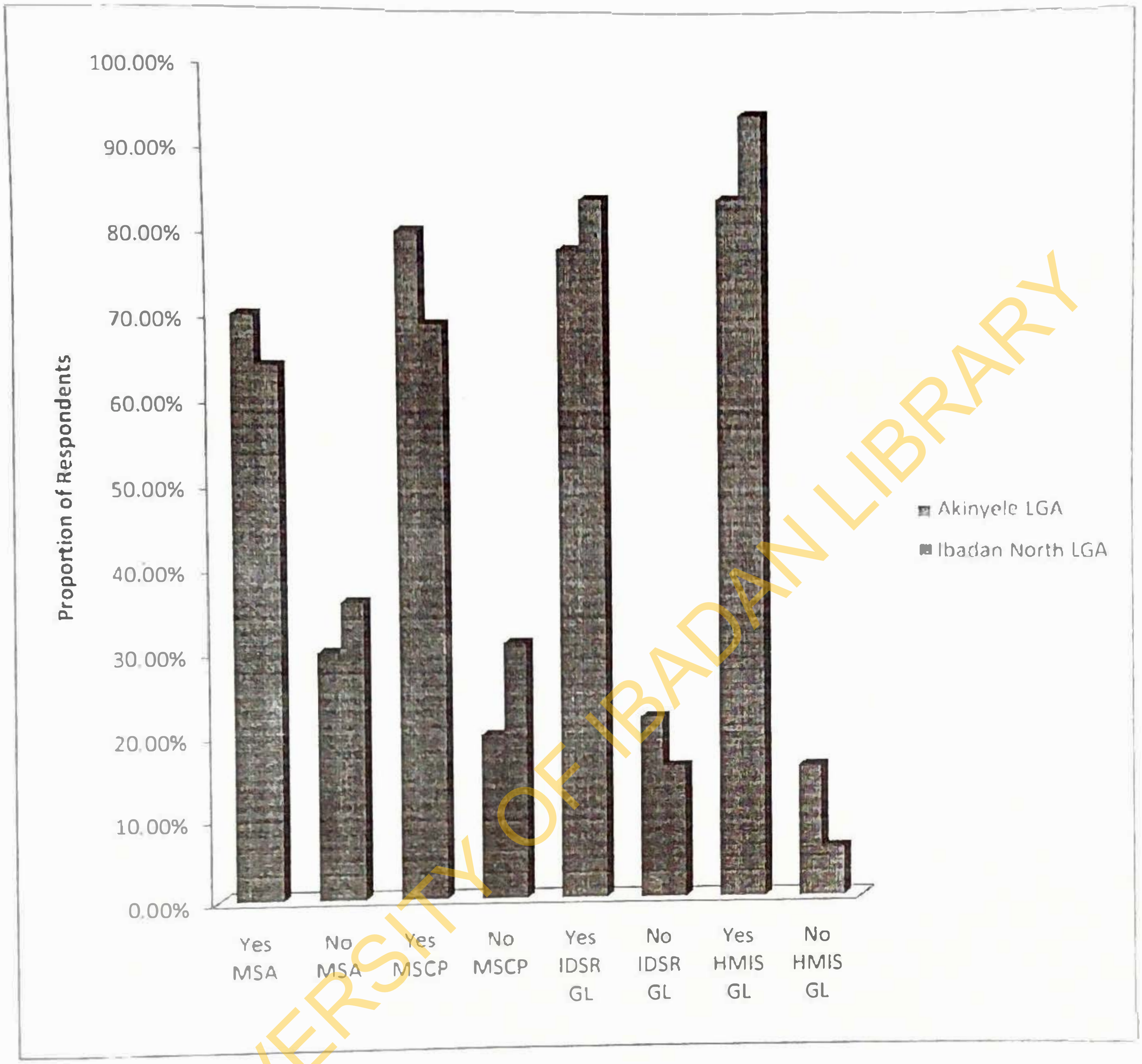
Respondents awareness of the IDSR guidelines for malaria surveillance was as high as 77.0% in Akinyele LGA and 84.0% in Ibadan North LGA, awareness of the HMIS malaria data collection guidelines was 84.0% and 94.0% in Akinyele and Ibadan North LGAs respectively while awareness of respondents on malaria surveillance activities carried out within their LGA was 69.0% and 64.0% in Akinyele and Ibadan North respectively. Respondents' awareness of a surveillance coordination focal point at the LGA district health office was 80.2% and 68.5% in Akinyele and Ibadan North respectively. Figure 4.1 shows respondents' awareness of malaria surveillance activities within their LGA, the presence of malaria surveillance focal points and the IDSR and HMIS malaria surveillance guidelines

Table 4.3 Multivariate Analyses of Overall Factors Associated with Malaria Surveillance among Respondents

Variable Adjusted	p-value	95% CI	OR
Age group (years)			
≥ 40	2.6	0.222	0.6 -12.4
30-39	0.7	0.717	0.1 – 4.0
20-29 (r)	1.0		
Sex			
Male	1.6	0.314	0.6 -4.3
Female (r)	1.0		
Years of work Experience			
> 10	3.2	0.015	1.3 -8.3
≤10	1.0		
Knowledge of Malaria surveillance			
Good	5.3	0.003	2.5 -15.9
Poor	1.9		
Available supplies (Forms etc)			
Yes	11.7	0.000	4.5 – 42.6
No	3.0		
Received malaria surveillance training			
Yes	6.8	0.001	1.9 – 14.1
No	1.9		
Profession of focal person			
Nurse	12.2	0.099	0.9 – 5.4
CHEW 8.9			
CHO 7.1			
LGA Location			
Ibadan North	1.5	0.913	0.4 – 2.5
Akinyele	1.0		

*Significant at p<0.05

Figure 4.4 **Awareness, Knowledge And Practice of Malaria Surveillance InAkinyeleAnd Ibadan North LGAs**



4.2.2 Although not significant, respondents awareness and information about malaria surveillance were from different sources: training seminars, workshops and conferences (69.8% AKY) and (52.6% IBN) and also from journals and newsletters or professional colleagues stepping down information post training as shown in the table 4.3 below:

Table 4.3 Source of Information about IDSR and Malaria Surveillance (%)

Variables	AKYN=76 (%)	IBN N=89(%)	X^2	p-value
Seminar/workshop/conference	37 (69.8)	30 (52.6)	2.3	0.057
Journals/newsletter/Scientific literature	3 (5.7)	11 (19.3)		
Professional Colleagues	12(22.6)	11 (20.3)		
Others	1(1.9)	5 (8.8)		

+Significant at p<0.05

4.2.3 Knowledge of Malaria Surveillance

Respondents who reported having received training on malaria surveillance in the last six months were only 4.0% in Akinyele and 17.0% in Ibadan North LGA. Despite this, results showed that knowledge of respondents on IDSR guidelines for malaria surveillance based on knowledge scores was higher in Ibadan North LGA, 62.8% had good knowledge of the IDSR guidelines for malaria notification and surveillance; Overall mean knowledge score was 6.2 with standard deviation of 1.6 in Akinyele while Ibadan north had a mean knowledge score of 6.4 with standard deviation of 1.6. Although only 50.0% and 28.1% of respondents interviewed in Akinyele and Ibadan North LGA respectively claimed to have received training on malaria surveillance within the last six months, 69.8% of respondents had attended at least one seminar or workshop on malaria surveillance in Akinyele LGA and 52.6% of respondents in Ibadan North LGA.

From the ten point knowledge assessment scale, respondents' knowledge was classified as good (above average) or poor (below average) for the variables below:

- Mode of identification of malaria cases for notification (i.e. standard malaria case definition)
- Categories of malaria cases for notification
- The IDSR malaria surveillance guidelines
- The standard response mechanism when malaria cases observed are higher than the usual trend
- The feedback mechanism on malaria surveillance between the LGA health department, the health facilities and the community

Table 4.5 **Respondents knowledge of Malaria case notification and surveillance guidelines**

Variables	AKY(%)	IBN(%)	p-value
Good knowledge of the standard malaria case definition for notification	52.6	42.7	0.372
Good knowledge of categories of malaria cases for notification	12.1	52.8	0.019*
Good knowledge of the IDSR malaria surveillance guidelines	47.3	62.8	0.182
Good knowledge of the standard response mechanism	34.4	40.4	0.036*
Good knowledge of the feedback mechanism	27.9	52.9	0.061*

+Significant at p<0.05

4.3 Association between Demographic Factors and General Knowledge of Malaria Surveillance

In associating the demographic factors with the respondent's knowledge of malaria surveillance, ethnic group of respondents and the educational status of respondents were the significant factors observed in both Akinyele and Ibadan North LGA.

(Recall from the knowledge scale, good knowledge =above average (6-10) ; poor knowledge=below average (0-5))

Table 4.5. Demographic factors by knowledge of malaria surveillance in Akinyele and Ibadan North LGA

Variables	Frequency (%) Good Knowledge of malaria surveillance		χ^2	p-value
Akinyele LGA	**Ibadan North LGA**			
Sex				
Male	62.9	41.17	1.446	0.135
Female	70.47	58.63		
Age (Years)				
<20	93.86	0		
20-29	55.7	47.5	8.266	0.069
30-39	49.6	48.8		
40-49	48.7	51.2		
>50	50.0	50.4		
Marital Status of respondents				
Never Married	45.6	57.2		
Currently Married	44.8	46.7	1.984	0.443
Others	68.1	52.0		
Ethnic group of respondents				
Yoruba	64.1	67.9	8.671	0.008
Others	35.8	32.2		
Educational status of respondents				
University Degree	56.3	66.7		
Higher Diploma	52.8	47.2	9.112	0.006
Diploma	44.6	35.4		
SSCE/NCE	33.7	36.3		

+Significant at p<0.05

Table 4.6 **Profession of Respondent and Years of Experience by Knowledge of Malaria Surveillance in Akinyele and Ibadan North LGA**

Variables value	Above average (>50%)	Knowledge Score	χ^2	p-
Medicine	96.0	87.0	19.862	0.002
Nursing	65.2	54.8		
Laboratory Scientist Technologist	25.0	75.0		
District Surveillance and Notification Officer	100.0	100.0		
Auxillary or Trainee Nurse	45.0	55.0		
Pharmacist	90.1	65.9		
Community Health Officer	64.0	61.0		
Records Officer/Data Manager	78.0	74.0		
Community Health extension worker	77.0	73.0		
Pharmacy Technician	40.0	60.0		
Years of Experience				
1-5 years	58.9	48.7	11.332	0.004
6-10 years	56.1	64.9		
11-15 years	76.7	68.3		
16-20 years	52.5	57.5		
>20 years	49.1	69.4		

+Significant at p<0.05

4.4 Type of malaria surveillance activity carried out at the health facilities:

1. Types of reporting forms used across all facilities are different and in many cases multiple forms are available thus increasing the workload on staff. Combination of IDSR forms 001,002,003, Rollback malaria ACT forms and HMIS forms were found in 46.1% and 42.7% of facilities visited in the urban and rural area respectively.Table 4.7 summarizes the malaria surveillance activities implemented by respondents which vary at different health facilities from HMIS, IDSR to Roll Back Malaria data generation all carried out as combined malaria surveillance or single vertical programs. Combined malaria surveillance was the major practice in Akinyele (15.9%) and HMIS monthly malaria surveillance data 36.5%. IDSR malaria surveillance data collection was the major practice in Ibadan North LGA (17.8%) however 35.6% of the facilities visited in Ibadan North LGA were not practicing any monthly malaria surveillance data colllection.Distinguishing type of malaria cases based on categories such as uncomplicated malaria, severe malaria and malaria in pregnancy is not carried out across all facilities. (40.8% vs 55.1%, Akinyele and Ibadan North LGA respectively).

Table 4.7 Malaria Surveillance Activity at the Health Facilities

Varaibles	Frequency % AKY	IBN	χ^2	p-value
Monthly data generation for IDSR only	6 (9.5)	13 (17.8)		
Monthly data generation for roll back malaria (RBM) program	4 (6.3)	9 (12.3)		
Monthly data generation for HMIS	23 (36.5)	7(9.6)		
Monthly data generation for IDSR and RBM	2 (3.2)	1 (1.4)		
Monthly data generation for IDSR and HMIS	3 (4.8)	9 (12.3)		
Monthly data generation for HMIS and RBM	4 (6.3)	7 (9.6)		
Monthly data generation for IDSR, HMIS and RBM	10 (15.9)	1 (1.4)		
No monthly malaria data generation	11 (17.5)	26 (35.6%)		

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Monthly data generation for roll back malaria (RBM) program	4 (6.3)	9 (12.3)		
Monthly data generation for HMIS	23 (36.5)	7(9.6)		
Monthly data generation for IDSR and RBM	2 (3.2)	1 (1.4)		
Monthly data generation for IDSR and HMIS	3 (4.8)	9 (12.3)		
Monthly data generation for HMIS and RBM	4 (6.3)	7 (9.6)		
Monthly data generation for IDSR, HMIS and RBM	10 (15.9)	1 (1.4)		
No monthly malaria data generation	11 (17.5)	26 (35.6%)		

4.4 Malaria Surveillance Infrastructure Available At the Health Facilities:

Self-verification of available infrastructure for malaria surveillance in both LGAs was carried out using the IDSR facility check list to verify what the respondents had indicated in the questionnaire. Results show that physical structures, tools and equipment, data collection forms and personnel are inadequate in both LGA. It was also noted that reported infrastructure was significantly lower than what was present at the facilities during the verification process.

On reported availability of malaria surveillance data collection forms at the health facility within the last six months; in Akinyele LGA 46 health facilities (60.5%) had a reliable supply of the necessary reporting forms over the past six months, compared with 57.3% of facilities in Ibadan North. Applying the facility check list for verification, facilities in Akinyele LGA also had more forms overall. Results of the malaria surveillance forms present in the facility at time of visit are shown in the table below:

Table 4.8 Types of Malaria Surveillance Forms Present in the Facility at Time of Visit

Variables	Frequency (%)	AKY(%)IBN(%)	
IDSR forms (dsn 001,002,003) only (1)		2.6	0
HMIS forms only (2)		15.8	31.4
Roll Back malaria free ACT forms only (3)		14.4	7.9
Combinations of Forms 1,2 &3		46.1	42.7
No reporting forms found		21.1	18.0

Table 4.8 Types of Malaria Surveillance Forms Present in the Facility at Time of Visit

Variables	Frequency (%)	AKY(%)IBN(%)	
IDSR forms (dsn 001,002,003) only (1)		2.6	0
HMIS forms only (2)		15.8	31.4
Roll Back malaria free ACT forms only (3)		14.4	7.9
Combinations of Forms 1,2 &3		46.1	42.7
No reporting forms found		21.1	18.0

4.4.1 Supplies for Malaria Surveillance and Malaria Data Management in Akinyele an Ibadan North LGA

From the questionnaire, the reported available supplies for data management/analysis at the health facilities involved in this study were: Calculators and papers, 34.2% in Akinyele and 34.8% at Ibadan North LGA. Computers with software for statistical data analysis were more in Ibadan North LGA 31.9% as against 7.1% in Akinyele LGA. More than half of the facilities in Akinyele LGA (57.1%) however reported not having any supplies for malaria surveillance data management/analysis. Table 4.9 below shows the data management as indicated by the respondents while table 4.10 shows the supplies present at the facilities at time of verification.

Table 4.9 Respondents report of available Supplies for Data Management/Analysis

Variables	Frequency (%) AKY	IBN	Fishers T-test	p-value
Data Management Tools				
Calculators and papers	13	26	0.071	0.048*
Computers with statistical software	4	21		
Case registers	12	19		
IEC Materials				
Posters and bills	23.6	27.0	0.536	0.095
VCR and monitor	50.0	53.0		
Scheduled health talks and community dialogue sessions	13.2	6.1		
None	13.2	4.9		
Communication Infrastructure				
Telephones for communication	13.2	12.4	0.405	0.002*
Memos and letters	17.7	22.0		
Walk-in direct communication to visit the DSNO	69.1	65.6		
Transportation and Logistics Supply for Surveillance Purposes				
Vehicles with fuel supply	7.6	10.5	0.098	0.051*
Motorcycles with fuel supply	15.2	7.0		
Portable generator with fuel supply	6.3	11.6		
None	70.9	71.0		
Facility for laboratory diagnosis of malaria cases	32.9	57.3		
Designated staff for malaria surveillance				
Malaria surveillance focal person	58.0	32.5	0.921	0.061
Data manager	9.2	17.4		
Laboratory technician	15.8	46.5		
None	17.0	3.6		

+Significant at p<0.05

Table 4.10Facilities that had Supplies for Data Management/Analysis available duringVerification

Variables	Frequency (%) AKY	IBN	Fishers T-test	p-value
Data management tools				
Calculators and papers	9.0	12.0	0.062	0.030
Computers with statistical software	2.6	11.4		
Case registers	7.2	15.3[2]		
Exercise books and sheets of paper in a folder	14.2	7.0		
IEC Materials				
Posters and bills	20.6	22.00.7400.091		
VCR and monitor	36.0	23.0		
Scheduled health talk and community dialogue sessions	14.2	8.1		
None	11.2	2.9		
Communication Infrastructure				
Telephones for communication	11.2	10.40.378	0.002	
Memos and letters	17.7	22.0		
Walk-in direct communication to visit the DSNO	69.1	65.6		
Transportation and logistics supply for surveillance purposes				
Vehicles with fuel supply	7.6	10.5	0.098	0.04
Motorcycles with fuel supply	15.2	7.0		
Portable generator with fuel supply	6.3	11.6		
None	70.9	71.0		
Facility for laboratory diagnosis of malaria cases	32.9	57.3		
Designated staff for malaria surveillance				
Malaria surveillance focal person	58.03	2.5	0.820	0.068
Data manager	9.2	17.4		
Laboratory technician	15.8	46.5		
None	17.0	3.6		

[2]Note that respondents did not indicate in the questionnaire that exercise books and other improvised materials were used in the absence of caseregisters, these were found at the health facilities during verfification.

4.5 FACTORS AFFECTING MALARIA SURVEILLANCE PRACTICE IN THE FACILITY

From the questionnaire, respondents rated the practice of malaria surveillance at the health facilities on an ordinal scale from very good to poor, rated the functionality of the current malaria control programs in place and listed current major challenges to efficient and effective malaria surveillance in Oyo state.Although respondents stated that supervisory activities on malaria surveillance within the facilities are well carried out (63.2% and 50.6% rural and urban respectively), when asked to rate the practice of malaria surveillance in their health facilities, 7.9% gave a rating of very good malaria surveillance activities in Akinyele LGA, 44.7% rated malaria surveillance in their facility as good, 27.6% as fair and 3.9% as poor

Results are shown in the figure 4.2 and tables 4.12 and 4.13 below

Figure 4.2 Supervisory activities carried out by facility and LGA senior officers to encourage and monitor malaria surveillance activities

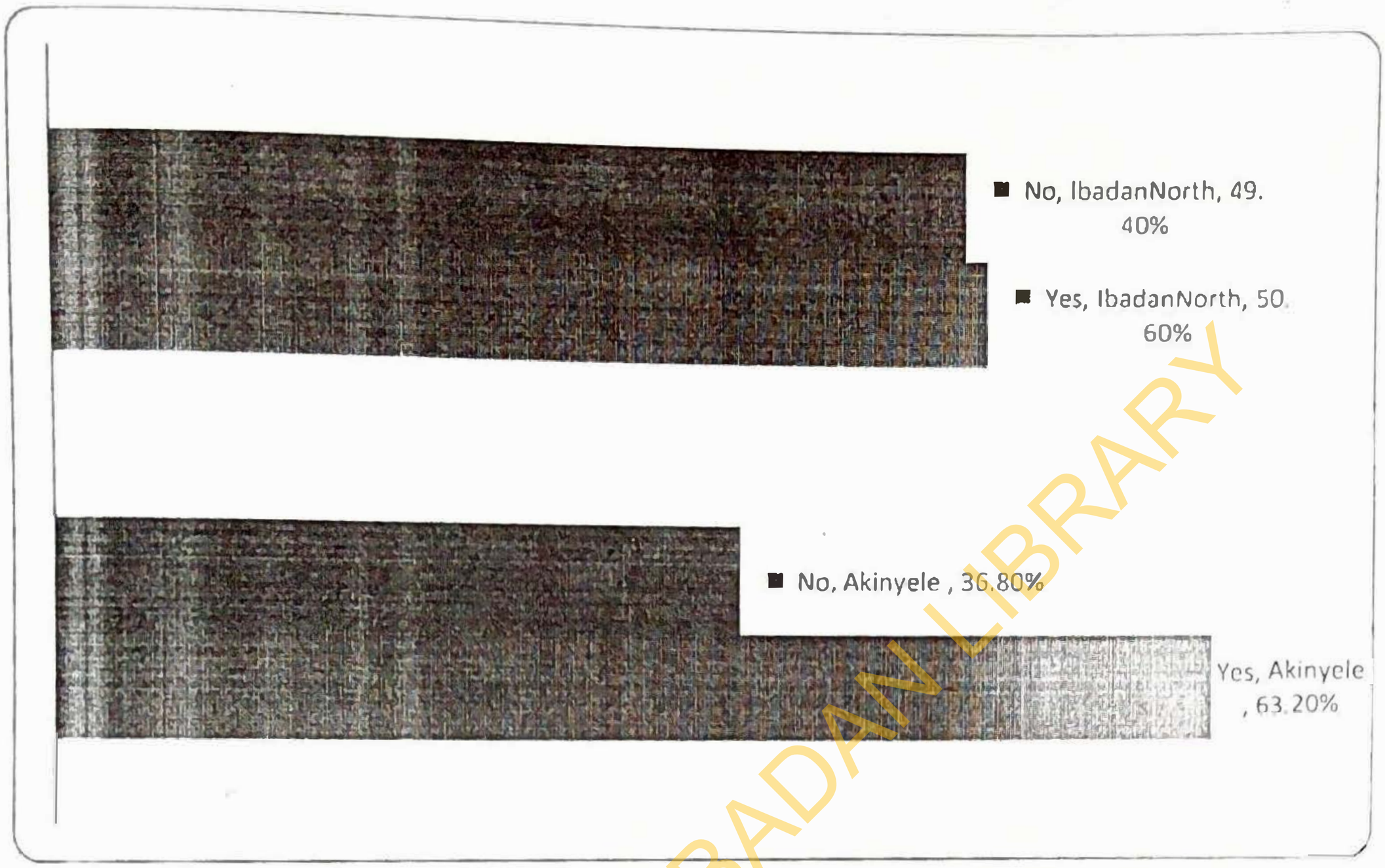

Table 4.12 **Current Challenges to Malaria Surveillance at the LGA as Identified by Respondents:**

Variables	Frequency (%)	AKYIBN	χ^2	P-value
Lack of awareness on malaria surveillance activities	11.8	19.1	22.900	.006*
Lack of resources/infrastructure for surveillance	26.3	14.6		
Poor communication with L.G.A. surveillance unit	6.6	13.5		
Absence of proper records/data to submit	3.9	3.4		
Lack of trained personnel for malaria surveillance	18.4	14.6		
Inadequate incentives to support surveillance at all levels	6.6	4.5		
Lack of cooperation between the different levels of health care providers	3.9	5.6		
Inadequate coordination and supervision of malaria surveillance activities	10.5	2.2		
Health facility located in hard to reach area	7.9	2.2		
No comments	3.9	20.2		

Factors listed by respondents include: Lack of awareness on malaria surveillance (11.8% vs 19.1%), lack of resources/infrastructure for surveillance (26.3% vs 14.6%), poor communication with LGA surveillance unit (6.6% vs 13.5%), absence of proper data to submit (3.9% vs 3.4%), lack of trained personnel for malaria surveillance (18.4% vs14.6%), inadequate incentives to support surveillance at all levels (6.6% vs 4.5%), lack of cooperation between different levels of health care providers (3.9% vs 5.6%), inadequate coordination and supervision of malaria surveillance activities (10.5% vs 2.2%), health facility located in hard to reach area making communication with L.G.A very difficult (7.9% vs 2.2%). 3.9% of respondents in Akinyele and 20.2% of respondents in Ibadan did not comment on this issue. The Pearson's chi square test was 22.9 and the statistical significance was 0.006.

Table 4.13 Rating of Current Malaria Surveillance Activities at the Health Facilities by Respondents:

Variables	Frequency (%)Akinyele	Ibadan North	χ^2	P-value
Very Good	7.9	7.9	1.96	0.077
Good	44.7	37.1		
Fair	27.6	32.6		
Poor	3.9	14.6		
No comment	15.8	7.0		

4.6 Completeness of malaria surveillance data submitted to the LGA:

Table 4.14 Total Number of cases recorded in case registers at the public health facilities (pooled) (S)

Study period January-June 2008	Number of malaria cases recorded in case registers at the public health facilities in Akinyele LGA	Number of malaria cases recorded in case registers at the public health facilities in Ibadan North LGA
January	627	3373
February	703	2147
March	774	1527
April	844	1959
May	976	2418
June	1111	3033
Total (S)	5035	14457

Table 4.15 Total Number of cases reported to LGA district surveillance& notification Unit (pooled) (R)

Study period January-June 2008	Number of malaria cases reported to the DSNO monthlyin Akinyele LGA	Number of malaria cases reported to the DSNO monthly in Ibadan North LGA
January	671	407
February	715	541
March	852	747
April	818	525
May	875	356
June	897	339
Total (R)	4798	2915

	Cases found at Health facilities but not found at LGA (X_1)	Cases found at LGA but not found at Health Facilities (X_2)	No of cases present in both LGA records and Health Facilities (C)(C=R-X_1)
Akinyele	677	250	4403
Ibadan North	11892	424	2565

Applying the Lincoln-Petersen formula for calculating completeness of cases; in Akinyele LGA

N= [(R+1)*(S+1)/C+1]-1

% Completeness of notification=R/N*(100) (Barat et al, 1995).

For Akinyele LGA: R=4898, S= 5080, C=4403

N=5651.1 *total malaria cases expected in Akinyele LGA from January to July 2008 estimated using the Lincoln-Petersen capture recapture technique* (95% CI=5640, 5653)

For Ibadan North LGA: R= 2915, S=14457, C=2565

N=16429.1 *total malaria cases expected in Ibadan North LGA from January to July 2008 estimated using the Lincoln-Petersen capture recapture technique* (95% CI=16418-16444)

% Completeness of notification Akinyele LGA= 4898/5651*100=86.7%=87%

% Completeness of notification Ibadan North LGA= 2915/16429*100=17.7%=17%

Comparing: Completeness of notification in Akinyele LGA vs Ibadan North LGA= 87%vs17%

Formula for adjusting for multiple ascertainment of cases:

$d_{MLE}=bc/a$; p=a+b+c+d (Hook and Regal)

DSNO malaria cases at the LGA (pooled) =data source (a),

All health facility recorded malaria cases (pooled) =second data source (b).

Number of malaria cases identified by both methods= (c)

Missed cases in total population (d)

For Akinyele LGA: **d=5080*4403/4898=4566, p= 18947**

For Ibadan north LGA: **d=14457*2565/2915=12721, p=32658** (adjusted total malaria cases, January-June 2008)

Standard error of 0.0048 was obtained using the formula:

$$\mathbf{SE=\frac{\sqrt{N2(C+1)(C-R)}}{(R+1)(R+1)(R+2)}}$$

The 95% confidence interval for completeness of reporting coverage obtained above was also determined using the formula $N\pm(1.96)(SE)$ or $R/C \pm 1.96\frac{\sqrt{(R/C)*(1-R/C)}}{C-1}$

C.I = 5651.10948 – 5651.09052

Testing the sensitivity of our case finding method:

S(%) = R/N×100 for sample source 1 (pooled health facility data)

S(%) = C/N×100 for sample source 2 (LGA surveillance data)

Akinyele LGA Sensitivity of pooled health facility data= 86.67%

Akinyele LGA Sensitivity of LGA surveillance data = 77.91%

Ibadan North LGA Sensitivity of pooled health facility data= 17.74%

Ibadan North LGA Sensitivity of LGA surveillance data = 15.61%

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.0 Discussion

There have been very few studies, assessments and evaluation of disease surveillance systems globally and even lesser studies on malaria surveillance especially for Africa and countries like Nigeria where malaria is endemic and yearly takes its toll on the country's population through morbidity and mortality. This paucity of data can be attributed to the low priority assigned to disease surveillance systems in the efforts to control diseases not marked for elimination or eradication (Silk and Berkelmann, 2005). Surveillance in the case of a disease like malaria is assumed to be of lesser importance to poliomyelitis surveillance, measles surveillance etc. Despite all malaria control efforts put in place over the years and attempts to capture data to guide these control efforts, the WHO only recently in 2012 published a complete and detailed guidance document/operational manual on disease surveillance for malaria control (WHO, 2012). All prior WHO malaria surveillance guidance had been embedded in world malaria reports and other assessment documents. Malaria surveillance did not begin to come to the front burner for disease surveillance at WHO until 1994. This study is therefore looking at an emerging and critical aspect of malaria control that needs more global attention as efforts are increased and combined in different parts of the world to eliminate malaria.

Health worker knowledge of malaria surveillance according to IDSR guidelines:

The knowledge score used to evaluate the knowledge of respondents in this study showed excellent knowledge rated as 42.1% and 52.8% for Akinyele and Ibadan North LGAs respectively. It can be concluded from this result that health workers and district

surveillance and notification officers have a relatively very good knowledge of malaria surveillance in both rural and urban settings in Ibadan. This can be corroborated by the study of Ajumobi et al, 2010 which cited simplicity and acceptability of the malaria surveillance system by all stakeholders based on factors such as case definition, standardized tools, communication channels, willingness to participate etc. Despite this level of knowledge of malaria surveillance, the practice of malaria surveillance faces many challenges some of which were revealed in this study: Identification of malaria cases reported does not follow the same criteria across all facilities due to absence of diagnostic testing in some facilities (IDSR guidelines allow fever cases in the absence of RDT kits to also be listed as malaria) and varying degree of knowledge of the surveillance case definition for malaria cases by the health workers.

The findings of this study show that the low level of awareness of the feedback communication between every level of malaria data reporting is crippling the utilization of the feedback mechanism for malaria surveillance, and the Roll Back Malaria (RBM) response mechanism is not functional due to inability to analyze data and utilize data for decision making at the local government level.

These findings are similar to the result of the study by Adetokunbo (1976) on communicable disease surveillance in tropical Africa which noted that major constraints to malaria surveillance were similar for rural and urban areas and include: Lack of efficient communication between the health facilities and the LGA district surveillance and notification units, managerial problems interfering with the collection and transmission of data from the peripheral units to the national authority, pattern of utilization of health facilities more especially in rural areas where it is affected by the farming season, market days, festivals etc, local beliefs, attitudes and practices e.g home

management and consultation of patent medicine stores resulting in concealment of cases.

Adequacy of malaria surveillance infrastructure: The malaria surveillance tools assessed in this study are: Case registers, reporting forms, calculators and computers with statistical software. Computers and calculators were significantly higher in the urban LGA although it was only available in 9% and 32% of the facilities visited in this area. Availability/accessibility of data collection forms for reporting at the facility level in both LGA's was poor though Malaria case registers were almost equally present in all the facilities visited in both LGAs, 55.0% vs 56.5%. Having a reliable supply of recommended forms for disease notification and reporting at all times is very crucial if the malaria data captured in the case registers are to be reported in a timely and efficient way to the DSNO. The significantly higher availability of structures such as laboratories and rapid diagnostic kits in the urban LGA is characteristic of the location and especially with the proliferation of private health facilities however this may not have a significant effect on malaria case notification to the DSNO given the result of the study by Klein and Bosman (2005). They noted that though laboratory involvement in case notification significantly increased in the Netherlands between 1995-2003, there was no change in completeness of malaria case notification based on hospital admissions. It was observed that communication gadgets and transportation vehicles were slightly more in the rural LGA. This factor may have been influenced by a confounder as the standard requirements for primary health care facilities in rural locations includes having an effective method of communicating with the LGA and facilities at a higher level for referrals/emergencies and transportation facilities to move from hard to reach areas to facilities in better geographical location. Personnel for malaria surveillance such as laboratory technicians and statisticians/data managers were also significantly higher in

the urban LGA. The availability of surveillance focal persons who can be held responsible for malaria data was more in Akinyele than Ibadan North LGA.

Overall, infrastructure availability for malaria surveillance at all the health facilities and the district surveillance and notification unit in both the urban and rural LGAs visited in this study is inadequate. This should be noted by the malaria control unit of Oyo state- improving malaria control efforts through selected tools instead of the entire infrastructure may not readily effect a positive change in malaria surveillance.

The study by Romi-Chunara et al, 2012, stated that with a careful study design, micro-monetary incentives and online reporting are a rapid way to solicit malaria, and potentially other public health information as a complement to traditional public health surveillance methods, offering an opportunity to obtain information about malaria activity, temporal progression, demographics affected or Plasmodium-specific diagnosis at a finer resolution than official reports can provide. The recent adoption of technologies, such as the Internet supports self-reporting mediums, and self-reporting should continue to be studied as it can foster preventative health behavior. This method could also be considered in Nigeria so as to strengthen reporting through new technology where infrastructure is available.

Completeness of reporting coverage and Completeness of case notification

Ajumobi et al in a study to evaluate malaria surveillance in Nigeria from 2001-2009 showed that reporting completeness was 30.0% (for number of states expected to report malaria data in comparison with the actual number of states that reported malaria data) and also 30.0% data completeness (for number of reports expected vs number of reports received) both at state levels for the 36 states in Nigeria and the FCT. Using this same method, the findings from this study at LGA level showed a contrasting 84.0% reporting

completeness from the rural LGA and 47.0% at the urban LGA for six months within the year 2008- this suggests a need to intensify malaria surveillance from the district level and monitoring to ensure reports are submitted to the state level and properly collated at the state level. Although the limitation of this method is that it gives equal weight to all health facilities and may not reflect the completeness of case reporting, the missing reports from district hospitals are likely to represent a larger number of missing cases than missing reports from remote rural health facilities. A suggestion from this finding will be that rural LGAs are more likely to submit malaria surveillance date and efforts should be intensified at the urban LGAs to ensure a balance in completeness of submitting reports.

The use of Lincoln Peterson capture-recapture method to calculate completeness of reporting malaria cases in this study showed 87.0% completeness of case reporting for Akinyele LGA and 17.0% completeness of case reporting for Ibadan North LGA. The number of missing malaria cases in both communities not registered at the health facilities was calculated by applying the Hook and Regal adjustment for multiple ascertainment of cases showed 4566 missed cases in Akinyele LGA and 12721 missed cases in Ibadan North LGA. This does not take into account the extent to which patients attending health facilities fail to be registered (e.g. because of a large patient load) thus it can be suggested that special studies are needed to assess the extent of this type of problem.

ThesameLincoln-Petersen method combined with Hook and Regal adjustment formula was used by Klein and Bosman (2005) in a study on completeness of malaria notification in the Netherlands between 1995 and 2003. Completenss of malaria case notification based on this study was 35.5% (95% CI of 32.1-39.7) for 1995-1998 and 36.1% (95% CI of 31.7-41.9) for 2000-2003.It is therefore pertinent for the agency responsible for

malaria control efforts in Nigeria to take into account the adjustment for missing cases when collating annual malaria data for decision making.

Ensuring that the entire continental Africa malaria data is an accurate estimate requires more accuracy, sensitivity and specificity in Malaria case notification knowing that Nigeria and Ethiopia alone contribute at least 30.0% of Africa's annual malaria cases (Carter Center 2011). Statisticians and epidemiologists involved in malaria surveillance should be trained to apply the most efficient techniques to account for missed cases and test completeness of national malaria data before it is shared globally.

Another significant finding in this study is the difference in completeness of reporting malaria cases between the rural and the urban LGA—this can suggest that areas with large number of primary health facilities are more likely to report complete malaria data than urban areas where secondary, private and tertiary health facilities abound. However this argument is confounded by the presence of many factors such as lower population in the rural area, occupational and behavioral factors preventing rural dwellers from assessing malaria treatment at the primary health facility and traditional beliefs in the rural areas leading to more home/herbal treatment for malaria.

Timeliness of reporting was calculated as 70% vs 29% in Akinyele and Ibadan north LGAs respectively, following the same pattern as completeness of reporting and reporting efficiency. The study by Ajumobi et al (2009) showed the 65% of all states in Nigeria were late in reporting malaria data at the state level. It will be suggested that collection and collation at the district level (LGA) be strengthened especially in urban areas so as to improve national malaria surveillance.

5.1 Conclusion

Malaria surveillance has been a salient and passive part of all malaria control efforts put in place in Nigeria to check the menace of the endemic killer disease. The current system of malaria surveillance is useful, acceptable and flexible, however it is worthy to note that without an effective and efficient surveillance system for malaria in Nigeria and other malaria endemic countries, every malaria control effort put in place will not achieve its full potential for controlling the disease. As the world health organization WHO brings malaria back into focus targeting the elimination of proper control of the disease in the various regions worldwide, it is also scaling up efforts towards malaria surveillance as seen in the malaria surveillance guideline released by WHO in 2012 ten years after the IDSR guidelines were adopted.

This study shows that rural LGAs are able to carry out malaria surveillance activities but need to be strengthened to improve on malaria data reporting completeness for cases and data coverage, timeliness and representativeness, while urban LGAs need more training in addition to mentoring and supportive supervision to utilize the feedback mechanism for malaria surveillance. The provision of all necessary surveillance infrastructures according to guidelines will improve malaria surveillance in both LGAs.

Despite all challenges noted in Nigeria, lessons can be learnt from Iran where existing malaria surveillance activities provide timely, specific and accurate data to decision-makers at district-level (Jonathan Cox, 2007).

5.2 Recommendations

1. Archiving is highly recommended for malaria surveillance as a streamlined and central data storage system will minimize the need for data analysis at the Local Government Level.The 2012 WHO operational manual for malaria surveillance should be adopted as a standard for all current malaria surveillance activities.

2. Malaria surveillance should focus on the minimal essential data required rather than the current practice that tends towards collecting the maximum amount of data possible for monitoring, evaluation, and surveillance.

3. Malaria data collected by routine surveillance needs to be "actionable"; i.e linked to program performance indicators and planning to direct program activities at district level and below, rather than simply to count and tabulate deaths, cases, or infections at different administrative levels. This can be achieved by strengthening the national regulatory mechanisms for disease surveillance.

4. There is need for increased government commitment towards surveillance as a tool for malaria control, need for government to provide the necessary infrastructure allocate funds and provide continuous training to ensure malaria surveillance is carried out at every level of malaria control.

5. State malaria control departments should be encouraged to share reports collated from the LGAs comparing timeliness and completeness of reporting among the LGAs and the states to encourage healthy malaria surveillance data competition between states while also involving the community.

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APPENDIX:

Timeliness and completeness of monthly case reporting for malaria surveillance from the health facility to the LGA using the IDSR analysis template:

Key: T =arrived on time L= arrived late W= report not received

State ____OYO **LGA** _Akinyele**Year** ____2008_____

Health Facility	**January**	**February**	**March**	**April**	**May**	**June**
Alade PHC	1	1	1	1	1	1
Melee PHC	1	1	1	1	1	1
Oretu PHC	1	1	1	1	1	1
Iwokoto PHC	1	1	1	1	1	1
Olorisa PHC	2	2	2	2	2	2
Igbooloyin PHC	1	1	1	1	1	1
Ileba PHC	1	1	1	1	1	1
Ijaye PHC	1	1	1	1	1	1
Moniya GH	1	1	1	1	1	1
Pade PHC	1	1	1	1	1	1
Iroko PHC	2	2	2	2	2	2
Onidundu PHC	1	1	1	1	1	1
Ikereku PHC	1	1	1	1	1	1
Orogun PHC	1	1	1	1	1	1
Ajibode PHC	1	1	1	1	1	1
Ojoo PHC	1	1	1	1	1	1
Elekuru PHC	1	1	1	1	1	1
Shasha PHC	1	1	1	1	1	1
Alabata PHC	1	1	1	1	1	1
Adegbite HF	1	1	1	1	1	1
Jarija PHC	1	1	1	1	1	1
Iware PHC	1	1	1	1	1	1
Moniya PHC	1	1	1	1	1	1
Aroro PHC	1	1	1	1	1	1
Total Number of reports expected (N)	26	26	26	26	26	26
Total reports sent on time (T)	19	17	22	22	20	9
Total reports sent late (L)	2	5	2	2	4	7
Total number of reports not received (W)	5	4	2	2	2	10
Timeliness of the reports (%) = 100*T/N	73.1	65.4	84.6	84.6	76.9	34.6
Completeness of reporting coverage within the LGA (%) = 100*(N-W)/N	80.7	84.7	92.3	92.3	92.3	61.6

Average timeliness of reporting for the period: 70%

Average completeness of reporting coverage for the period: 84%

Timeliness and completeness of monthly reporting from the health facility to the LGA

Key: T =arrived on time L= arrived late W= report not received

State ____OYO_____ LGA _Ibadan North___ Year ____2008_____

Health Facility	January	February	March	April	May	June
Idi Ogungun	1	1	1	1	1	1
Yemetu	1	1	1	1	1	1
Adeoyo	1	1	1	1	1	1
Sango	1	1	1	1	1	1
Agbowo	1	1	1	1	1	1
Samonda	1	1	1	1	1	1
Cerehad	1	1	1	1	1	1
OkeAremo	1	1	1	1	1	1
Olive	1	1	1	1	1	1
NPI	1	1	1	1	1	1
Iderade	1	1	1	1	1	1
Banka	1	1	1	1	1	1
UCH	1	1	1	1	1	1
Jaja Clinic	1	1	1	1	1	1
Ashi Health Post	1	1	1	1	1	1
Secretariat Clinic	1	1	1	1	1	1
Blood transfusion Unit Agodi	1	1	1	1	1	1
Federal Secretariat Staff clinic	1	1	1	1	1	1
Government House Clinic	1	1	1	1	1	1
Total Number of reports expected (N)	19	19	19	19	19	19
Total reports sent on time (T)	6	6	4	8	6	3
Total reports sent late (L)	3	4	5	2	2	5
Total number of reports not received (W)	10	9	10	9	11	11
Timeliness of the reports (%) = 100*T/N	31.6	31.6	21.1	42.1	31.6	15.8
Completeness of reporting coverage within the LGA (%)= 100*(N-W)/N	47.4	52.6	47.4	52.6	42.1	42.1

Average timeliness of reporting for the period: 29%

Average completeness of reporting coverage for the period: 47.4%

Comparing reporting timeliness for Akinyele LGA and Ibadan North LGA: 70% VS 29%

Comparing completeness of reporting coverage for Akinyele LGA and Ibadan North LGA:

84% vs 47.4%

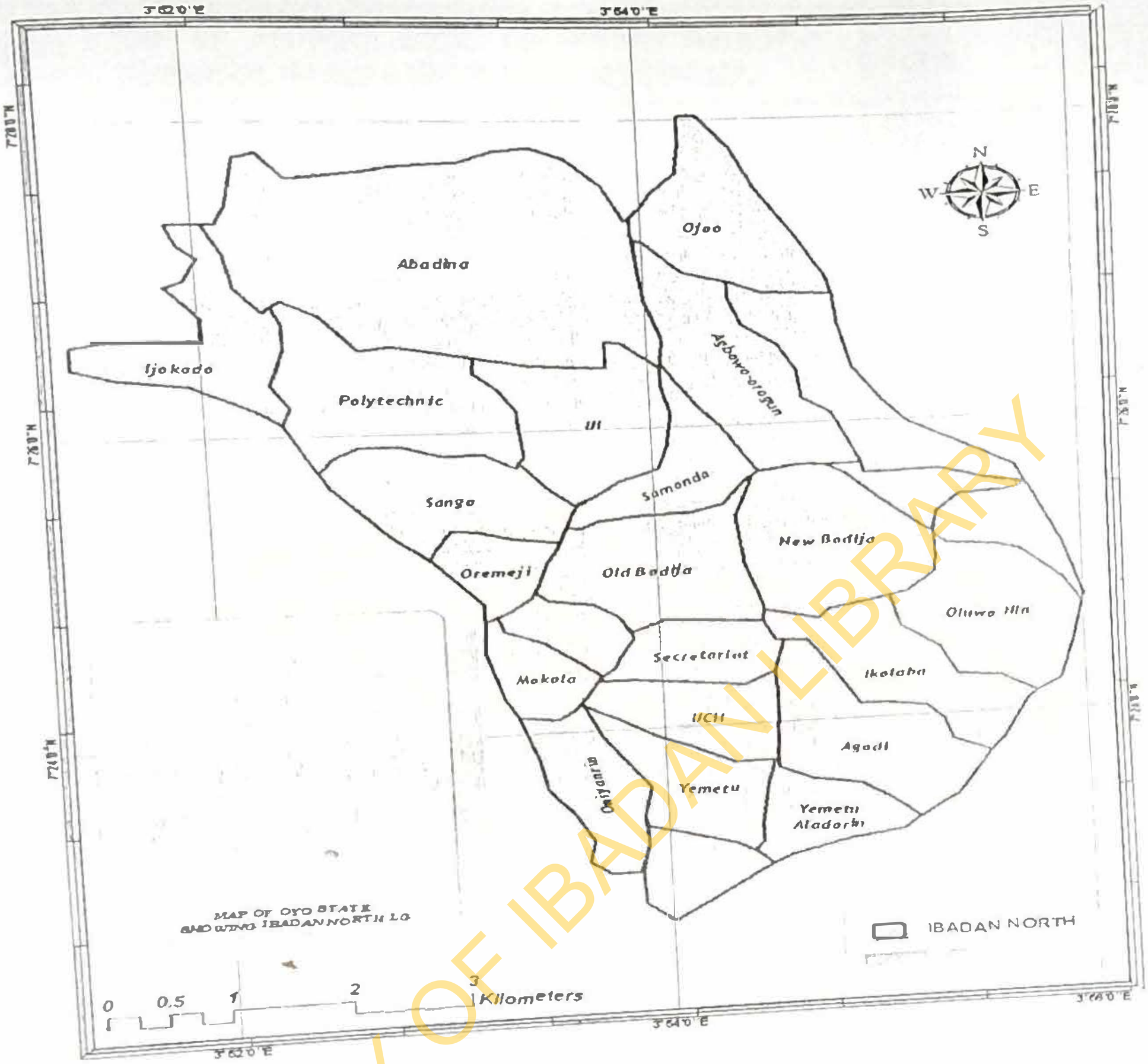
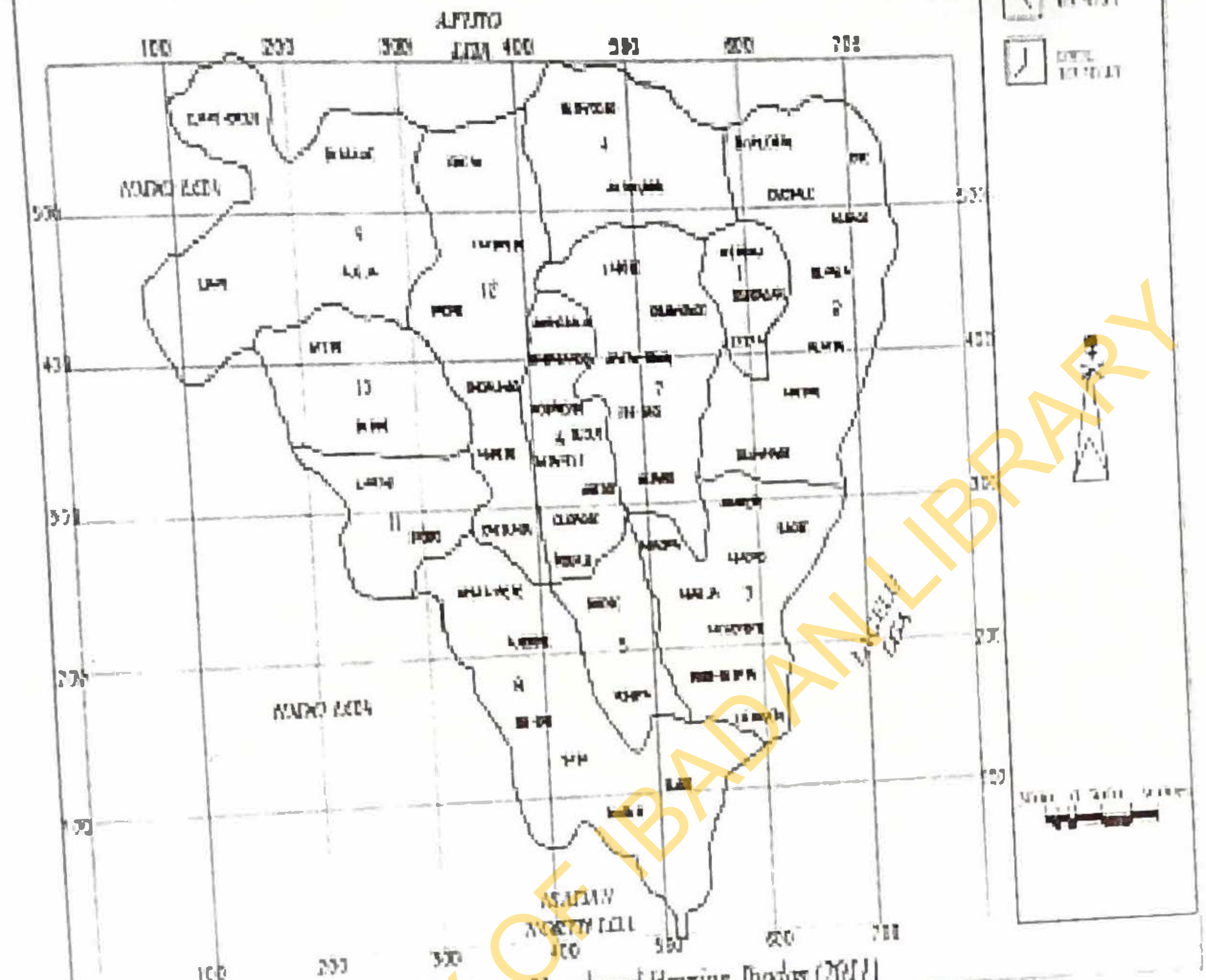


Fig. III MAP OF AKINYELE LOCAL GOVERNMENT SHOWING ELECTORAL WARDS & MAJOR RURAL SETTLEMENTS



Source: Ministry of Lands and Housing, Ibadan (2011)

COMPLETENESS OF MALARIA CASE NOTIFICATION AND SURVEILLANCE INFRASTRUCTURE AT HEALTH FACILITIES IN AKINYELE AND IBADAN NORTH LOCAL GOVERNMENT AREAS, NIGERIA

QUESTIONNAIRE

Introduction

Good day sir/ madam, My name is FolukeAdetolaOgunyemi, a post graduate student of the department of epidemiology and medical statistics at the faculty of public health, university of Ibadan, Ibadan. I am carrying out a study on malaria surveillance in Ibadan north and Akinyele LGAs and it will involve the malaria surveillance focal persons at all participating public health facilities and the district surveillance and notification officers of both LGAs. The head of this facility has selected you as the focal person involved in malaria data collation and reporting to be interviewed and I will ask you some questions which you may find difficult to answer. Please note that your answers will be kept very confidential. You will be given a number and your name will not be written on the form so that your name will never be used in connection with the information you give. The information you and other people give will be used by government to improve malaria surveillance in Oyo state and Nigeria, and improve on malaria control programs.

You are free to take part in the study and you have a right to withdraw at any time if you choose to do so. Your honest responses to the questions and your time will be greatly appreciated. Thank you.

Consent: Now that this study has been well explained to me and I fully understand the content of the study process, I will be willing to take part in the study on "completeness of malaria case notification in Akinyele and Ibadan North LGAs, Oyo state, Nigeria.

.....

Signature

Section A: FACILITY IDENTIFICATION

Serial No.....

Name of health facility.....

Local Government area.....

Section B: SOCIO DEMOGRAPHIC CHARACTERISTICS OF PARTICIPANTS

Please answer by ticking the options that apply to you or filling the blank spaces.

1. Age (as at last birthday): .....
2. Sex 1.Male ☐ Female ☐
3. Profession Medicine Nursing ☐ Laboratory science ☐
   Others.....
4. Years of practice/experience .....
5. Official rank or level, specify.....
6. Highest level of education MBBS ☐ B. Pharm ☐ General nursing ☐
   SMLT ☐ Postgraduate Qualification (specify) .....

Section C: AWARENESS AND PRACTICE OF INTEGRATED DISEASE SURVEILLANCE AND RESPONSE AND MALARIA SURVEILLANCE

1. Have you ever heard about the integrated disease surveillance and response (IDSR)? YES/ NO
2. Do you know that malaria is one of the priority diseases of public health importance under surveillance? YES/NO
3. Through which of the following sources did you hear about malaria surveillance?
   A. Seminar/ workshop/conference
   B. Journals/ Scientific/ Medical literature
   C. Official newsletters
   D. Professional colleagues
   E. Others.....please specify.....
4. Are you aware of any malaria surveillance activity being carried out in this facility? YES/NO

5. If yes, please state the activity.....

6. Has this health facility appointed a focal person to be in charge of malaria surveillance activities? YES/NO

7. Is any supervisory activity carried out by the head of this facility on malaria surveillance reporting? YES/NO

8. Has the L.G.A District Surveillance officer ever visited or contacted this facility for malaria surveillance data? YES/NO

9. Malaria surveillance requires laboratory based active case detection; does this health facility have a clinical laboratory attached to it? YES/NO

10. How do you identify the malaria cases reported?

A. I use the standard surveillance case definition for measles

B. I report laboratory confirmed cases

C. I report all cases diagnosed as malaria

11. Which of the following should be left out when reporting a malaria case?

A. Identity of patient

B. Source of information about the case being reported

C. Malaria parasites identified at the laboratory

D. Type of treatment administered

E. None of the above

12. Do you monitor the trend in number of cases by plotting graphs or spot maps? YES/NO

13. Do you carry out any analysis on the data collected? YES/NO

14. Malaria surveillance will help this facility deliver better malaria control and treatment to its clients? YES/NO

15. If yes, how.....

SECTION D: ADEQUACY OF INFRASTRUCTURE FOR REPORTING

16. Do you have a surveillance co-coordinating focal point in this Local Government Heath department? 1. Yes 2. No
17. Do you review cases of malaria registers and logs for reported cases? 1. Yes 2. No
18. Do you have a reliable supply of recommended forms at all times over the last six months? 1.Yes 2. No
19. Did you submit all required reports to the next higher level at the right time during the last 6 months? 1. Yes 2. No
20. Do you perform trend analysis of malaria cases for each health facility? 1. Yes 2. No
21. Do you prepare and disseminate a written report of surveillance information at least quarterly during the last year? 1.Yes 2. No
22. Do you receive a written report or bulletin containing information for your Local Government from a higher level during the last year? 1.Yes 2. No
23. Do you provide feedback to the community? 1.Yes 2. No
24. If yes, how.....
25. Do the health personnel in this LGA receive training for malaria surveillance during the last six months?1.Yes 2. No
26. Do you provide transportation or logistical supports (vehicles with fuel, motor cycle) for surveillance purposes? 1.Yes 2. No
27. Do you have supplies for managing surveillance data (computers, statistical program package)? 1.Yes 2. No
28. If yes, specify.....
29. Do you have easy and fast means of communicating with the health facilities (reliable telephone service, facsimile, radiophone, electronic mail)? 1.Yes 2. No
30. If yes, specify.....
31. Do you have information and education materials (portable generator, screen projector (slides or film) for efficient malaria surveillance activities? 1. Yes 2. No
32. Do you have adequate human resources (trained epidemiologist, laboratory technologists, and data managers)? 1. Yes 2. No
33. Identify the sources of information about health events in the LGA, including points of contact the community has with health services.
    a. Health Facilities and Hospitals? 1. Yes 2. No

b. Community health workers. 1. Yes 2. No

c. Traditional birth attendance. 1. Yes 2. No

d. Public health officers. 1. Yes 2. No

e. Private sector practitioners. 1. Yes 2. No

f. Others (please describe)_____

34. Do you have a data manager/data analysis tools? YES/NO

35. Do you have a standard response mechanism when cases observed are higher than the usual trend? YES/ NO

36. What mode of communication exists between this facility and the L.G.A Surveillance unit?

A. Person to person direct contact at any time

B. Direct telephone contact

C. Indirect contact involving only submission of forms, electronic mails or a third party

37. Do you have any feedback mechanism in place for the benefit of the community that data is obtained from? YES/NO

38. Which option best suits the availability /accessibility of surveillance forms for this facility?

A. Always available and accessible

B. Available sometimes but not accessible by data managers

C. Rarely available

39. In your opinion, how would you rate the practice of reporting malaria surveillance in this facility?.....

40. Suggest various ways for improving the practice of malaria surveillance in this facility.

41. Please present relevant data about this LGA that can be used to advocate for additional resources for improving malaria surveillance and response activities._____

___

42. State three or more objectives you would like to achieve for improving surveillance in this Local Government Area over the next year._____

COMPLETENESS OF MALARIA CASE NOTIFICATION AND SURVEILLANCE INFRASTRUCTURE AT HEALTH FACILITIES IN AKINYELE AND IBADAN NORTH LOCAL GOVERNMENT AREAS, NIGERIA

Data Extraction Form

Section A: Facility Identification

1. Serial No.....
2. Name of health facility.....
3. Type of Health Facility.....
4. Local Government area.....
5. Focal person designated for surveillance.....
6. Malaria surveillance technique utilized.....

SECTION B: Data Extraction Form

Please provide the relevant data from your case register for the number of malaria cases recorded for each of these months in the year 2009.

	January	February	March	April	May	June
Total number of malaria cases reported for the month						
Cases reported per age group						
less than 5 yrs						
5-14 yrs						
c. 15 yrs and above						
Case classification Uncomplicated Malaria						
Severe Malaria						
Malaria in pregnancy						
Treatment classification In-patient						
b. Out-patient						
Mortality recorded for malaria						