

**DETERMINANTS OF AWARENESS OF NIGERIAN
PHARMACOVIGILANCE PROGRAMME AND ACTIVITIES OF
NATIONAL AGENCY FOR FOOD, DRUGS ADMINISTRATION AND
CONTROL.**

BY

ALO, OLUWAFEMI DAVID

MATRIC NO: 173093

**A DISSERTATION SUBMITTED TO THE DEPARTMENT OF
EPIDEMIOLOGY AND MEDICAL STATISTICS**

FACULTY OF PUBLIC HEALTH

COLLEGE OF MEDICINE

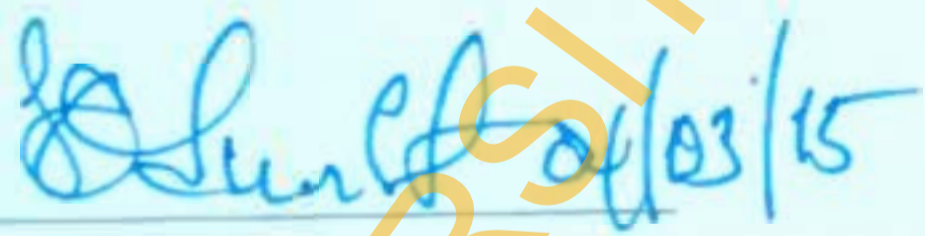
UNIVERSITY OF IBADAN, IBADAN

**IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE
AWARD OF THE DEGREE OF MSC IN BIOSTATISTICS**

MARCH, 2015

CERTIFICATION

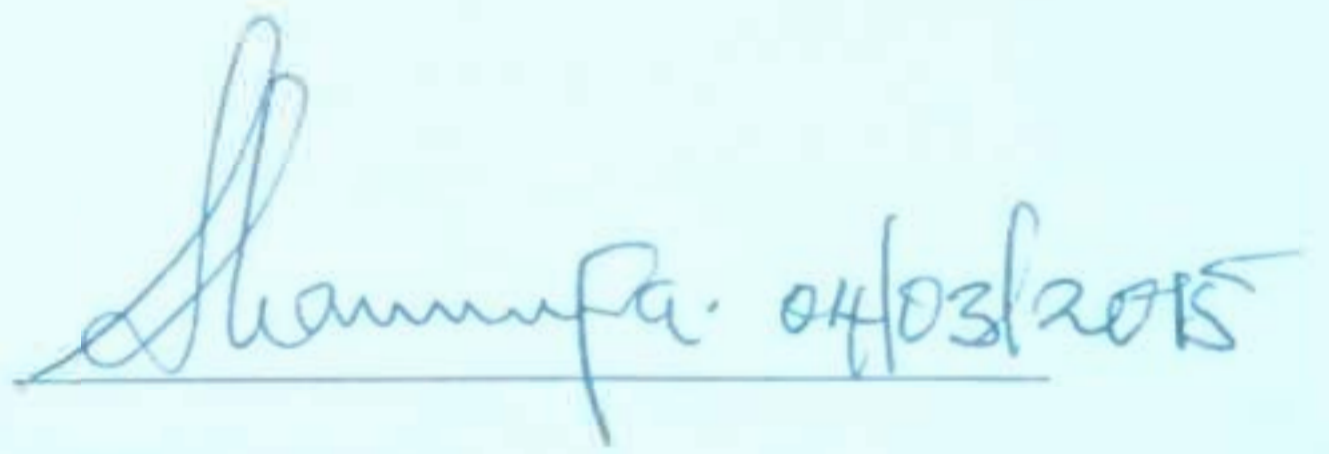
WE CERTIFY THAT THIS PROJECT WAS CARRIED OUT UNDER OUR SUPERVISION BY ALO OLUWAFEMI DAVID OF THE DEPARTMENT OF EPIDEMIOLOGY AND MEDICAL STATISTICS, FACULTY OF PUBLIC HEALTH, COLLEGE OF MEDICINE, UNIVERSITY OF IBADAN, IBADAN.


04/03/15

(SUPERVISOR)

DR. J.O. AKINYEMI

B.Tech (Akure), M.Sc, Ph.D (Ib)


04/03/2015

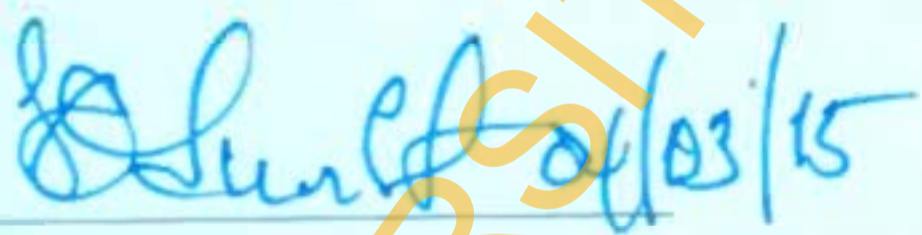
(SUPERVISOR)

DR. O.M. AKPA

B.Sc, M.Sc, Ph.D (Ilorin)

CERTIFICATION

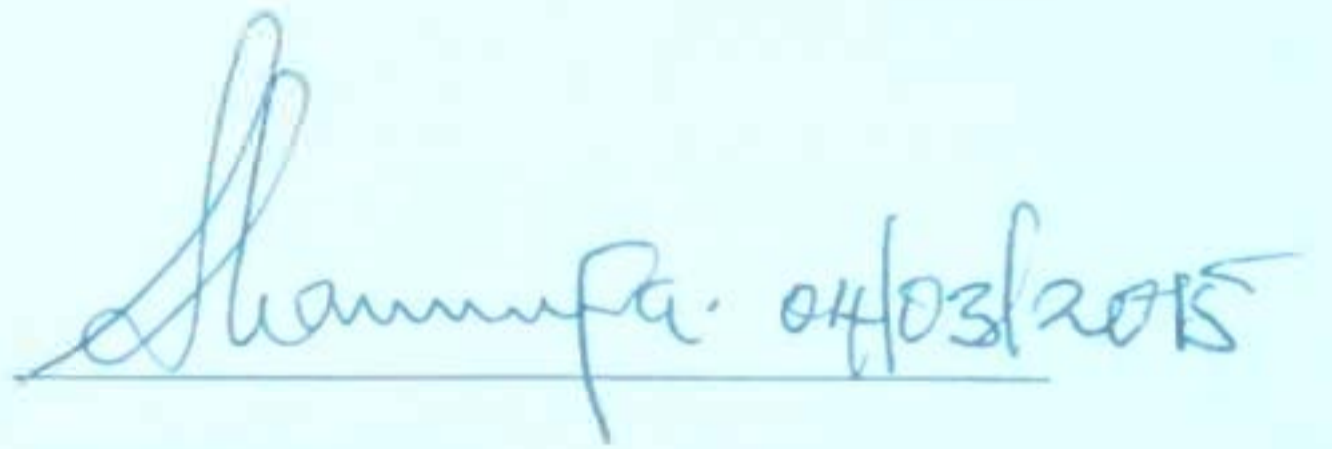
WE CERTIFY THAT THIS PROJECT WAS CARRIED OUT UNDER OUR SUPERVISION BY ALO OLUWAFEMI DAVID OF THE DEPARTMENT OF EPIDEMIOLOGY AND MEDICAL STATISTICS, FACULTY OF PUBLIC HEALTH, COLLEGE OF MEDICINE, UNIVERSITY OF IBADAN, IBADAN.


04/03/15

(SUPERVISOR)

DR. J.O. AKINYEMI

B.Tech (Akure), M.Sc, Ph.D (Ib)


04/03/2015

(SUPERVISOR)

DR. O.M. AKPA

B.Sc, M.Sc, Ph.D (Ilorin)

DEDICATION

This dissertation is dedicated to God Almighty and my family.

UNIVERSITY OF IBADAN LIBRARY

DEDICATION

This dissertation is dedicated to God Almighty and my family.

UNIVERSITY OF IBADAN LIBRARY

ACKNOWLEDGEMENT

My deepest gratitude and appreciation first of all goes to God Almighty for granting me the grace, inspiration, wisdom and knowledge in completion of this study. Also, my appreciation goes to my wonderful parent: Pastor and Mrs Alo for their immeasurable support towards this project. Same goes to my sisters and their husband for their support toward the successful completion of this project.

This study owes much to my supervisors, Dr J.O Akinyemi and Dr O.M Akpa for their overwhelming support towards this project and graciously reading through the manuscript of this dissertation.

I am also grateful to all my lecturers in the Department of Epidemiology and Medical Statistics, College of Medicine, University of Ibadan for imparting knowledge in one way or the other. They include Prof Elijah A. Bangboye, Prof Olusola Ayeni, Dr Olufunmilayo I. Fawole, Dr Oyeneye I. Ajayi, Dr David M. Dairo, Dr Bidemi Yusuf, Dr Adeniyi F Fagbamigbe, Dr Ayo S Adebowale, Dr Adejoke I Adeoye, Dr Babatunde O. Adedokun, Mr Babatunde M. Gbadebo and Mr Rotimi Afolabi.

My gratitude also goes to my entire class member for their addition to this dissertation.

God bless you all.

ABSTRACT

Background: Effective pharmacovigilance relies on contributions by many people with varying educational backgrounds. The concept of pharmacovigilance is most times not well understood, either by health professionals, patients or the general population. The aim of this study is to investigate the effect of individual and community-level factors on awareness of NAFDAC and the effectiveness of its campaign against fake drugs and awareness of Nigerian pharmacovigilance programme.

Methods: This study was a secondary analysis of data collected in the 2012 National HIV & AIDS and Reproductive Health and Serological Survey (NARHS Plus). The survey covered all the 36 states of Nigeria and female aged 15-49 years and males 15-64 years were selected through a multi-stage sampling method. The total number of individuals selected for final interview was 31,235. STATA version 12 was used for the analysis. Descriptive statistics as well as a three-level logistic regression analyses were used.

Results: Half (50.8%) of those in the reproductive age were aware of NAFDAC while about one-third (36.5%) checked for NAFDAC registration before they bought drugs/food products. One-fourth (26.0%) of the respondents was aware of Nigerian pharmacovigilance programme. The most significant individual-level predictors of NAFDAC awareness were how often an individual listened to radio and how often an individual watched television. Also, educational level and gender were associated with NAFDAC awareness. An individual with tertiary educational level was approximately twenty times (OR= 19.67, 95% C.I= 16.19 – 23.15) more likely to checked for NAFDAC registration number compared to an individual without formal education. Similarly, sex, occupation and type of location (rural or urban) were associated with checking for NAFDAC registration number. An individual who have ever heard/seen any NAFDAC campaign was approximately thirty-three times (OR= 32.85, 95% C.I= 29.133 – 36.567) more likely to be aware of Nigerian pharmacovigilance programme compared to an individual who have not heard/seen the advert. Furthermore, education, occupation and type of location (rural or urban) were associated with awareness of Nigerian pharmacovigilance programme.

Conclusion: The study has shown that gender, educational level, how often an individual watch television and how often an individual listen to radio are factors influencing the awareness of NAFDAC. Also, gender, educational level, type of location (rural or urban) and occupation are factors associated with checking for NAFDAC registration number. Furthermore, NAFDAC campaign on ADRs reporting influences the awareness of Nigerian pharmacovigilance programme. Similarly, educational level, occupational status and type of location are also factors affecting the awareness of Nigerian pharmacovigilance programme.

Programmes and advertisements related to NAFDAC and pharmacovigilance should be done on media and packaged for the illiterate to understand. Also, legislators, policy makers, government officials, NAFDAC, health ministries, non-governmental organizations, educational institutions and media should work together in order to raise the awareness level of pharmacovigilance.

TABLE OF CONTENTS

	Page
Title page.....	i
Certification.....	ii
Dedication.....	iii
Acknowledgement.....	iv
Abstract.....	v
Table of contents.....	vi
List of figures.....	vii
CHAPTER ONE	
1.0 Background.....	1
1.1 Rationale of the study.....	4
1.2 Broad objective.....	5
1.3 Specific objective.....	5
1.4 Research Hypothesis.....	6
CHAPTER TWO: Literature review	
2.1 Overview of NAFDAC and its Function.....	7
2.2 NAFDAC Registration Number.....	8

TABLE OF CONTENTS

	Page
Title page.....	i
Certification.....	ii
Dedication.....	iii
Acknowledgement.....	iv
Abstract.....	v
Table of contents.....	vi
List of figures.....	vii
CHAPTER ONE	
1.0 Background.....	1
1.1 Rationale of the study.....	4
1.2 Broad objective.....	5
1.3 Specific objective.....	5
1.4 Research Hypothesis.....	6
CHAPTER TWO: Literature review	
2.1 Overview of NAFDAC and its Function.....	7
2.2 NAFDAC Registration Number.....	8

TABLE OF CONTENTS

	Page
Title page.....	i
Certification.....	ii
Dedication.....	iii
Acknowledgement.....	iv
Abstract.....	v
Table of contents.....	vi
List of figures.....	vii
CHAPTER ONE	
1.0 Background.....	1
1.1 Rationale of the study.....	4
1.2 Broad objective.....	5
1.3 Specific objective.....	5
1.4 Research Hypothesis.....	6
CHAPTER TWO: Literature review	
2.1 Overview of NAFDAC and its Function.....	7
2.2 NAFDAC Registration Number.....	8

2.3	Overview of the pharmacovigilance in Nigeria.....	9
2.4	ADRs reporting guideline in Nigeria.....	10
2.5	Global overview of pharmacovigilance awareness.....	11
2.6	Awareness and Pharmacovigilance practice in Nigeria.....	12
2.7	Factors affecting pharmacovigilance awareness among healthcare professionals.....	13
2.8	Challenges of ADRs reporting in Nigeria.....	14
2.9	Community member's awareness about ADRs reporting.....	14

CHAPTER THREE

3.1	Study setting.....	16
3.2	Study design.....	16
3.3	Sampling technique and Sample size.....	16
3.4	Data collection tool.....	17
3.5	Variables of Interest.....	17
3.6	Data Management and Data analysis.....	18
3.6.1	Intercept Only Multilevel Logistic Model.....	19
3.6.2	Intra-Class Correlation (ICC) and Akaike's Information Criterion (AIC).....	20
3.6.3	three-level random intercept binary logistic model.....	21

CHAPTER FOUR: RESULT

4.1	Descriptive analysis.....	27
4.2	Bivariate analysis.....	29
4.2.1	Bivariate analysis of the relationship between selected individual and Community level factors and awareness of NAFDAC.....	29
4.2.2	Bivariate analysis of the relationship between selected individual and community level factors and checking for NAFDAC registration number on drug/food products.....	31
4.3	Multilevel models.....	38
4.3.1	Awareness of NAFDAC.....	40
4.3.2	Checking for NAFDAC registration number on drug/food product before buying it.....	43
4.3.3	Awareness of Nigerian pharmacovigilance programme.....	46
CHAPTER FIVE		
5.0	Discussion.....	50
5.1	Awareness of NAFDAC and checking for NAFDAC registration number.....	50
5.2	Awareness of Nigerian pharmacovigilance programme.....	53
5.3	Limitation of the study.....	53
5.4	Conclusion.....	53
5.5	Recommendation.....	54
REFERENCES.....		55

LIST OF TABLES

Tables	Page
Table 1 Descriptive statistics of the study variables.....	26
Table 2 Bivariate result of awareness of NAFDAC on selected individual..... and cluster characteristics.....	29
Table 3 Bivariate result of checking of NAFDAC registration number on drugs/food products on selected individual and cluster characteristics.....	32
Table 4 Bivariate analysis of awareness of Nigerian pharmacovigilance programme according to individual and community characteristics selected.....	35
Table 5 Random intercept-only model for the awareness of NAFDAC.....	38
Table 6 Random intercept only model on checking for NAFDAC registration number on drugs/food products before buying it.....	38
Table 7 Random intercept only model for awareness of Nigerian Pharmacovigilance Programme.....	39
Table 8 Three-level random intercept model for the factors affecting awareness of NAFDAC..	41
Table 9 Three-level random intercept model for factors associated with checking of NAFDAC' registration number on drugs/food products.....	44
Table 10 Three-level random intercept model for factors associated with awareness of Nigerian pharmacovigilance programme.....	47

LIST OF ABBREVIATIONS

NAFDAC – National Agency for Food, Drug Administration and Control

NARHS- National HIV & AIDS and Reproductive Health and Serological Survey

WHO- World Health Organization

WHA- World Health Assembly

NPC- National Pharmacovigilance Center

ADRs- Adverse Drug Reactions

FRN- Federal Republic of Nigeria

UNIVERSITY OF IBADAN LIBRARY

CHAPTER ONE

1.0 Background

Pharmacovigilance is the science and activities relating to the detection, assessment, understanding and prevention of adverse effects or any other possible drug-related problems. Recently, its concerns have been widened to include: herbals, traditional and complementary medicines, blood products, biological, medical devices and vaccines (WHO, 2002).

The need started with the thalidomide disaster in 1961 which led to congenital deformity in neonates born to mothers who used thalidomide to treat morning sickness during pregnancy (Rawlins, 1995). It was not until the disaster that the first programmatic international efforts were initiated to address drug safety issues (WHO, 2002). The Sixteenth World Health Assembly (1963) adopted a resolution (WHA 16.36) that reaffirmed the need for early action in regard to rapid dissemination of information on adverse drug reactions and led, later, to creation of the WHO Pilot Research Project for International Drug Monitoring in 1968 (WHO, 1972). The purpose of this was to develop a programme, applicable internationally for detecting previously unknown or poorly understood adverse effects of medicines.

The specific aims of pharmacovigilance are to: improve patient care and safety in relation to the use of medicines and all medical and paramedical interventions, improve public health and safety in relation to the use of medicines, contribute to the assessment of benefit, harm, effectiveness and risk of medicines, encouraging their safe, rational and more effective (including cost-effective) use, and promote understanding, education and clinical training in pharmacovigilance and its effective communication to the public (Erice and Sicily, 1997).

Good pharmacovigilance will identify the risks and the risk factors in the shortest possible time so that harm can be avoided or minimized. When communicated effectively, this information

allows for the intelligent, evidence-based use of medicines and has the potential for preventing many adverse reactions (WHO, 2006).

At present, post-marketing surveillance of medicines is mainly co-ordinate by National Pharmacovigilance Centers (WHO, 2002). The number of National Centers participating in the WHO International Drug Monitoring Programme was initially 10 in 1968 but currently 86 countries participate in the programme (Kumar, 2011). Centers vary considerably in size, resources, support structure, and scope of activities. Collecting Spontaneous reports of suspected ADRs remain their core activity (WHO, 2002).

On an international level, the WHO runs the Uppsala monitoring centre, and the European Union runs the European Medicine Agency (EMA) (Safety Monitoring of Medicinal Products, 2002)

On an international level, the WHO runs the Uppsala monitoring centre, and the European Union runs the European Medicine Agency (EMA) (Safety Monitoring of Medicinal Products, 2002).

Pharmacovigilance was initiated in Nigeria in 2004 by the National Agency for Food and Drug Administration and Control (NAFDAC), which operates the Nigerian National Pharmacovigilance Centre (NPC, NAFDAC, 2004). One of the objectives of the centre includes creating awareness among health workers of the need to consider ADR reporting as one of their responsibilities.

The effectiveness of a national Pharmacovigilance programme is directly dependent on the active participation of health professionals. Health professionals are in the best position to report suspected ADRs observed in their every day patient care, because they are the people who diagnose, prescribe, dispense and monitor the patients' response to the medicines (NAFDAC, 2004).

Active participation of consumers will also lead to a successful spontaneous reporting because only a patient knows the actual benefit and harm of a medication taken. Observations and reports made by health professional will be an interpretation of description originally provided by the patients, together with objective measurement (WHO, 2002). Some people believe strongly that direct consumers participation in the reporting of ADRs problems will increase the efficacy of the pharmacovigilance Programme and will overcome some of the short comings of the programmes based on reports from health professionals only (WHO, 2000).

1.1 Rationale for the study

Effective pharmacovigilance relies on contributions by many people with varying educational backgrounds. The concept of pharmacovigilance is most times not well understood, either by health professionals, patients or the general population (WHO, 2006).

Documentation of adverse drug reactions is a major component of Pharmacovigilance. Adverse reactions are a significant cause of morbidity and mortality and can affect adherence to treatment schedules and increase the risk of resistance and relapse of the disease (WHO, 2006). Adverse drug reaction has been shown to be the fourth to sixth principal cause of mortality in USA (Lazarou J, 1998). It is estimated that only 6–10% of all ADRs are reported (Inman, 1996).

Spontaneous reporting is a programme whereby case reports of adverse drug events are voluntarily submitted by health professionals, pharmaceutical companies or consumers to the national pharmacovigilance centre (WHO, 2006). The lack of awareness and under-reporting remains a major drawback of spontaneous reporting especially in developing countries like Nigeria (Lopez-Gonzales *et al.*, 2009, Smith *et al.*, 1996).

There is also insufficient information on the burden of ADR in developing countries like Nigeria (Nwokike, 2008).

Various studies have been done on adverse drug reporting, perception, knowledge and practice of Pharmacovigilance among health workers in some parts of Nigeria (Oshikoya and Awobusuyi .2009, Oreagba *et al.*, 2011). However, no study has documented factors affecting the awareness of Nigerian Pharmacovigilance Programme. Furthermore, all the previous studies done in Nigeria were facility-based involving mainly health workers (doctors, nurses, pharmacist etc). However, it is important to assess the awareness of pharmacovigilance in the general population.

1.2 Broad Objective

The broad objective of this study is to investigate the effect of individual and community-level factors on awareness of NAFDAC and the effectiveness of its campaign against fake drugs and awareness of Nigerian pharmacovigilance programme.

1.3 Specific Objectives

1. To assess the effect of individual and community-level factors on awareness of NAFDAC.
2. To determine the individual and community-level factors affecting checking of NAFDAC registration number on drugs/food products before purchase.
3. To assess the factors affecting the awareness of Nigerian pharmacovigilance programme.

1.4 Research Hypothesis

It is hypothesized that individual and community-level factors are associated with the awareness of NAFDAC, checking of NAFDAC registration number on drugs/food product before purchase and awareness of Nigerian pharmacovigilance programme.

The individual-level factors are socio-demographic characteristics, how frequent individual listen to radio, how frequent individual watch television, heard/seen any NAFDAC programme (advert) on what people should do when they experience adverse reactions on drugs/food product and community-level factors are location and geo-political zone.

UNIVERSITY OF IBADAN LIBRARY

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview of NAFDAC and its Function

The National Agency for Food and Drug Administration and Control (NAFDAC) was established to control and regulate the manufacture, importation, exportation, distribution, advertisement, sales and use of food, drugs, cosmetics, medical devices and packaged water including all drinks (referred to as regulated products).

In accordance with the enabling laws, NAFDAC is authorized to:

1. Regulate and control the importation, exportation, manufacture, advertisement, distribution, sales and use of regulated products
2. Conduct appropriate tests and ensure compliance with standard specifications
3. Undertake appropriate investigation of the production premises and raw materials of regulated products
4. Compile standard specifications, regulations and guidelines for production, importation, exportation, sale and distribution of regulated products
5. Control the exportation and issue quality certification of regulated products intended for export
6. Ensure that the use of narcotic drugs and psychotropic substances are limited to medical and scientific use only
7. Undertake the registration of food, drugs, medical devices, bottled water and chemicals
8. Undertake inspection of important regulated products
9. Pronounce on the quality and safety of regulated products after appropriate analysis

2.2 NAFDAC Registration Number

On a daily basis Nigerians are faced with the task of deciding which drug is authentic among the growing list of drugs and regulated products. The National Agency for Food, Drugs Administration and Control (NAFDAC) is responsible for making drugs and other regulated products safe for use. This it does by ensuring due registration of food and drugs manufacturing industries.

NAFDAC undertake registration of food, drugs, medical devices, cosmetics, agrochemicals and other similar products in Nigeria. At the end of the registration process, a NAFDAC registration number is given to the product and a registration certificate is issued to the applicant.

NAFDAC registration number is a unique number assigned to a particular product. This effectively grants the holder of the number marketing authorization. This number when assigned to a product gives consumer confidence in the quality of the product since NAFDAC registration number is the major means consumer can differentiate a registered regulated product from a counterfeit. The registration number is maintained by the product as long as the registration is renewed on expiration. The full product registration usually remains valid for five years.

It has been estimated that up to 15% of all drugs sold are fake, and in parts of Africa and Asia this figure exceeds 50% (WHO, 1998 & Newton, 2002).

Aliyu (2008) stated that NAFDAC has once again advised members of the public to be vigilant and ensure that genuine regulated products as certified by the agency are purchased for consumption.

Babatunde (2008) revealed that majority of consumers in Ado-Ekiti do not check information on products before purchase and consumption. Although Odili et al (2006) reported that majority of community pharmacists in Lagos check for NAFDAC registration number.

2.3 Overview of pharmacovigilance in Nigeria

The Nigeria National Drug Policy recognizes that no active drug is entirely free from adverse reactions (Federal Ministry of Health, 2006). The policy states that government will encourage the establishment of adequately equipped pharmacovigilance units nationwide to collect evaluate and disseminate relevant information on ADRs and poisoning. The policy requires that all drugs should be monitored with respect to efficacy, safety and quality so as to inform regulatory decision. The National Pharmacovigilance Center was opened in 2004 and is affiliated to the WHO Collaborating Center for International Drug Monitoring.

The NPC is an integral part of the National Agency for Food and Drug Administration and Control (NAFDAC). The regulatory authority also constituted the National Drug Safety Advisory Committee on 26th July, 2006 (NAFDAC, 2007). The committee tasks include making recommendations to NAFDAC on safety, quality, and efficacy issues of registered drugs and assessing safety issues related to drug use. The NPC developed a guideline for the monitoring of safety of medicines in Nigeria which set out clear objectives including:

1. Raise awareness on the magnitude of drug safety problems
2. Convince health professionals that reporting of Adverse Drug Reactions (ADRs) is their professional and moral obligation.
3. Aid health professionals in becoming vigilant in the detection and reporting of ADRs and other induced problems.

2.4 ADRs reporting guideline in Nigeria

According to National Agency for Food and Drug Administration and Control (NAFDAC) all healthcare professionals including doctors, dentists, pharmacist, nurses, traditional practitioners and other healthcare professionals are requested to report all suspected adverse reaction to drugs including western medicines vaccines, X-rays, contrast media, medical devices, cosmetics, traditional and herbal medicines. It is important to report an ADR to the National Pharmacovigilance Center in NAFDAC even if there is uncertainty that the medicine is definitely responsible for causing the reaction.

Also patients are requested to report an adverse reaction to a health professional so that the ADRs reporting form can be filled.

The following are some basic principles of efficient reporting:

1. Timeliness of reporting:

The event (adverse effect) should be reported soon after it occurs. A recent event is easier to report upon and is more likely to be accurate. The report should be sent to the NPC preferably within one week.

2. Integrity/Reliability of suspect judgment:

If any supplementary data is obtained by the healthcare professionals from the patients; that is if the patients develops the reaction again, or if something happens which increases suspicion. The supplementary note should be sent to the NPC.

3. Completeness/Eligibility of report:

Only report with some minimal standards of adequacy of information should be submitted to the NPC.

Four pieces of information constitute the minimal standards;

- i. An identifiable source of information
- ii. An identifiable patients
- iii. An identifiable drug
- iv. An identifiable suspect reaction

If any of these essential elements is missing, then such a report is unreliable and may not be useful.

ADRs report should be written on the ADR reporting form provided by the national center. This form can be accessed on the NPC homepage on NAFDAC website; it can also be obtained by contacting the National Center in Abuja, Nigeria or all NAFDAC state offices, tertiary and secondary health institutions and health offices of all local government areas nationwide.

2.5 Global overview of pharmacovigilance awareness

The number of ADRs reported to Vigiflow online pharmacovigilance database (the World Health Organization global database for ADRs reports) has been less than 25 in countries like Congo, Cyprus and Uzbekistan (Uppsala, 2006)

In Malaysia, majority of the Pharmacists are not aware about pharmacovigilance activities by the drug authorities in Malaysia (Elkalmi et al, 2009). Also about half of Physicians are not aware of the existence of the National Reporting Programme in Malaysia (Aziz et al, 2007). Most of the community pharmacists in Turkey have no knowledge about pharmacovigilance (Hale et al, 2008) but an average number of the Midwives/Nurses are aware of Pharmacovigilance in Turkey (Alan et al, 2012).

In 2013, the National Pharmacovigilance Center in Saudi Arabia reported that there was under reporting of ADRs and one of the main reasons was lack of awareness of pharmacovigilance

issues. Also in Nepal, knowledge, attitude and practice on pharmacovigilance was low among healthcare professionals (Subish et al, 2008)

In United Arab Emirate, John et al reported that 49.5% of the nurses surveyed were aware of the 'Pharmacovigilance Centers'. In Iran, there is a good knowledge of Iranian pharmacovigilance center among the Pharmacists (Ghazal et al, 2009). Xu H et al, 2009 reported a poor knowledge of Pharmacovigilance among healthcare professionals in China while larger percentage of the resident doctors were aware of pharmacovigilance and the National Pharmacovigilance Programme in India (Pimpalkhute et al, 2012 and Hardcey et al, 2011).

Elnor et al, 2012 reported that there is low awareness about ADRs and pharmacovigilance among healthcare professionals in Sudan. In Senegal, Diouf et al (2013) reported that almost 90% of dentists are not aware of the existing pharmacovigilance system. Overall knowledge and practice of pharmacovigilance in Nigeria was still below average (Osakwe et al, 2013).

2.6 Awareness and Pharmacovigilance practice in Nigeria.

In the southwest region of Nigeria, more than 50% of the healthcare professionals are aware of pharmacovigilance although the practice of pharmacovigilance is really poor in this region.

In Lagos state, a significant number of healthcare professionals have heard about pharmacovigilance and could define it correctly (Kazeem et al, 2012 & Awodele et al, 2011 & Oreagba et al, 2013). However only very few of the healthcare workers in the state who observed adverse drug reactions do actually report it to the National Pharmacovigilance Center (Ohaju-Obodo et al, 2009, Awodele et al, 2011 and Oreagba et al, 2013). In Oyo State, there is a good awareness among medical doctors on the National Pharmacovigilance but the practice of Pharmacovigilance is very poor, similar to that of Lagos State very few doctors who observed

issues. Also in Nepal, knowledge, attitude and practice on pharmacovigilance was low among healthcare professionals (Subish et al, 2008)

In United Arab Emirate, John et al reported that 49.5% of the nurses surveyed were aware of the Pharmacovigilance Centers'. In Iran, there is a good knowledge of Iranian pharmacovigilance center among the Pharmacists (Ghazal et al, 2009). Xu H et al, 2009 reported a poor knowledge of Pharmacovigilance among healthcare professionals in China while larger percentage of the resident doctors were aware of pharmacovigilance and the National Pharmacovigilance Programme in India (Pimpalkhute et al, 2012 and Hardeep et al, 2011).

Elnor et al, 2012 reported that there is low awareness about ADRs and pharmacovigilance among healthcare professionals in Sudan. In Senegal, Diouf et al (2013) reported that almost 90% of dentists are not aware of the existing pharmacovigilance system. Overall knowledge and practice of pharmacovigilance in Nigeria was still below average (Osakwe et al, 2013).

2.6 Awareness and Pharmacovigilance practice in Nigeria.

In the southwest region of Nigeria, more than 50% of the healthcare professionals are aware of pharmacovigilance although the practice of pharmacovigilance is really poor in this region.

In Lagos state, a significant number of healthcare professionals have heard about pharmacovigilance and could define it correctly (Kazeem et al, 2012 & Awodele et al, 2011 & Oreagba et al, 2013). However only very few of the healthcare workers in the state who observed adverse drug reactions do actually report it to the National Pharmacovigilance Center (Ohaju-Obido et al, 2009, Awodele et al, 2011 and Oreagha et al, 2013). In Oyo State, there is a good awareness among medical doctors on the National Pharmacovigilance but the practice of Pharmacovigilance is very poor: similar to that of Lagos State very few doctors who observed

ADRs do report them to the National Pharmacovigilance Center (Adedeji et al, 2013 and Okezie et al, 2013)

The awareness of pharmacovigilance among healthcare professionals is low in Edo State, South-Eastern part of Nigeria. Most of the healthcare professionals have inadequate knowledge of Pharmacovigilance and are also aware of the yellow forms for ADRs reporting which was distributed by the National Agency for Food and Drug Administration and Control. This results in a poor practice of pharmacovigilance in the State (Ohaju-Obodo et al, 2009).

In the North-Western Nigeria, the awareness of pharmacovigilance in Sokoto State is relatively higher among the healthcare professionals compare to the hospital patients (Chinenye et al, 2012) but very few clinicians are aware of the ADRs reporting Programme (Bello et al, 2011). Also only few of the health worker reported potential 1 ADRs. Likewise in Kano State, the awareness of pharmacovigilance is quite low (Fadare et al, 2011).

2.7 Factors affecting pharmacovigilance awareness among healthcare professionals

The type of institution a healthcare professional attends and their years of experience were found to be associated with the awareness of Pharmacovigilance (Ohaju-Obodo et al, 2009). Also, regions, facility type, profession, educational level and professional cadre are some other factors that affect the awareness of Pharmacovigilance (Xu H et al, 2009). Madhan et al 2011 suggested that poor awareness of pharmacovigilance may be due to less emphasis that is given to this program and inadequate measure for raising awareness on pharmacovigilance.

2.8 Challenges of ADRs reporting in Nigeria

A challenge in ADR is under-reporting even though this is a worldwide phenomenon (Wiholm et al. 1994). ADRs are much more under-reported in Nigeria (Oshikoya et al, 2007), one of the reasons for under-reporting might be a poor understanding of the existing pharmacovigilance Programme by the healthcare professionals.

In Nigeria, lack of knowledge of professionals on pharmacovigilance activities (Oreagba et al, 2011), lack of knowledge on the availability of the yellow reporting forms and ignorance of the reporting procedure are the commonest challenge of ADRs reporting in Nigeria (Okezie et al, 2008, Oshikoya and Awobusuyi 2009, Ohaju-Obodo 2010).

Other challenges of ADRs reporting include, general belief that only serious ADRs should be reported uncertainty about the causal link between the drug and the ADRs and a mistaken belief that only safe drugs are marketed. ADRs reporting for traditional and herbal medicines are not seriously done in Nigeria because most of the herbal drugs do not pass through clinical studies to determine the efficacy and toxicity level of the drugs.

2.9 Community member's awareness about ADRs reporting

In an increasing number of countries (Australia, Canada, Denmark, the Netherlands, Sweden, the UK and United States) consumers are being encouraged to report adverse reactions to medicines to a spontaneous reporting programme and organizations. Very few findings have been documented on the awareness of community members on ADRs reporting.

In UK, the first survey on the awareness of yellow reporting card scheme for reporting adverse drug reactions in the general population indicates that the awareness is quite low (Fortnum et al, 2012) Likewise in Australia, the awareness of the available ADRs reporting programme is low

among the consumers (Robertson et al, 2013). There are no documented findings on community member's awareness about ADRs reporting in Nigeria.

UNIVERSITY OF IBADAN LIBRARY

CHAPTER THREE

3.1 Study setting

Nigeria is a federal constitutional republic with 36 states including the Federal Capital Territory, Abuja. The country is located in West Africa and shares borders with Republic of Benin in the West, Chad and Cameroon in the East and Niger in the North. Nigeria is the most populated country in Sub-Saharan Africa and has a land area of 923768 square kilometers. Based on the 2006 National Population Census figure, Nigeria's population was 140431790 (FRN Official Gazette, 2009).

3.2 Study design

This study was a secondary analysis of data collected in the 2012 National HIV & AIDS and Reproductive Health and Serological Survey (NARHS Plus).

3.3 Sampling technique and Sample size

The survey covered all the 36 states of Nigeria and female aged 15-49 years and males 15-64 years were selected through a multi-stage probability sampling method.

- ✓ Stage 1 involved the selection of rural and urban localities.
- ✓ Stage 2 involved the selection of Enumeration Areas (EA) within the selected rural and urban localities.
- ✓ Stage 3 involved the listing and selection of households within the selected Enumeration Areas (EA).
- ✓ Stage 4 involved selection of individual respondents for interview and testing.

The total number of individuals selected for final interview was 31,235.

3.4 Data collection tool

The data collection tool for the NARHS survey was a structured and semi-structured questionnaire. The sections and themes covered by the questionnaire include: characteristics of the household and survey population, sexual behaviour, knowledge, opinion and attitudes about HIV and AIDS knowledge, opinion and attitudes about HIV and AIDS, condom promotion, knowledge, access and use during sexual activity, stigma and discrimination against people living with HIV & AIDS, regulatory activities about food and drug, family planning, maternal and child health, other health issues, communications for behaviour change, malaria.

The sections of the questionnaire that was used for this study are characteristics of household and survey population and regulatory activities about food and drug.

3.5 Variables of Interest

The dependent variables for this study are awareness of NAFDAC, awareness of Nigerian pharmacovigilance programme (awareness of any government programme asking people to report adverse reactions to drugs/food products in Nigeria), checking of NAFDAC registration number on drugs/food product before purchasing it. Awareness of NAFDAC, awareness of Nigerian pharmacovigilance programme, checking of NAFDAC registration number on drugs/food products before buying it was measured by a dichotomous categorical variable coded 1 as "Yes" and 0 as "No".

The individual-level factors that were considered for this study are sex, age group, marital status, religion, occupation, educational level, seen heard of any NAFDAC programme (advert) on what people should do when they experience adverse reactions to drug/food products, how often

individual listen to radio and how often individual watch television. The community-level factors are location and geo-political zone.

3.6 Data Management and Data Analysis

Data was analyzed using STATA version 12. Descriptive statistics (Number and proportions) was used to summarize the dependent variables and explanatory variables. Bivariate analysis was done to determine the relationship between individual-level factors and community-level factors on the awareness of NAFDAC, checking of NAFDAC registration number on drugs/food products before purchasing it and awareness of Nigerian Pharmacovigilance programme.

In the 2012 NARHS data, 31235 Individuals (level 1) are nested within 1076 Clusters (level 2) and Clusters are nested within the 37 States (level 3). In order to examine the individual-level and community-level factors associated with the dependent variables, the hierarchical structure of the data cannot be overlooked. Hence a Multilevel binary logistic regression was used to assess the role of measured individual and community (Cluster) factors on the dependent variables.

The structure of nested data makes the use of traditional regression methods inappropriate because some of the assumptions in traditional regression methods are violated. Some of these assumptions include the assumption of independence among individuals within the same group and the assumption of equal variance across groups (Guo G & Zhao, 2000).

A multilevel model provides a convenient framework that encourages a systematic analysis of how covariates measured at various levels of a hierarchical structure affect the dependent variable and how the interactions among covariates measured at different levels affect the outcome variable. Therefore, multilevel modeling corrects for the biases in parameter estimates

resulting from clustering. Likewise, multilevel modeling provides correct standard errors, confidence intervals and significance tests.

In this study, three-level random intercept model that assessed the predictive values of measured individual and community-level factors for each dependent variable was estimated using the *gllamm* command in Stata (Rabe-Hesketh, 2002).

Two models were estimated: an empty model that contains no covariates and a full random intercept model that included fixed effects at the individual and community levels with community and state-level random effects. The empty model was used to verify if the magnitude of random effects at the community level and state level justifies assessing random effects at that level.

3.6.1 Intercept Only Multilevel Logistic Model

A simple model with no predictors i.e. an intercept-only model was estimated for each dependent variable.

The functional form of the model is

$$\ln \left\{ \frac{P_{ijk}}{1-P_{ijk}} \right\} = \beta_{0jk} = \gamma_{000} + v_{0jk} + \mu_{0jk}$$

Where:

P_{ijk} denotes the response probability $\Pr(Y_{ijk}=1)$ for the i^{th} individual from the j^{th} community in the k^{th} state.

γ_{000} is the intercept of the model

μ_{0jk} is the community-level random effects intercept

v_{0jk} is the state-level random effects intercept

μ_{0jk} and v_{0jk} are normally distributed with mean 0 and variance σ_{μ}^2 and σ_v^2 respectively.

3.6.2 Intra-Class Correlation (ICC) and Akaike's Information Criterion (AIC).

Intra-class correlation was estimated to measure the amount of dependency that was observable due to the clustering of the data. It was also used to determine the proportion of the total variance in outcome that was accounted for by the clustering. It can also be interpreted as the correlation among observations within the same community.

$$\text{ICC for individuals within community} = \frac{\sigma_u^2 + \sigma_v^2}{\sigma_u^2 + \sigma_v^2 + \sigma_e^2}$$

$$\text{ICC for individuals within state} = \frac{\sigma_v^2}{\sigma_u^2 + \sigma_v^2 + \sigma_e^2}$$

Where

σ_u^2 is the component of variance between states, σ_v^2 is the variance between communities within states, and σ_e^2 associated with individuals within communities and states.

For the individual level logistic model, $\sigma_v^2 = \frac{\pi^2}{3}$

Akaike's Information Criterion (AIC) was used to compare models. The model with the least AIC was selected as the final full model for each outcome variables. The smaller the value of AIC, the better the model.

$$\text{AIC} = -2\log L + \alpha q$$

Where

q = number of parameters

α = predetermined constant whose value is between 2 & 8.

3.6.3 three-level random intercept binary logistic model

A three-level random intercept binary logistics model was fitted for each of the dependent variable.

three-level random intercept binary logistic model for the factors affecting the awareness of NAFDAC.

For the individual-level:

The variables that was considered as individual-level factors are; age group (X_{1ijk}), sex (X_{2ijk}), occupation (X_{3ijk}), marital status (X_{4ijk}), educational level (X_{5ijk}), Religion (X_{6ijk}), how often an individual watch television (X_{7ijk}) and how often an individual listen to music (X_{8ijk}).

$$\ln\left\{\frac{P_{ijk}}{1-P_{ijk}}\right\} = \beta_{0jk} + \beta_{1jk}X_{1ijk} + \beta_{2jk}X_{2ijk} + \beta_{3jk}X_{3ijk} + \beta_{4jk}X_{4ijk} + \beta_{5jk}X_{5ijk} + \beta_{6jk}X_{6ijk} + \beta_{7jk}X_{7ijk} + \beta_{8jk}X_{8ijk}$$

For community-level:

The variables that were considered as a community-level factors are location (X_{9jk}) and geo-political zone (X_{10jk})

$$\beta_{0jk} = \gamma_{00k} + \gamma_{01k}X_{9jk} + \gamma_{02k}X_{10jk} + \mu_{0jk}$$

$$\beta_{1jk} = \gamma_{10k}$$

$$\beta_{2jk} = \gamma_{20k}$$

$$\beta_{3jk} = \gamma_{30k}$$

$$\beta_{4jk} = \gamma_{40k}$$

$$\beta_{5jk} = \gamma_{50k}$$

$$\beta_{6jk} = \gamma_{60k}$$

$$\beta_{7jk} = \gamma_{70k}$$

$$\beta_{8jk} = \gamma_{80k}$$

3.6.3 three-level random intercept binary logistic model

A three-level random intercept binary logistics model was fitted for each of the dependent variable.

three-level random intercept binary logistic model for the factors affecting the awareness of NAFDAC.

For the individual-level:

The variables that was considered as individual-level factors are; age group (X_{1ijk}), sex (X_{2ijk}), occupation (X_{3ijk}), marital status (X_{4ijk}), educational level (X_{5ijk}), Religion (X_{6ijk}), how often an individual watch television (X_{7ijk}) and how often an individual listen to music (X_{8ijk}).

$$\ln\left\{\frac{P_{ijk}}{1-P_{ijk}}\right\} = \beta_{0jk} + \beta_{1jk}X_{1ijk} + \beta_{2jk}X_{2ijk} + \beta_{3jk}X_{3ijk} + \beta_{4jk}X_{4ijk} + \beta_{5jk}X_{5ijk} + \beta_{6jk}X_{6ijk} + \beta_{7jk}X_{7ijk} + \beta_{8jk}X_{8ijk}$$

For community-level:

The variables that were considered as a community-level factors are location (X_{9jk}) and geo-political zone (X_{10jk})

$$\beta_{0jk} = \gamma_{00k} + \gamma_{01k}X_{9jk} + \gamma_{02k}X_{10jk} + \mu_{0jk}$$

$$\beta_{1jk} = \gamma_{10k}$$

$$\beta_{2jk} = \gamma_{20k}$$

$$\beta_{3jk} = \gamma_{30k}$$

$$\beta_{4jk} = \gamma_{40k}$$

$$\beta_{5jk} = \gamma_{50k}$$

$$\beta_{6jk} = \gamma_{60k}$$

$$\beta_{7jk} = \gamma_{70k}$$

$$\beta_{8jk} = \gamma_{80k}$$

3.6.3 three-level random intercept binary logistic model

A three-level random intercept binary logistics model was fitted for each of the dependent variable.

three-level random intercept binary logistic model for the factors affecting the awareness of NAFDAC.

For the individual-level:

The variables that was considered as individual-level factors are; age group (X_{1ijk}), sex (X_{2ijk}), occupation (X_{3ijk}), marital status (X_{4ijk}), educational level (X_{5ijk}), Religion (X_{6ijk}), how often an individual watch television (X_{7ijk}) and how often an individual listen to music (X_{8ijk}).

$$\ln\left\{\frac{P_{ijk}}{1-P_{ijk}}\right\} = \beta_{0jk} + \beta_{1jk}X_{1ijk} + \beta_{2jk}X_{2ijk} + \beta_{3jk}X_{3ijk} + \beta_{4jk}X_{4ijk} + \beta_{5jk}X_{5ijk} + \beta_{6jk}X_{6ijk} + \beta_{7jk}X_{7ijk} + \beta_{8jk}X_{8ijk}$$

For community-level:

The variables that were considered as a community-level factors are location (X_{9jk}) and geo-political zone (X_{10jk})

$$\beta_{0jk} = \gamma_{00k} + \gamma_{01k}X_{9jk} + \gamma_{02k}X_{10jk} + \mu_{0jk}$$

$$\beta_{1jk} = \gamma_{10k}$$

$$\beta_{2jk} = \gamma_{20k}$$

$$\beta_{3jk} = \gamma_{30k}$$

$$\beta_{4jk} = \gamma_{40k}$$

$$\beta_{5jk} = \gamma_{50k}$$

$$\beta_{6jk} = \gamma_{60k}$$

$$\beta_{7jk} = \gamma_{70k}$$

$$\beta_{8jk} = \gamma_{80k}$$

At the state-level:

No state-level factor was considered.

$$\gamma_{00k} = \lambda_{000} + v_{0k}$$

$$\gamma_{01k} = \lambda_{010}$$

$$\gamma_{02k} = \lambda_{020}$$

$$\gamma_{10k} = \lambda_{100}$$

$$\gamma_{20k} = \lambda_{200}$$

$$\gamma_{30k} = \lambda_{300}$$

$$\gamma_{40k} = \lambda_{400}$$

$$\gamma_{50k} = \lambda_{500}$$

$$\gamma_{60k} = \lambda_{600}$$

$$\gamma_{70k} = \lambda_{700}$$

$$\gamma_{80k} = \lambda_{800}$$

Hence, the combined three-level random intercept binary logistic model was;

$$\ln\left\{\frac{P_{ijk}}{1-P_{ijk}}\right\} = \lambda_{000} + \lambda_{100}X_{1ijk} + \lambda_{200}X_{2ijk} + \lambda_{300}X_{3ijk} + \lambda_{400}X_{4ijk} + \lambda_{500}X_{5ijk} + \lambda_{600}X_{6ijk} + \lambda_{700}X_{7ijk} + \lambda_{800}X_{8ijk} + \lambda_{010}X_{9jk} + \lambda_{020}X_{10jk} + \mu_{0jk} + v_{0k}$$

Where λ_{000} is the overall intercept, λ_{010} and λ_{020} are the coefficients for community-level factors,

$\lambda_{100} \dots \lambda_{800}$ are the coefficient for individual-level factors.

Three-level random intercept binary logistic model for the factors affecting awareness of Nigerian pharmacovigilance programme

For the individual-level:

The variables that was considered as individual-level factors are; age group (X_{1ijk}), sex (X_{2ijk}), occupation (X_{3ijk}), marital status (X_{4ijk}), educational level (X_{5ijk}), Religion (X_{6ijk}), how often an individual watch television (X_{7ijk}) and how often an individual listen to music (X_{8ijk}) and seen/heard of any NAFDAC programme (advert) on what people should do when they experience adverse reactions to drug/food products (X_{9ijk}).

$$\ln\left\{\frac{P_{ijk}}{1-P_{ijk}}\right\} = \beta_{0jk} + \beta_{1jk}X_{1ijk} + \beta_{2jk}X_{2ijk} + \beta_{3jk}X_{3ijk} + \beta_{4jk}X_{4ijk} + \beta_{5jk}X_{5ijk} + \beta_{6jk}X_{6ijk} + \beta_{7jk}X_{7ijk} + \beta_{8jk}X_{8ijk} + \beta_{9jk}X_{9ijk}$$

For community-level:

The variables that were considered as a community level factors are location (X_{10jk}) and geo-political zone (X_{11jk})

$$\beta_{0jk} = \gamma_{00k} + \gamma_{01k}X_{10jk} + \gamma_{02k}X_{11jk} + \mu_{0jk}$$

$$\beta_{1jk} = \gamma_{10k}$$

$$\beta_{2jk} = \gamma_{20k}$$

$$\beta_{3jk} = \gamma_{30k}$$

$$\beta_{4jk} = \gamma_{40k}$$

$$\beta_{5jk} = \gamma_{50k}$$

$$\beta_{6jk} = \gamma_{60k}$$

$$\beta_{7jk} = \gamma_{70k}$$

$$\beta_{8jk} = \gamma_{80k}$$

$$\beta_{9jk} = \gamma_{90k}$$

At the state-level:

No state-level factor was considered.

$$\gamma_{00k} = \lambda_{000} + v_{0k}$$

$$\gamma_{01k} = \lambda_{010}$$

$$\gamma_{02k} = \lambda_{020}$$

$$\gamma_{10k} = \lambda_{100}$$

$$\gamma_{20k} = \lambda_{200}$$

$$\gamma_{30k} = \lambda_{300}$$

$$\gamma_{40k} = \lambda_{400}$$

$$\gamma_{50k} = \lambda_{500}$$

$$\gamma_{60k} = \lambda_{600}$$

$$\gamma_{70k} = \lambda_{700}$$

$$\gamma_{80k} = \lambda_{800}$$

$$\gamma_{90k} = \lambda_{900}$$

Hence, the combined three-level random intercept multilevel binary logistic model will give:

$$\ln\left\{\frac{P_{ijk}}{1-P_{ijk}}\right\} = \lambda_{000} + \lambda_{100}X_{1ijk} + \lambda_{200}X_{2ijk} + \lambda_{300}X_{3ijk} + \lambda_{400}X_{4ijk} + \lambda_{500}X_{5ijk} + \lambda_{600}X_{6ijk} + \lambda_{700}X_{7ijk} + \lambda_{800}X_{8ijk} + \lambda_{900}X_{9ijk} + \lambda_{010}X_{10jk} + \lambda_{020}X_{11jk} + \mu_{0jk} + v_{0k}$$

Where λ_{000} is the overall intercept, λ_{010} and λ_{020} are the coefficient for community-level factors.

$\lambda_{100}, \dots, \lambda_{900}$ are the coefficient for individual-level factors.

At the state-level:

No state-level factor was considered.

$$\gamma_{00k} = \lambda_{000} + v_{0k}$$

$$\gamma_{01k} = \lambda_{010}$$

$$\gamma_{02k} = \lambda_{020}$$

$$\gamma_{10k} = \lambda_{100}$$

$$\gamma_{20k} = \lambda_{200}$$

$$\gamma_{30k} = \lambda_{300}$$

$$\gamma_{40k} = \lambda_{400}$$

$$\gamma_{50k} = \lambda_{500}$$

$$\gamma_{60k} = \lambda_{600}$$

$$\gamma_{70k} = \lambda_{700}$$

$$\gamma_{80k} = \lambda_{800}$$

$$\gamma_{90k} = \lambda_{900}$$

Hence, the combined three-level random intercept multilevel binary logistic model will give;

$$\ln \left\{ \frac{P_{ijk}}{1 - P_{ijk}} \right\} = \lambda_{000} + \lambda_{100}X_{1ijk} + \lambda_{200}X_{2ijk} + \lambda_{300}X_{3ijk} + \lambda_{400}X_{4ijk} + \lambda_{500}X_{5ijk} + \lambda_{600}X_{6ijk} + \lambda_{700}X_{7ijk} + \lambda_{800}X_{8ijk} + \lambda_{900}X_{9ijk} + \lambda_{010}X_{10jk} + \lambda_{020}X_{11jk} + \mu_{0jk} + v_{0k}$$

Where λ_{000} is the overall intercept, λ_{010} and λ_{020} are the coefficient for community-level factors.

$\lambda_{100}, \dots, \lambda_{900}$ are the coefficient for individual-level factors.

Three-level random intercept binary logistic model for the factors affecting checking for NAFDAC registration number on drugs/food products before purchase.

For the individual-level:

The variables that was considered as individual-level factors are; age group (X_{1ijk}), sex (X_{2ijk}), occupation (X_{3ijk}), marital status (X_{4ijk}), educational level (X_{5ijk}), Religion (X_{6ijk}), how often an individual watch television (X_{7ijk}) and how often an individual listen to music (X_{8ijk}).

$$\ln\left\{\frac{P_{ijk}}{1-P_{ijk}}\right\} = \beta_{0jk} + \beta_{1jk}X_{1ijk} + \beta_{2jk}X_{2ijk} + \beta_{3jk}X_{3ijk} + \beta_{4jk}X_{4ijk} + \beta_{5jk}X_{5ijk} + \beta_{6jk}X_{6ijk} + \beta_{7jk}X_{7ijk} + \beta_{8jk}X_{8ijk}$$

For community-level:

The variables that were considered as a community-level factors are location (X_{9jk}) and geo-political zone (X_{10jk})

$$\beta_{0jk} = \gamma_{00k} + \gamma_{01k}X_{9jk} + \gamma_{02k}X_{10jk} + \mu_{0jk}$$

$$\beta_{1jk} = \gamma_{10k}$$

$$\beta_{2jk} = \gamma_{20k}$$

$$\beta_{3jk} = \gamma_{30k}$$

$$\beta_{4jk} = \gamma_{40k}$$

$$\beta_{5jk} = \gamma_{50k}$$

$$\beta_{6jk} = \gamma_{60k}$$

$$\beta_{7jk} = \gamma_{70k}$$

$$\beta_{8jk} = \gamma_{80k}$$

At the state-level:

No state-level factor was considered.

$$\gamma_{00k} = \gamma_{000} + v_{0k}$$

$$\gamma_{01k} = \lambda_{010}$$

$$\gamma_{02k} = \lambda_{020}$$

$$\gamma_{10k} = \lambda_{100}$$

$$\gamma_{20k} = \lambda_{200}$$

$$\gamma_{30k} = \lambda_{300}$$

$$\gamma_{40k} = \lambda_{400}$$

$$\gamma_{50k} = \lambda_{500}$$

$$\gamma_{60k} = \lambda_{600}$$

$$\gamma_{70k} = \lambda_{700}$$

$$\gamma_{80k} = \lambda_{800}$$

Hence, the combined three-level random intercept binary logistic model was;

$$\ln\left\{\frac{P_{ijk}}{1-P_{ijk}}\right\} = \lambda_{000} + \lambda_{100}X_{1ijk} + \lambda_{200}X_{2ijk} + \lambda_{300}X_{3ijk} + \lambda_{400}X_{4ijk} + \lambda_{500}X_{5ijk} + \lambda_{600}X_{6ijk} + \lambda_{700}X_{7ijk} + \lambda_{800}X_{8ijk} + \lambda_{010}X_{9jk} + \lambda_{020}X_{10jk} + \mu_{0jk} + v_{0k}$$

Where λ_{000} is the overall intercept, λ_{010} and λ_{020} are the coefficients for community-level factors,

$\lambda_{100} \dots \lambda_{800}$ are the coefficient for individual-level factors.

CHAPTER FOUR

RESULT

4.1 Descriptive analysis

Females constituted 50.1% of the total sample with 68.7% residing in rural areas. The mean age of the respondents was 31.45 years (S.D=11.8). Half (50.8%) of the respondents were aware of NAFDAC while about one-third (36.5%) check for NAFDAC registration number before buying drugs/food products. One-fourth (26.0%) of the respondents was aware of Nigerian pharmacovigilance programme. Also, 39.0% of the respondents had secondary education while only 12.3% had higher education (Table 1).

Table 1 Descriptive statistics of the study variables

Dependent variables	Yes		No		Total
	N	%	N	%	
Are you aware of a Government Agency called NAFDAC	15639	50.8	15148	49.2	30787
Do you check for NAFDAC registration number before buying drug/food product	11248	36.5	19546	63.5	30794
Are you aware of any government prog. asking people to report adverse reactions to drugs/food products in Nigeria	7994	26.0	22801	74.0	30795

CHAPTER FOUR

RESULT

4.1 Descriptive analysis

Females constituted 50.1% of the total sample with 68.7% residing in rural areas. The mean age of the respondents was 31.45 years (S.D=11.8). Half (50.8%) of the respondents were aware of NAFDAC while about one-third (36.5%) check for NAFDAC registration number before buying drugs/food products. One-fourth (26.0%) of the respondents was aware of Nigerian pharmacovigilance programme. Also, 39.0% of the respondents had secondary education while only 12.3% had higher education (Table 1).

Table 1 Descriptive statistics of the study variables

Dependent variables	Yes		No		Total
	N	%	N	%	
Are you aware of a Government Agency called NAFDAC	15639	50.8	15148	49.2	30787
Do you check for NAFDAC registration number before buying drug/food product	11248	36.5	19546	63.5	30794
Are you aware of any government prog. asking people to report adverse reactions to drugs/food products in Nigeria	7994	26.0	22801	74.0	30795

Type of variable	Variable	Number	Frequency
Individual-level variables	Sex		
	Female	15639	50.1
	Male	15596	49.9
	Age group		
	15-19	5243	16.8
	20-24	4848	15.5
	25-29	5000	16.0
	30-34	4336	13.9
	35-39	3457	11.1
	40+	8351	26.7
	Occupation		
	Unemployed/Retired	7112	22.8
	Director/Upper management/other management/Professionals/Specialists/Civil Servant	2090	6.7
	Blue collar skilled & semi skilled/Clerk/Clerical/Self employed	6294	20.2
	Student	5979	19.2
	Unskilled/Informal sector/Agricultural worker	9700	31.1
	Education		
	No formal education	9914	31.8
	Primary	5264	16.9
	Secondary	12172	39.0
	Higher	3835	12.3
	Marital status		
	Never married	9624	31.2
	Currently married/LW sexual partner	19943	64.7
	Separated/Divorced	599	1.9
	Widowed	646	2.1
	Religion		
	No religion	200	0.6
	Islam	134200	43.1
	Christian	17271	55.4
	Traditional	270	0.9
	Have you ever heard/seen any NAFDAC programme (advert) on what people should do when they experience adverse reactions		
	No	2353	76.4
	Yes	7260	23.6
	How often do you listen to radio		
	Not at all	7761	26.4
	Every day/almost every day	8291	28.2
	Atleast once a week	7990	27.2
	Less than a week	5353	18.2

Type of variable	Variable	Number	Frequency
Individual-level variables	Sex		
	Female	15639	50.1
	Male	15596	49.9
	Age group		
	15-19	5243	16.8
	20-24	4848	15.5
	25-29	5000	16.0
	30-34	4336	13.9
	35-39	3457	11.1
	40+	8351	26.7
	Occupation		
	Unemployed/Retired	7112	22.8
	Director/Upper management/other management/Professionals/Specialists/Civil Servant	2090	6.7
	Blue collar skilled & semi skilled/Clerk/Clerical/Self employed	6294	20.2
	Student	5979	19.2
	Unskilled/Informal sector/Agricultural worker	9700	31.1
	Education		
	No formal education	9914	31.8
	Primary	5264	16.9
	Secondary	12172	39.0
	Higher	3835	12.3
	Marital status		
	Never married	9624	31.2
	Currently married/LW sexual partner	19943	64.7
	Separated/Divorced	599	1.9
	Widowed	646	2.1
	Religion		
	No religion	200	0.6
	Islam	134200	43.1
	Christian	17271	55.4
	Traditional	270	0.9
	Have you ever heard/seen any NAFDAC programme (advert) on what people should do when they experience adverse reactions		
	No	2353	76.4
	Yes	7260	23.6
	How often do you listen to radio		
	Not at all	7761	26.4
	Every day/almost every day	8291	28.2
	Atleast once a week	7090	27.2
	Less than a week	5353	18.2

	How often do you watch television		
	Not at all	11464	39.5
	Every day/almost every day	6161	21.2
	At least once a week	6305	21.7
	Less than a week	5102	17.6
Cluster-level variables	Location		
	Rural	21448	68.7
	Urban	9787	31.3
	Zone		
	North Central	6008	19.2
	North East	4875	15.6
	North West	6152	19.7
	South East	4282	13.7
	South South	4939	15.8
	South West	4979	15.9

4.2 Bivariate analysis

4.2.1 Bivariate analysis of the relationship between selected individual and community-level factors and awareness of NAFDAC.

Table 2 shows that 53.4% of the male respondents was aware of NAFDAC and there was significant relationship between sex and awareness of NAFDAC ($P < 0.001$). Also, the proportion of respondents that were aware of NAFDAC increased with educational level: 59.6% of the respondents with higher educational level were aware of NAFDAC while 43.3% of the respondents with no formal education were aware of NAFDAC. The difference in the awareness of NAFDAC across educational level was found to be statistically significant ($P < 0.001$).

Similarly, the proportion of respondents that were aware of NAFDAC increased steadily with respect to how often individual watched television and how often individual listened to radio: 83.0% and 71.1% of respondents who watched television everyday or almost every and listened to radio everyday or almost every day respectively were aware of NAFDAC while only 22.8% and 21.5% of the respondent who do not watch television at all and who do not listen to radio at all respectively were aware of NAFDAC ($P < 0.001$). Furthermore, there was significant

relationship between age group, occupation, religion, marital status and awareness of NAFDAC (table 2).

About 53.3% of the respondents that resided in the urban communities were aware of NAFDAC while 49.7% of the respondents that resided in the rural communities were aware of NAFDAC and this difference was statistically significant ($P < 0.001$). Furthermore, there was significant difference in awareness of NAFDAC across geo-political zones ($P = 0.002$).

Table 2: Bivariate result of awareness of NAFDAC on selected individual and cluster characteristics.

Characteristics	Percentages reporting awareness of NAFDAC		
	Yes	No	P-value
Individual factors			
Sex:			<0.001
Female	48.2	51.8	
Male	53.4	46.6	
Education:			<0.001
No formal education	43.3	56.7	
Primary	45.7	54.3	
Secondary	56.4	43.6	
Higher	59.6	40.4	
Age group:			<0.001
15-19	50.3	49.7	
20-24	49.6	50.4	
25-29	49.6	50.4	
30-34	49.6	50.4	
35-39	50.4	49.6	
40+	53.2	46.8	
Occupation:			<0.001
Unemployed/Retired	43.8	56.2	
Director/Management	54.9	55.1	
Civil servant	54.9	55.1	
Blue collar skilled & Semi skilled/self employed	60.5	39.5	
Student	46.4	53.6	
Unskilled/Agricultural worker			<0.001
Marital status:			
Never married	57.4	42.6	
Currently married/LW sexual	47.8	52.2	

partner			
Separated/Divorced	51.4	48.6	
Widowed	45.8	54.2	
Religion:			
No religion	57.3	42.7	<0.001
Islam	49.3	50.7	
Christian	51.7	48.3	
Traditional	59.5	40.5	
How often do you listen to radio:			
Not at all	21.5	78.5	<0.001
Every day/Almost every day	71.1	28.9	
At least once a week	61.6	38.4	
Less than once a week	49.6	50.4	
How often do you watch television:			
Not at all	22.8	77.2	<0.001
Every day/Almost every day	83.0	17.0	
At least once a week	67.5	32.5	
Less than once a week	56.1	43.9	
Community-level factors			
Location:			
Rural	49.7	50.3	<0.001
Urban	53.3	46.7	
Region:			
North Central	51.7	48.3	0.002
North East	52.7	47.3	
North West	51.1	48.9	
South East	48.8	51.2	
South South	49.9	50.1	
South West	50.1	49.9	

4.2.2 Bivariate analysis of the relationship between selected individual and community-level factors and checking for NAFDAC registration number on drug/food products.

Table 3 shows that the proportion of male respondents and female respondents that check for NAFDAC registration number on drug/food products before buying it were 40.8% and 32.2% respectively ($P < 0.001$).

Also, the proportion of respondents that checked for NAFDAC registration number increased steadily with educational level; 75.4% of the respondents with higher educational level checked

for NAFDAC registration number while only 7.9% of the respondents without formal education checked for NAFDAC registration number. The difference in the checking for NAFDAC registration number across educational level was found to be statistically significant ($P < 0.001$).

Similarly, the proportion of respondents who checked for NAFDAC registration number increased slightly with respect to how often individual listened to radio: 40.6% of respondents who listened to radio everyday or almost every day checked for NAFDAC registration number while 29.9% of the respondent who do not listened to radio at all checked for NAFDAC registration number. Also the difference this proportion was statistically significant ($P < 0.001$).

Furthermore, there was significant relationship between other individual level factors and checking for NAFDAC registration number on drug/food products (table 3).

There were significant difference between urban communities (57.1%) and rural (27.2%) in the proportion of respondent ($P < 0.001$). Also, checking of NAFDAC registration number varied across geo-political zone ($P < 0.001$).

UNIVERSITY OF IBADAN LIBRARY

Table 3: Bivariate result of checking of NAFDAC registration number on drugs/food products on selected individual and cluster characteristics.

Characteristics	Percentages reporting checking of NAFDAC registration number on drugs/food products		
	Yes	No	P-value
Individual factors			
Sex:			<0.001
Female	32.2	67.8	
Male	40.8	59.2	
Education:			<0.001
No formal education	7.9	92.1	
Primary	29.8	70.2	
Secondary	50.5	49.5	
Higher	75.4	24.6	
Age group:			<0.001
15-19	36.9	63.1	
20-24	34.9	65.1	
25-29	33.6	66.4	
30-34	37.9	62.1	
35-39	38.7	61.3	
40+	38.7	61.3	
Occupation:			<0.001
Unemployed/Retired	23.1	76.9	
Director/Management/ Civil servant	68.0	32.0	
Blue collar skilled & Semi skilled/self employed	50.7	49.3	
Student	50.0	50.0	
Unskilled/Agricultural worker	22.1	77.9	
Marital status:			<0.001
Never married	46.2	53.8	
Currently married/LW sexual partner	32.5	67.5	
Separated/Divorced	32.6	67.4	
Widowed	25.2	74.8	
Religion:			<0.001
No religion	40.4	59.6	
Islam	35.1	64.9	
Christian	37.5	62.5	
Traditional	46.3	53.7	
How often do you listen to radio:			<0.001
Not at all	29.9	70.1	
Every day/Almost every day	40.6	59.4	
At least once a week	39.1	60.9	
Less than once a week	36.8	63.2	

Table 3: Bivariate result of checking of NAFDAC registration number on drugs/food products on selected individual and cluster characteristics.

Characteristics	Percentages reporting checking of NAFDAC registration number on drugs/food products		
	Yes	No	P-value
Individual factors			
Sex:			<0.001
Female	32.2	67.8	
Male	40.8	59.2	
Education:			<0.001
No formal education	7.9	92.1	
Primary	29.8	70.2	
Secondary	50.5	49.5	
Higher	75.4	24.6	
Age group:			<0.001
15-19	36.9	63.1	
20-24	34.9	65.1	
25-29	33.6	66.4	
30-34	37.9	62.1	
35-39	38.7	61.3	
40+	38.7	61.3	
Occupation:			<0.001
Unemployed/Retired	23.1	76.9	
Director/Management/	68.0	32.0	
Civil servant	50.7	49.3	
Blue collar skilled& Semi skilled/self employed	50.0	50.0	
Student	22.1	77.9	
Unskilled/Agricultural worker			<0.001
Marital status:			<0.001
Never married	46.2	53.8	
Currently married/LW sexual partner	32.5	67.5	
Separated/Divorced	32.6	67.4	
Widowed	25.2	74.8	
Religion:			<0.001
No religion	40.4	59.6	
Islam	35.1	64.9	
Christian	37.5	62.5	
Traditional	46.3	53.7	
How often do you listen to radio:			<0.001
Not at all	29.9	70.1	
Every day/Almost every day	40.6	59.4	
At least once a week	39.1	60.9	
Less than once a week	36.8	63.2	

How often do you watch television:			
Not at all			<0.001
Every day/Almost every day	33.7	66.3	
At least once a week	36.2	63.8	
Less than once a week	39.6	60.4	
Community-level factors			
Location:			
Rural			<0.001
Urban	27.2	72.8	
	57.1	42.9	
Region:			
North Central			<0.001
North East	26.1	73.9	
North West	28.1	71.9	
South East	46.5	53.5	
South South	49.1	50.9	
South West	46.6	53.4	
	24.7	75.3	

4.1.3 Bivariate analysis of the relationship between selected individual and community-level factors and awareness of Nigerian pharmacovigilance programme.

Table 4 shows that the proportion of male respondents and female respondents reporting awareness of Nigerian pharmacovigilance programme were 28.8% and 23.1% respectively ($P < 0.001$).

Also, the proportion of respondents who reported awareness of Nigerian pharmacovigilance programme increased steadily with educational level; 57.7% of the respondents with higher educational level reported awareness of Nigerian pharmacovigilance programme while only 7.8% of the respondents without formal education reported awareness of Nigerian pharmacovigilance programme. The difference in these proportions was found to be statistically significant ($P < 0.001$).

Similarly, 79.7% of the respondent who have heard/seen any NAFDAC programme (advert) on what people should do when they experience adverse reactions reported awareness of Nigerian pharmacovigilance programme while only 9.4% of the respondents who have not heard/seen any

How often do you watch television:			<0.001
Not at all	33.7	66.3	
Every day/Almost every day	36.2	63.8	
At least once a week	39.6	60.4	
Less than once a week	39.1	60.9	
Community-level factors			<0.001
Location:			
Rural	27.2	72.8	
Urban	57.1	42.9	
Region:			
North Central	26.1	73.9	
North East	28.1	71.9	
North West	46.5	53.5	
South East	49.1	50.9	
South South	46.6	53.4	
South West	24.7	75.3	

4.1.3 Bivariate analysis of the relationship between selected individual and community-level factors and awareness of Nigerian pharmacovigilance programme.

Table 4 shows that the proportion of male respondents and female respondents reporting awareness of Nigerian pharmacovigilance programme were 28.8% and 23.1% respectively ($P < 0.001$).

Also, the proportion of respondents who reported awareness of Nigerian pharmacovigilance programme increased steadily with educational level: 57.7% of the respondents with higher educational level reported awareness of Nigerian pharmacovigilance programme while only 7.8% of the respondents without formal education reported awareness of Nigerian pharmacovigilance programme. The difference in these proportions was found to be statistically significant ($P < 0.001$).

Similarly, 79.7% of the respondent who have heard/seen any NAFDAC programme (advert) on what people should do when they experience adverse reactions reported awareness of Nigerian pharmacovigilance programme while only 9.4% of the respondents who have not heard/seen any

NAFDAC programme (advert) on what people should do when they experience adverse reactions reported awareness of Nigerian pharmacovigilance programme ($P < 0.001$).

Furthermore, there was significant relationship between age group, occupation, religion, marital status, how often an individual listen to radio, how often an individual watch television and checking for NAFDAC registration number on drug/food products (table 4).

A significant higher proportion of urban respondents (39.4%) than rural (19.8%) reported awareness of the Nigerian pharmacovigilance programme.

UNIVERSITY OF IBADAN LIBRARY

Table 4: Bivariate analysis of awareness of Nigerian pharmacovigilance programme according to selected individual and community characteristics.

Characteristics	Percentages reporting awareness of Nigerian pharmacovigilance programme.		
	Yes	No	P-value
Individual factors			
Sex:			<0.001
Female	23.1	76.9	
Male	28.8	71.2	
Education:			<0.001
No formal education	7.8	92.2	
Primary	19.8	81.2	
Secondary	33.3	66.7	
Higher	57.7	42.3	
Age group:			0.023
15-19	25.5	74.5	
20-24	25.0	75.0	
25-29	25.1	74.9	
30-34	26.8	73.2	
35-39	25.5	74.5	
40+	27.1	72.8	
Occupation:			<0.001
Unemployed/Retired	18.0	82.0	
Director/Management/ Civil servant	53.5	46.5	
Blue collar skilled & Semi skilled/self employed	34.6	65.4	
Student	34.6	65.4	
Unskilled/Agricultural worker	15.0	85.0	
Marital status:			<0.001
Never married	31.2	78.8	
Currently married/LW sexual partner	23.7	76.3	
Separated/Divorced	22.8	77.2	
Widowed	19.8	80.2	
Religion:			<0.001
No religion	27.3	72.7	
Islam	24.6	75.4	
Christian	26.9	73.1	
Traditional	35.4	64.6	
Have you ever heard/seen any NAFDAC programme (advert) on what people should do when they			<0.001

experience ARs:			
No	9.4	90.6	
Yes	79.7	20.3	
How often do you listen to radio:			<0.001
Not at all	21.1	79.9	
Every day/Almost every day	27.6	72.4	
At least once a week	28.1	71.9	
Less than once a week	26.6	73.4	
How often do you watch television:			<0.001
Not at all	25.0	75.0	
Every day/Almost every day	24.3	75.7	
At least once a week	27.8	72.2	
Less than once a week	27.5	72.5	
Community-level factors			
Location:			<0.001
Rural	19.8	80.2	
Urban	39.4	60.6	
Region:			< 0.001
North Central	16.5	83.5	
North East	17.1	82.9	
North West	37.4	62.6	
South East	33.7	66.3	
South South	32.6	67.3	
South West	19.0	81.0	

4.3 Multilevel models

The bivariate relationships indicated by the data on Tables 2-4 can be due to interrelationships among the various measured characteristics as well as the unmeasured characteristics at the community and state level. Multilevel modeling was therefore used to determine the predictors of awareness of NAFDAC, checking of NAFDAC registration number and awareness of Nigerian pharmacovigilance programme. In the multilevel models, community and state were considered as random effects.

The modeling started with an empty intercept-only model to test the null hypothesis that community and state-level variance for awareness of NAFDAC, checking of NAFDAC registration number before buying drugs/food products and awareness of Nigerian pharmacovigilance programme was zero and to assess if the data justify the decision to assess random effects at the community and state level.

The results presented in Tables 5-7 shows that there was considerable inter-communities and inter-states heterogeneity for the awareness of NAFDAC, checking of NAFDAC registration number before buying drugs/food products and awareness of Nigerian pharmacovigilance programme.

For example, table 7 shows the community-level variance and state-level variance in the empty model was large and significant pointing to considerable differences in the awareness of Nigerian pharmacovigilance programme across communities and states. The intra-class (ICC) correlation in the empty model for awareness of Nigerian pharmacovigilance programme indicated that 68.6% and 14.7% of the total variance in awareness of Nigerian pharmacovigilance programme was attributable to the dependency of observations within communities and states respectively. This implies that, the awareness of Nigerian

pharmacovigilance programme correlated significantly within community and state (Table 5). Similar results were observed for awareness of NAFDAC and checking of NAFDAC registration number (Table 5 and 6).

Table 5: Random intercept-only model for the awareness of NAFDAC.

Awareness of NAFDAC	Coefficient	Std. Error	P-value	95% Confidence Interval		
Constant	0.045	0.041	0.264	-0.034	0.125	
Standard deviation of Random effects						ICC
Community level	1.911	0.040	0.000	1.832	1.989	0.53
State level	0.183	0.039	0.000	0.106	0.261	0.01
log likelihood = -18616.494			AIC= 37247.988			

However, in table 5 the inter-class correlation coefficient for the state-level was very low (0.5%). This implies that the level of NAFDAC awareness was relatively the same across the states. There was significant variability of NAFDAC awareness across the states ($P < 0.001$). Hence, this justified assessment of random effect at the state-level.

4.3.1 Awareness of NAFDAC

Table 8 shows that, the most significant individual-level predictors of NAFDAC awareness were how often an individual listened to radio and how often an individual watched television. An individual who listen to radio every day was four times (OR= 4.06, 95% C.I= 3.63 - 4.49) more likely to be aware of NAFDAC compared to an individual who do not listened to radio at all. Similarly, an individual who listened to radio at least once a week and less than once a week were three times (OR= 3.35, 95% C.I= 3.104 - 3.686) and twice (OR=2.36, 95% C.I= 2.100 - 2.611) more likely respectively to be aware of NAFDAC compared to an individual who do not listen to radio at all.

Also, an individual who watched television everyday was approximately twelve times (OR= 11.55, 95% C.I= 10.273 - 12.827) more likely to be aware of NAFDAC compared to an individual who do not watch television at all. Furthermore, an individual who watched television at least once a week and less than once a week was approximately five times (OR= 4.77, 95% C.I= 4.320 - 5.220) and three (OR= 3.13, 95% C.I= 2.827 - 3.433) more likely respectively to be aware of NAFDAC compared to an individual who do not watch television at all.

Table 6: Random intercept only model on checking for NAFDAC registration number on drugs/food products before buying it.

Checking for NAFDAC registration number on drugs/food products	Coefficient	Std. Error	P-value	95% Confidence Interval		
Constant	-0.728	0.218	0.001	-1.156	-0.301	
Standard deviation of Random effects						ICC
Community level	1.604	0.039	0.000	1.528	1.681	0.58
State level	1.425	0.163	0.000	1.106	1.745	0.26
log likelihood = -16114.924			AIC= 32238.848			

Also, there was significant association between sex, educational level and awareness of NAFDAC. However, occupation, marital status and religion were not significant individual-level predictor of awareness of NAFDAC.

There was no significant association between location and NAFDAC awareness. An individual who resided in the South West region of Nigeria was approximately 1.5 times (OR= 1.45, 95% C.I= 1.27 - 1.63) more likely to be aware of NAFDAC compared to an individual who reside in the North central region of Nigeria.

Finally, community level random effects was significant ($P < 0.001$); the residual intra-class correlation for the community was still appreciably large (28.3%) indicating that even after controlling for individual level and community level factors there was still considerable clustering of NAFDAC awareness at the community level.

Table 7: Random intercept only model for awareness of Nigerian Pharmacovigilance programme

Awareness of Nigerian Pharmacovigilance programme	Coefficient	Std. Error	P-value	95% Confidence Interval		
Constant	-1.753	0.165	0.000	-2.076	-1.429	
Standard deviation of Random effects						
Community level	2.377	0.058	0.000	2.263	2.491	ICC 0.69
State level	1.245	0.134	0.000	0.982	1.507	0.15
Log-likelihood = -13898.29			AIC = 27805.58			

Table 8: Three-level random intercept model for the factors affecting awareness of NAFDAC

Awareness of NAFDAC	OR	Std. Err.	P-Value	95% Confidence Interval	
Individual-level factors					
**Sex					
Female(ref)	1.00				
Male	1.20	0.049	0.036	1.10	1.29
^μ Aggroup					
15-19 (ref)	1.00				
20-24	0.99	0.058	0.909	0.88	1.10
25-29	0.96	0.056	0.476	0.85	1.07
30-34	0.95	0.061	0.350	0.83	1.07
35-39	0.97	0.062	0.617	0.85	1.09
40+	1.04	0.054	0.433	0.93	1.15
Religion					
No religion (ref)	1.00				
Islam	0.97	0.202	0.869	0.57	1.37
Christian	1.00	0.208	1.000	0.59	1.41
Traditional	1.59	0.444	0.097	0.72	2.46
Occupation					
Unemployed (ref)	1.00				
Director /Management and civil servant	0.93	0.087	0.480	0.80	1.20
Blue collar skilled & Semi and self employed	1.17	0.079	0.018	1.02	1.33
Student	1.17	0.092	0.047	1.00	1.39
Unskilled/ Informal sector and agricultural worker	0.90	0.056	0.088	0.79	1.01
**Educational level					
No form laeducation (ref)	1.00				
Primary	1.21	0.079	0.004	1.06	1.37
Secondary	1.47	0.088	0.000	1.30	1.64
Tertiary	1.76	0.136	0.000	1.49	2.03
Marital					
Never married (ref.)	1.00				
Currently married/LW sexual partner	0.95	0.048	0.353	0.86	1.05
Separated/Divorced	1.05	0.135	0.729	0.79	1.3
Widowed	1.14	0.148	0.314	0.85	1.43

**How often do you watch television					
Not at all (ref)	1.00				
Every day	11.55	0.651	0.000	10.27	12.83
At least once a week	4.77	0.230	0.000	4.32	5.22
Less than once a week	3.13	0.155	0.000	2.83	3.43
**How often do you listen to radio					
Not at all (ref)	1.00				
Every day	4.06	0.220	0.000	3.63	4.49
At least once a week	3.35	0.172	0.000	3.10	3.69
Less than once a week	2.36	0.128	0.000	2.11	2.61
Community-level factor					
Location					
Rural (ref)	1.00				
Urban	0.94	0.039	0.111	0.86	1.012
Region					
North Central (ref)	1.00				
North East	1.28	0.079	0.000	1.13	1.44
North West	0.95	0.055	0.333	0.84	1.06
South East	0.81	0.003	0.001	0.81	0.83
South South	0.90	0.055	0.075	0.79	1.01
South West	1.45	0.091	0.000	1.27	1.63
Random effects component					
Level	Std. Dev.	ICC (%)	P-value	95% Confidence Interval	
Community-level	1.139	28.3	0.000	1.074	1.205
State-level	0.057		0.183	-0.027	0.142
Log-likelihood = -14418.448		AIC = 28872.88			

Note: ** P < 0.05

4.3.2 Checking for NAFDAC registration number on drug/food product before purchase.

Table 9 shows that the most significant individual-level predictor of checking for NAFDAC registration number on drugs/food products before buying it was educational level.

An individual with tertiary educational level was approximately twenty times (OR = 19.67, 95% C.I = 16.19 – 23.15) more likely to check for NAFDAC registration number compare to an individual without formal education

Likewise, a civil servant or a director or an individual in management position was approximately two times (OR= 1.54, 95% C.I = 1.26 – 1.82) more likely to check for NAFDAC registration number compared to an unemployed individual. Also, a blue collar skilled, semi skilled and self employed individual was about 1.6 times (OR= 1.56, 95% C.I = 1.35 – 1.77) more likely to check for NAFDAC registration number compared to an unemployed individual. There was no significant association between age group, marital status, religion, how often an individual watched television and how often an individual listened to radio on checking for NAFDAC registration number on drug/food products.

Those living in urban location were two times (OR= 2.02, 95% C.I= 1.842 – 2.198) more likely to check for NAFDAC registration number on drugs/food products compared to those living in urban location.

Finally, community level and state level random effects are significant; the residual intra-class correlation for the community (35.7%) and state-level (14.7%) were still appreciably large.

Table 9: Three-level random intercept model for factors associated with checking of NAFDAC registration number on drugs/food products.

Checking of NAFDAC registration number	OR	Std. Err.	P-Value	95% Confidence Interval	
<i>Individual-level factors</i>					
**Sex					
Female(ref)	1.00				
Male	1.46	0.066	0.000	1.33	1.59
Age group					
15-19 (ref)	1.00				
20-24	0.96	0.059	0.543	0.85	1.08
25-29	0.92	0.057	0.178	0.81	1.03
30-34	1.05	0.067	0.411	0.92	1.18
35- 39	1.00	0.067	0.986	0.87	1.13
40+	0.95	0.051	0.301	0.85	1.05
Religion					
No religion (ref)	1.00				
Islam	1.09	0.221	0.686	0.66	1.52
Christian	1.15	0.232	0.496	0.70	1.60
Traditional	1.61	0.444	0.085	0.74	2.48
Occupation					
Unemployed (ref)	1.00				
Director /Management and civil servant	1.54	0.142	0.000	1.26	1.82
Blue collar skilled & Semi and self employed	1.56	0.108	0.000	1.35	1.77
Student	1.07	0.084	0.405	0.91	1.24
Unskilled/Informal sector and agricultural worker	0.89	0.062	0.084	0.77	1.01
**Educational level					
No formal education (ref)	1.00				
Primary	2.61	0.200	0.000	2.22	3.00
Secondary	6.84	0.499	0.000	5.86	7.82
Tertiary	19.67	1.776	0.000	16.19	23.15
Marital					
Never married (ref.)	1.00				
Currently married/LW sexual partner	1.07	0.055	0.219	0.96	1.18
Separated/Divorced	0.94	0.127	0.671	0.69	1.10
Widowed	0.82	0.115	0.158	0.60	1.05

How often do you watch television					
Not at all (ref)	1.00				
Every day	0.95	0.054	0.417	0.84	1.06
At least once a week	1.01	0.054	0.782	0.90	1.12
Less than once a week	1.01	0.056	0.798	0.90	1.12
How often do you listen to radio					
Not at all (ref)	1.00				
Every day	0.99	0.056	0.878	0.88	1.10
At least once a week	1.02	0.056	0.785	0.91	1.13
Less than once a week	0.99	0.059	0.811	0.88	1.11
Community-level factor					
**Location					
Rural (ref)	1.00				
Urban	2.02	0.091	0.000	1.84	2.20
Region					
North Central (ref)	1.00				
North East	0.89	0.062	0.097	0.77	1.01
North West	1.62	0.103	0.000	1.42	1.82
South East	1.19	0.084	0.013	1.03	1.37
South South	1.15	0.076	0.038	1.00	1.30
South West	1.14	0.084	0.069	0.98	1.30
Random effects component					
Level	Std. Dev	ICC (%)	P-value	95% Confidence Interval	
Community-level	1.037	35.7	0.000	0.964	1.110
State-level	0.867	14.7	0.000	0.658	1.076
Log-likelihood= -12915.736		AIC= 25864.472			

Note: **P<0.05

4.3.3 Awareness of Nigerian pharmacovigilance programme

Table 10 shows that, an individual who have ever heard/seen any NAFDAC programme (advert) on what people should do when they experience adverse reactions were approximately thirty-three times (OR = 32.85, 95% C.I = 29.133 – 36.567) more likely to be aware of Nigerian pharmacovigilance programme compared to an individual who have not heard/seen the advert.

An individual with tertiary educational level was four times (OR= 4.29, 95% C.I= 3.514 – 5.066) more likely to be aware of Nigerian pharmacovigilance programme compared to an individual without formal education while an individual with secondary and primary education were approximately two times (OR= 2.35, 95% C.I= 2.000 – 2.700) and two times (OR= 1.51, 95% C.I = 1.263 – 1.757) respectively more likely to be aware of Nigeria pharmacovigilance programme compared to an individual without formal education.

However, there was no significant association between sex, age group, religion, and marital status, how often an individual watch television and how often an individual listen to radio on awareness of Nigerian pharmacovigilance programme.

Finally, community level and state level random effects was significant; the residual intra-class correlation for the community (17.03%) and state-level (7.25%) was still appreciably large.

UNIVERSITY OF IBADAN LIBRARY

Table 10: Three-level random intercept model for factors associated with awareness of Nigerian pharmacovigilance programme.

Checking of NAFDAC registration number	OR	Std. Err.	P-Value	95% Confidence Interval	
<i>Individual-level factors</i>					
Sex					
Female(ref)	1.00				
Male	1.09	0.051	0.062	0.99	1.19
Age group					
15-19 (ref)	1.00				
20-24	1.08	0.078	0.309	0.93	1.23
25-29	1.10	0.080	0.174	0.94	1.26
30-34	1.13	0.084	0.097	0.97	1.30
35-39	1.10	0.087	0.251	0.93	1.27
40+	1.09	0.069	0.188	0.95	1.23
Religion					
No religion (ref)	1.00				
Islam	0.98	0.236	0.940	0.52	1.44
Christian	1.12	0.267	0.642	0.60	1.64
Traditional	1.14	0.362	0.691	0.43	1.85
**Occupation					
Unemployed (ref)	1.00				
Director /Management and civil servant	1.52	0.145	0.000	1.24	1.81
Blue collar skilled & Semi and self employed	1.25	0.089	0.002	1.08	1.42
Student	1.23	0.103	0.013	1.03	1.43
Unskilled/Informal sector and agricultural worker	0.96	0.067	0.577	0.83	1.10
**Educational level					
No formal education (ref)	1.00				
Primary	1.51	0.126	0.000	1.26	1.78
Secondary	2.35	0.179	0.000	2.00	2.70
Tertiary	4.29	0.396	0.000	3.51	5.07
Marital					
Never married (ref.)	1.00				
Currently married/LW sexual partner	1.11	0.067	0.078	0.98	1.24
Separated/Divorced	1.00	0.160	0.988	0.69	1.31
Widowed	1.01	0.166	0.930	0.68	1.34

How often do you watch television					
Not at all (ref)	1.00				
Every day	1.01	0.064	0.868	0.123	1.14
At least once a week	0.97	0.059	0.652	0.85	1.09
Less than once a week	1.03	0.066	0.615	0.90	1.16
How often do you listen to radio					
Not at all (ref)	1.00				
Every day	0.99	0.065	0.848	0.86	1.12
At least once a week	1.03	0.065	0.689	0.90	1.16
Less than once a week	1.01	0.070	0.852	0.87	1.15
**Have you ever heard/seen any NAFDAC programme (advert) on what people should do when they experience ARs					
No (ref)	1.00				
Yes	32.85	1.897	0.000	29.13	36.57
Community-level factor					
**Location					
Rural (ref)	1.00				
Urban	1.42	0.073	0.000	1.28	1.56
Region					
North Central (ref)	1.00				
North East	0.91	0.072	0.210	0.77	1.05
North West	0.97	0.070	0.712	0.83	1.11
South East	1.02	0.080	0.848	0.86	1.18
South South	0.93	0.069	0.309	0.79	1.07
South West	0.848	0.070	0.045	0.71	0.99
Random effects component					
Level	Std. Dev	ICC (%)	P-value	95% Confidence Interval	
Community-level	0.623	17.03	0.000	0.527	0.718
State-level	0.536	7.25	0.000	0.402	0.671
Log-likelihood= -8849.536		AIC= 17735.072			

Note: **P<0.05

CHAPTER FIVE

5.0 DISCUSSION

5.1 Awareness of NAFDAC and checking for NAFDAC registration number.

This study was set to assess factors affecting the awareness of NAFDAC, checking for NAFDAC registration number and awareness of Nigerian pharmacovigilance programme based on the data from the National HIV & AIDS and Reproductive Health and Serological Survey 2012.

This study shows that NAFDAC awareness in the populace was average. Also, as shown in this study, proportion of those who check for NAFDAC registration number was low. This was similar to findings by Babatunde (2008), he reported that only few consumers in Ado-Ekiti check for information before purchasing food products (this information includes NAFDAC registration number). Although, Odili et al (2006) reported that majority of community pharmacists in Lagos State check for NAFDAC registration number. Pharmacists are expected to be more cautious of NAFDAC registration number before prescribing any drug to the patients.

The result indicates that educational level has a positive and statistically significant influence on the awareness of NAFDAC and checking for NAFDAC registration number. The level of NAFDAC awareness increases with respect to the educational status of the consumers and as educational status of the consumers increases, they pay more attention to NAFDAC registration number. This may be because those who have higher education are likely to be well informed about NAFDAC and the negative effect of counterfeit drugs on human health.

Similarly, how often an individual watch television and listen to radio plays a major role in awareness of NAFDAC. This is not surprising at all, considering the fact that most

CHAPTER FIVE

5.0 DISCUSSION

5.1 Awareness of NAFDAC and checking for NAFDAC registration number.

This study was set to assess factors affecting the awareness of NAFDAC, checking for NAFDAC registration number and awareness of Nigerian pharmacovigilance programme based on the data from the National HIV & AIDS and Reproductive Health and Serological Survey 2012.

This study shows that NAFDAC awareness in the populace was average. Also, as shown in this study, proportion of those who check for NAFDAC registration number was low. This was similar to findings by Babatunde (2008), he reported that only few consumers in Ado-Ekiti check for information before purchasing food products (this information includes NAFDAC registration number). Although, Odili et al (2006) reported that majority of community pharmacists in Lagos State check for NAFDAC registration number. Pharmacists are expected to be more cautious of NAFDAC registration number before prescribing any drug to the patients.

The result indicates that educational level has a positive and statistically significant influence on the awareness of NAFDAC and checking for NAFDAC registration number. The level of NAFDAC awareness increases with respect to the educational status of the consumers and as educational status of the consumers increases, they pay more attention to NAFDAC registration number. This may be because those who have higher education are likely to be well informed about NAFDAC and the negative effect of counterfeit drugs on human health.

Similarly, how often an individual watch television and listen to radio plays a major role in awareness of NAFDAC. This is not surprising at all, considering the fact that most

advertisements on NAFDAC are carried out on the television and radio. Hence, an individual who watch television or listen to radio regularly have a better chance of being aware of NAFDAC.

Surprisingly, how often an individual watches television or listen to radio did not affect practice of checking for NAFDAC registration number. The implication of this is that the campaign on NAFDAC registration number has not been translated into practice as expected.

Those who are skilled, semi skilled, self employed and student have a slight edge in awareness of NAFDAC. Similarly, those who are director, manager, civil servant, skilled, semi skilled and self employed were slightly more likely to check for NAFDAC registration number. This may be related to the fact that those in these categories of profession are more educated and this can influence the practice of checking for NAFDAC registration number.

Those resident in urban areas were more likely to be aware of NAFDAC and check drugs for NAFDAC registration number. This may be due to higher visibility of NAFDAC activities in urban areas than rural settings. Also, those who reside in the urban communities are expected to be more sensitized on the implication of purchasing and consuming an unregistered drug/food product.

Lastly, even after controlling for individual and community factors, there is still considerable clustering in awareness of NAFDAC at the community level and checking for NAFDAC registration number at the community and state level. There is more dependence among people living in the same community regarding NAFDAC awareness and checking drug/food product for registration number. This may be due to the effect of some unmeasured community-level

factors such as how close the community is to NAFDAC State office, media concentration of the community and if the community is exposed to any NAFDAC campaign.

5.2 Awareness of Nigerian pharmacovigilance programme.

As reported in previous studies by Ohaju-Obodo et al (2009), Bello et al (2011) and Fadare et al, (2011), this study also shows that there is low awareness of pharmacovigilance programme in Nigeria. This was similar to the findings of Fortnum et al (2012) in U.K and Robertson et al (2013) in Australia who also reported low awareness of existing pharmacovigilance system.

Educational level has a positive effect on awareness of pharmacovigilance programme in Nigeria. This was similar to the findings of Xu H et al (2009) in China. This is because a lot of pharmacovigilance programme and adverts are packaged for those who can read and those who understand English language.

Exposure to any NAFDAC programme advertisement on what people should do when they experience adverse reaction is a major predictor for awareness of pharmacovigilance programme in Nigeria. Those who have heard/seen any NAFDAC programme advert on what people should do when they experience adverse reaction are overwhelmingly well aware of pharmacovigilance programme awareness in Nigeria. This was the case because advertisement is a more effective means of creating awareness on pharmacovigilance programme. Madhan et al (2011) opined that low awareness of pharmacovigilance is as a result of inadequate measure of raising the awareness of pharmacovigilance.

However, how often an individual listens to radio or watches television is not associated with awareness of Nigerian pharmacovigilance programme. This may be because there are very few

jingles or programme related to pharmacovigilance on Nigerian television and radio stations. In addition to this, most of the jingles and programme related to pharmacovigilance are in English.

Finally, even after controlling for individual and community factors, there are still considerable clustering in awareness of Nigeria pharmacovigilance programme at the community level and state level. This may be due to the effect of some unmeasured community-level and state-level factors: such as, media concentration of the community, if the community is expose to any pharmacovigilance campaign, presence of National Pharmacovigilance Center in the state etc.

5.3 LIMITATION OF THE STUDY

The limitations of this study are those inherent to questionnaire-based studies such as subjective response; some of the responses in the study might have been colored by the respondent perspective. Also, some of the responses are subjected to recall bias; respondents might not be able to remember certain information.

5.4 CONCLUSION

The study has shown that educational level, how often an individual watch television and how often an individual listen to radio are significant factors positively influencing the awareness of NAFDAC. In addition to this educational level, type of community and occupation are factors associated with checking for NAFDAC registration number.

Furthermore, NAFDAC campaign on what people should do when they experience adverse reaction overwhelmingly influence awareness of Nigerian pharmacovigilance programme. Educational level, occupational status and type of residence are other factors affecting the awareness of Nigerian pharmacovigilance programme.

5.5 RECOMMENDATION

The results of the study strongly point out the need for adequate measure in increasing the awareness of NAFDAC and pharmacovigilance programme among general population in Nigeria.

The media is very important in educating the population and dissemination of information related to pharmacovigilance. Therefore, advertisement and programme related to pharmacovigilance should be done on media in local languages and packaged for the illiterate to understand in order to achieve a greater penetration among less educated and rural dwellers.

Similarly, legislators, policy makers, government officials, NAFDAC, health ministries, non-governmental organizations, educational institutions, and media should work together in order to raise the level of awareness on pharmacovigilance, importance of checking for information on drug/food product before purchasing it among healthcare professionals and sensitization of the general public.

UNIVERSITY OF IBADAN LIBRARY

REFERENCE

- Alan S, Ozturk M, Gokyildiz S, Avcibay B, Karataş Y (2013): An evaluation of knowledge of pharmacovigilance among nurses and midwives in Turkey. *Indian Journal of Pharmacology*, 2013; 45, 616-8.
- Aziz Z, Siang T. C, Badarudin, N. S (2007): Reporting of adverse drug reactions: predictors of under-reporting in Malaysia. *Pharmacoepidemiol Drug Saf.* 2007;16(2): 223-228.
- Bello S. O, Umar M. T (2011): Knowledge and attitudes of physicians relating to reporting of adverse drug reactions in Sokoto, North-Western Nigeria. *Annals of African Medicine.* 2011;10(1):13-18.
- Chinenye J. U, Michael O. U (2012): health workers and hospital patients knowledge of pharmacovigilance in Sokoto, North-West Nigeria. *Nigerian Journal of Pharmaceutical Sciences* Vol. 11, No.2, September, 2012; ISSN: 0189-823X.
- Diouf M, Bodian S, Lo C.M, Cisse D, Faye D, Toure B, Fall M (2013): Pharmacovigilance among dentists: a survey of practitioners in Dakar, Senegal. *Sante publique*, 2013 Jan-Feb; 25(1), 69-76.
- Elkalmi R. M, Hassali M. A, Ibrahim M. I, Shafic A. A (2009): A qualitative study evaluating perception of community pharmacist towards ADRs reporting in northern Malaysia. *Drug Saf.* 2009; 32(10): 878.
- Fadare J. O, Okezie O. E, Afolabi A. O, et al (2011): Knowledge, attitude and practice of adverse drug reaction reporting among healthcare workers in a tertiary centre in Northern Nigeria. *Trop J of Pharm Res.* 2011;10(3):235-242.
- Federal Republic of Nigeria (FRN, 2007): Official Gazette, 15th May, 2007. Lagos: Federal Government Printing Press.
- Fortnum H, Lee A, J, Rupnik B, Avery A (2012); Yellow Card Study Collaboration. Survey to assess public awareness of patient reporting of adverse drug reactions in Great Britain. *J Clin Pharm Ther* 2012; 37: 161-165.
- Ghazal V, Zeinab M, Mehri M (2008): Knowledge, attitudes, and perceptions of pharmacists to adverse drug reaction reporting in Iran. *Pharm World Sci.* 2009 April; 31(2): 183-187. Published online 2008 December 31. doi: 10.1007/s11096-008-9276-6.
- Guang G, Hongxin Z (2000): Multilevel Modeling for Binary Data. *Annual Review of Sociology.* Vol. 26, 2000; pp. 441-462.
- Hardeep Bajaj J. K, Rakesh K (2013): A survey on the knowledge, attitude and the practice of pharmacovigilance among the health care professionals in a teaching hospital in northern India. *J Clin Diagn Res* 2013;7:97- 99.
- Inman W. H (1996): Attitudes to adverse drug-reaction reporting. *Br J Clin Pharmacol.* 1996; 141, 433-435.
- Kumar A (2011): Past, present and future of pharmacovigilance in India. *Syst Rev Pharm* 2011; 2:55-8.
- Lazarou J, Pomeroy B, H and Corey P. N (1998): Incidence of adverse reactions in hospitalized patients: A meta-analysis of prospective studies. *BMJ*, 1998, 279, 1200-1205.

- Lopez-Gonzalez E, Herdeiro M. T and Figueiras A (2009): Determinants of under-reporting of adverse drug reactions: a systematic review. *Drug Saf*, 2009; 32, 19-31.
- NAFDAC (2007): Guideline for prospective agents of foreign manufacturers of regulated products. Available at www.nafdacnigeria.org/drugs.html assessed on 6/10/2014.
- NAFDAC consumer safety bulletin: Special edition, 2004.
- National Agency for food and Drug Administration and Control (2007): Available online at <http://www.nafdacnigeria.org/identified.html> accessed August 10, 2014.
- National Agency for food and Drug Administration and Control (2007): Available online at <http://www.nafdacnigeria.org/identified.html> assessed on 6/10/2014.
- National Pharmacovigilance Centre (NPC), NAFDAC Nigeria (2004): Safety of medicines in Nigeria: a guide for detecting and reporting adverse drug reactions. NAFDAC-NPC-NIG-2004-1 Lagos: National Agency for Food and Drug Administration and Control.
- Newton P. N, Dondorp A, Green M, Mayxay M, White N. J (2003): Counterfeit artesunate antimalarials in Southeast Asia. *Lancet* 2003; 362: 169.
- Newton P. N, Rozendaal J, Green M, White N. J (2002): Murder by fake drugs: time for international action. *BMJ* 2002; 324: 800-01.
- Odili V.U, Osemwenkha S, Eke E.U, Okeri H.A (2006): Identification of counterfeit drugs by community pharmacists in Lagos State. *Tropical Journal of Pharmaceutical Research*, June 2006; 5(1), 545-550.
- Ohaju-Obodo J. O, Iribhogbe O. I (2010): Extent of pharmacovigilance among resident doctors in Edo and Lagos states of Nigeria. *Pharmacoepidem Drug Safe*, 2010; 19: 191-195. doi: 10.1002/pds.1724
- Olufunsho A, Akinwumi A, Oladunni A. A, Deborah F. A (2011): Pharmacovigilance amongst doctors in private hospitals in Lagos West Senatorial District, Nigeria. *Int J Risk Saf Med*. 2011; 23(4): 217-226. doi: 10.3233/JRS-2011-0541.
- Oreagba I. A, Ogunleye O. J and Olayemi S. O (2011): The knowledge, perceptions and practice of pharmacovigilance amongst community pharmacists in Lagos state, South West Nigeria. *Pharmacoepidemiol drug saf*, 20, 30-35. DOI: 10.1002/pds.2021.
- Osakwe A, Oreagba I, Adewunmi A. J, Adekoya A, Fajolu I (2013): Impact of training on Nigerian healthcare professionals' knowledge and practice of pharmacovigilance. *The International Journal of Risk and Safety in Medicine*, 2013; 25(4), 219-227.
- Oshikoya A. K and Awobusuyi O. J (2009): Perceptions of doctors to adverse drug reaction reporting in a teaching hospital in Lagos, Nigeria. *BMC Clin Pharmacol*, 2009; 9, 14. DOI:10.1186/1472-6904-9-14.
- Pimpalkhute S. A, Jaiswal K. M, Sontakke S. D, Bajait C. S, Gaikwad A (2012): Evaluation of awareness about pharmacovigilance and adverse drug reaction monitoring in resident doctors of a tertiary care teaching hospital. *Indian J Med Sci* 2012;66:55-61 <http://dx.doi.org/10.4103/0019-5359.110902>
- Rabe-Hesketh S, Skrondal A: Multilevel and longitudinal modeling using Stata 2nd edition. *Stata Press, College Station, TX*, 2008.
- Rawlins, M. D. (1995): Pharmacovigilance: paradise lost, required or postponed? *BR col Physicians Lond*, 1995, 29, 41-49.

- Robertson J, Newby D. A (2013): Low awareness of adverse drug reaction reporting systems: a consumer survey. *Med J*, August 2013; 199(10), 684-6.
- Safety Monitoring of Medicinal Products (2000): Guidelines for setting up and running a Pharmacovigilance Centre UMC.
- Smith C. C, Bennett P. M, Pearce H. M, Harrison P. I, Reynolds D. J, Aronson J. K and Grahame-Smith D. G (1996): Adverse drug reaction in a hospital general medical unit meriting notification to the Committee on Safety of Medicines. *Br J Clin Pharmacol*, 1996; 42, 423-429.
- Subish P, Izham M, Mishra P. Pharmacovigilance in Nepal (2007): A guide for healthcare professionals. Regional Pharmacovigilance Centre, Pokhara, Nepal 2007.
- W. H. O. (2002): The Importance of Pharmacovigilance, Safety Monitoring of Medical Products, Geneva.
- Wiholm B. E, Olsson S, Moore N, Wood S (1994): Spontaneous reporting systems outside the United States. In: Strom B. L, editor. *Pharmacovigilance*. Chichester: *John Wiley & Sons Ltd*; 1994. p. 139-55.
- World Health Organization (1973): Handbook of resolutions and decisions of the World Health Assembly and Executive Board, Geneva: WHA16.36 Clinical and pharmacological Evaluation of Drugs. Vol. 1 1948-1972.
- World Health Organization (1975): Requirements for adverse reaction reporting. Geneva, Switzerland: World Health Organization; 1975.
- World Health Organization (2002): Safety of Medicines: A guide to detecting and reporting adverse drug reactions, Geneva.
- World Health Organization (2006). Counterfeit Medicines. Available online at <http://www.who.int/mediacentre/factsheets/fs275/en/> accessed July 5, 2014.
- World Health Organization (2006). Counterfeit Medicines. Available online at <http://www.who.int/mediacentre/factsheets/fs275/en/> accessed July 5, 2014.
- World Health Organization (2012): Safety monitoring of medical products: reporting system for the general public. Geneva: WHO, 2012. http://www.who.int/medicines/areas/quality_safety/safety_efficacy/EMP_Consumer_Reporting_web_v2.pdf (accessed October 2014).
- Xu H, Wang Y, Liu N (2009): A hospital-based survey of healthcare professionals in the awareness of pharmacovigilance. *Pharmacovigilance Drug Saf*. 2009;18: 624-30.