PREDICTORS OF MAJOR DEPRESSIVE DISORDER AMONG AGEING NIGERIANS

By

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MATRIC NO: 138717

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT

FOR THE AWARD OF MASTER OF SCIENCE

(BIOSTATISTICS)

IN THE DEPARTMENT OF EPIDEMIOLOGY AND MEDICAL STATISTICS

FACULTY OF PUBLIC HEALTH

UNIVERSITY OF IBADAN

MARCH, 2015

CERTIFICATION

We certify that **Mr Idowu, Olusemi Philippe** carried out this research under our guidance and supervision at the Department of Epidemiology and Medical Statistics, Faculty of Public Health, College of Medicine, University of Ibadan, Nigeria for the Award of Degree of Masters of Science in Biostatistics.

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DEDICATION

DEDICATION

To The King of Kings: Jesus Christ, My Lord and Saviour,

My Parents: Israel (RIP) and Lydia Idowu,

and

All who have laboured continuously in making me a success in this world.

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to Dr. Yusuf O.B. and Dr. Akpa O.M. who have made the success of this work possible by devoting their time and resources. I really want to say 'thank you' for your constant support and encouragement.

I extend my gratitude to Prof. Gureje O. for making available the data used in this study. Also big thanks to Mr Afolabi N., Mr Abiona T., Mrs Bello O., Dr. Akinyemi J.O., Dr. Adedokun B., and Dr. Adebowale S. for your invaluable contributions to the success of this work.

My profound appreciations go to the families of Revd' and Dr. (Mrs) Adediran, Dr. (Mrs) Williams, Mr Olutayo W., Prof. Olorunnisola A.O., Prof. (Mrs) Ugbebor O., Dr. (Mrs) Ajayi D.O.A., Dr. (Mrs) Sangowanwa and Mrs Ogunleye. Words are not enough to describe how grateful I am to you; only God can reward your labour of love on me.

My thumbs up to the members of staff and my fellow postgraduate students in the Department of Epidemiology and Medical statistics, for your contribution and encouragement during the whole period of my study.

Finally, I would like to express my utmost gratitude to my mothers, uncles, aunties, siblings, cousins, friends and relatives. Your love and continuous support is highly appreciated. I believe the sky is just the starting point of our successes in this life.

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ABSTRACT

Depression in older people has been identified as a new public health problem in low and middle income countries. The liability of depression among the elderly is often worsened by environmental and physical factors as they increase with age. Hence, elderly people appear to suffer the effect of the disorder much more than people in other age groups. Most studies on major depressive disorder (MDD) among elderly Nigerians have used cross-sectional designs which are descriptive in nature and have not investigated the effects of individual and environmental factors predicting it among the elderly people, over time. Therefore, this study determined factors predicting MDD among ageing Nigerians.

The study was a retrospective analysis of a four year data from the Ibadan Study of Ageing (ISA). A total of 2,149 Yoruba-speaking elderly Nigerians from the states of Lagos, Ogun, Osun, Oyo, Ondo, Ekiti, Kogi and Kwara participated in the study between 2003 and 2009. MDD was assessed using the Geriatric Depression Scale (GDS), and was classified as "yes" for scores in the range of 10 – 30 and "no" for scores in the range of 0 - 9. Multilevel binary logistic models were used to determine factors predicting MDD among elderly Nigerians. Adjusted odds ratios (OR), 95% confidence intervals (95% CI), as well as, Intra-class Correlation Coefficients (ICC) for each random effect was estimated.

Of the 2,149 study participants, 1,157 (53.8%) were females, and 555 (25.8%) dwelled in urban areas. At baseline 712 (31.1%) were in the 65-69 years age group while 648 (30.2%) were at least 80years old. The overall prevalence of MDD was 27.34%. The differences in the occurrence of MDD among the elderly were attributable to differences between enumeration areas (6%) and individuals (22%). The statistically significant predictors of MDD were not keeping regular contact with family members (OR=2.91 (1.26-6.70)), not keeping regular contact with friends (OR=1.32 (1.05-1.67)), not participating in family activity (OR=2.07 (1.63-2.43)), not participating in community activity (OR=1.93 (1.54-2.43)), and good quality of health status (OR=0.25 (0.15-0.27)).

The study revealed that regular family contact, regular friend contact, family activity, community activity, and self reported quality of health were significantly associated with MDD among elderly Nigerians, over time. Elderly people living with depression are therefore

advised to engage themselves more in social activities so as to reduce new onset of depression.

Keywords: Major Depressive Disorder, Elderly Nigerians, Regular family and friend Contacts, Self reported quality of health.

Word Count: 383

CHAPTER ONE

INTRODUCTION

1.1 General Introduction

Depression, a common but serious mental disorder, occurs worldwide across all age groups. It is characterized by pervasive and persistent feelings of hopelessness and inadequacy that is accompanied by low self-esteem which interferes with daily life, normal functioning, and causes pain for both the depressed person and those in charge of his or her care. It is, also, not uncommon that depressed people often commit suicide which shorten their life expectancy than those without depression (Cassano & Fava, 2002). However, depressed individuals also have a higher rate of dying from other causes (Rush, 2007), being more susceptible to medical conditions such as heart disease (Alboni *et al.*, 2008). Globally, depression affects approximately 298 million people as at 2010 (4.3% of the global population) (Vos *et al.*, 2012), making it one of the major cause of morbidity (WHO, 2001). It is one of the 10 major diseases projected worldwide, by the year 2030, to cause the most disability-adjusted life years in low-income countries (Mathers & Loneard, 2006); a list which also include ischaemic heart disease, cerebrovascular disease and cataracts among others. Even though causes of depression are not well ascertained, experts have identified some factors when, combined in, together may result to depression. These factors include but are not restricted to biological, psychological, and social factors (Department of Health and Human Services (DHHS), 1999). For example depression may result when a pre-existing vulnerability (biological/genetic factor) is activated by a stressful life event (childbirth, menopause, financial difficulties, job problems, a medical diagnosis (HIV, cancer, other chronic diseases, etc.), sexual abuse, bullying, loss of a loved one, natural disasters, social isolation, relationship troubles, jealousy, separation, and catastrophic injury).

The most common forms of depression are Major Depressive Disorder (MDD) and Dysthymic Disorder out of several others. Major Depressive Disorder also known as major depression is characterized by a combination of symptoms that undermine the patient ability to eat, work, study, sleep, and enjoy activities he or she once found pleasurable. Major depression can be very disabling, and prevents the patient from functioning normally whereas Dysthymic Disorder also known as dysthymia or mild chronic depression is characterized by long-term (at least two years) of less severe symptoms that may not disable a patient but can

be an hindrance to his or her normal functioning and feeling well. In both cases, a patient can experience only one episode of depression in his or her lifetime, but more often, it is recurrent episodes throughout the lifetime. Other forms of depression include: Psychotic depression (delusional depression), Postpartum depression (postnatal depression), Seasonal affective disorder (SAD; NIMH, 2008) and Bipolar disorder (manic-depressive illness). This study will be based mainly on MDD because of its severely devastating effects (Fiske, Wetherell & Gatz, 2009) and being common, among the aging in Nigeria (Baiyewu *et al.*, 2007).

Symptoms of depression differ from one patient to another. How severe the symptoms are, how frequent and how long they last depends on the individual and his or her particular illness. The following symptoms are the most common among patients: persistent feelings of sadness, anxiety, and emptiness; feelings of hopelessness and/or pessimism; feelings of guilt, worthlessness and/or helplessness; irritability and restlessness; loss of interest in activities or hobbies once pleasurable, including sex; fatigue and decreased energy; difficulty concentrating, remembering details and making decisions; insomnia, early-morning wakefulness, or excessive sleeping; overeating, or appetite loss; thoughts of suicide, suicide attempts; and persistent aches or pains, headaches, cramps or digestive problems that do not ease even with treatment. Physical complaints such as fatigue and headaches are the most common symptoms in developing countries, according to the World Health Organization's criteria for depression (Patel, Abas & Broadhead, 2001). It is interesting to note that symptoms of depression, during an episode, often heal over time whether the patient is treated or not. A study, conducted among outpatients on a waiting list, revealed that major depressive symptoms reduced between 10 and 15% within a few months, and approximately 20% of the patients no longer met the full criteria for a depressive disorder (Posternak & Miller 2001).

Preventive programs such as behavioural interventions of the like of interpersonal therapy and cognitive-behavioural therapy have been found to be effective at preventing new onset depression (Muñoz, Beardslee & Leykin, 2012; Cuijpers, 2012; Cuijpers *et al.*, 2008). Depression is highly treatable - even in its most severe forms. Studies have shown that, early diagnostic and prompt treatment of a depressed person increases the treatment effectiveness and reduces significantly the likelihood of recurrence of the illness. Often, depression co-exists with other diseases. Such diseases may either cause or be a consequence of depression. There is a strong possibility that the mechanics behind the coexistence of depression and

other diseases differ for every patient and situation. Nevertheless, these other co-occurring illnesses need to be diagnosed and treated. As a matter of fact, studies have shown that people who have depression coupled with another serious medical illness tend to have more severe symptoms of both depression and the medical illness, more difficulty adapting to their medical condition, and more medical costs than those who do not have co-existing depression (Cassano & Fava, 2002). Research has yielded increasing evidence that treating the depression can also help improve the outcome of treating the co-occurring illness (Katon & Ciechanowski, 2002). In this study, only the co-occurrence of MDD with somatic illnesses such as hypertension, chronic pain and diabetes is reported.

Aging in Africa combined with the rapid urbanization of many African societies (Kalache, 1986), including Nigeria (UN Population Division, 2003), has received a boost due to improved treatment for infectious diseases. This subsequently means that aging people, faced with chronic disease and mental illness such as depression, increasingly constitute a major burden to the health sector (Mathers & Loneard, 2006). In response to the urgency of this challenge, the United Nations held a high-level General Assembly meeting in 2011 on non-communicable diseases (NCDs) including mental illness of the like of depression. It was recommended at the meeting, the second of its kind ever dedicated to health related issues, that plans to reduce the risk factors for NCDs must be set up by governments all over the world by the year 2013 (United Nations General Assembly, 2011). Two of the major challenges in the areas of mental health and aging, as identified by the Administration on Aging of the U.S Department of Health and Human Services are research, and prevention and early intervention (DHHS, 2001). Existing efforts generally focus on the diagnosis and treatment of illness rather than on the early identification of high-risk individuals and families, preventive measures, and the promotion of optimal health. An expanded mental health and aging research agenda is needed to deepen our understanding of the biological, behavioural, social, and cultural factors that prevent and cause disease, especially for at-risk and underserved populations. Research is needed in the areas of prevention, intervention, health services, and training so as to address the mental health needs of older persons in Africa and Nigeria in particular.

1.2 Statement of the Problem

It is an established fact that depression is not a normal part of aging (NIMH, 2008). According to the World Health Organization, depression is predicted by the year 2030, to be

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the second-leading cause of disease burden worldwide after HIV (Mathers & Loneard, 2006). The effects of this mental disorder on the elderly people are severely devastating (Fiske, Wetherell & Gatz, 2009). Aging is meant to be a time for achieving productive vocations and for sustaining close relationships at home and in the community. Longitudinal research on major depressive disorders with special emphasis on aging people, in Nigeria and Africa as a whole, are scanty. Therefore, this study is intended to investigate the predictors of major depressive disorders among aging Nigerians.

1.3 Justification and Significance of the Study

1.3.1 Justification

Depression in older people has been identified as an emerging public health problem in low and middle income countries (WHO, 2010). Nigeria being a middle income country is not exempted. Also, as observed by Onya and Stanley (2013), the liability of depression among the elderly is often worsened by environmental and physical factors as they increase with age. Hence, elderly people appear to suffer the effect of the disorder much more than people in other age groups. Therefore, it would be interesting to have an insight into the possible factors predicting major depressive disorder among the elderly.

The necessity in accounting for the variation within group, while analysing data which are hierarchical in nature, cannot be overemphasized because of correlation of the responses. A natural way to investigate predictors of depression is usually the ordinary regression model. However, in panel (repeated measurements) data, one would expect errors for measurements on the same individual to be correlated. For instance, someone with higher than expected symptoms of depression at a given year, given his covariates is also likely to have higher than expected symptoms of depression at other years. When one fails to account for such variations, there is a tendency to fall victim of the ecological fallacy. The ecological fallacy is regarded as interpreting data from several groups as an aggregated data form a single group (Hox, 2010). This directly leads to one of the major reasons to use multilevel models:

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- **Theoretical reason:** If the data are hierarchical or longitudinal in nature, then the data analytic methods should be as well.

- **Statistical reason**: Ignoring the structure of the data can lead to statistical problems as well. First, the errors are no longer independent. Second, it is assumed that effects are similar across the levels, which might not always be the case and thus lead to loss of information and the statistical analysis also loses power.

Multilevel analysis can be viewed as a tool of addressing research questions concerning how outcomes at the individual level can be seen as the result of the interplay between individual and environmental factors, i.e. the contextualization of the outcomes. This type of analysis is more specific as it is subject oriented in contrast to the ordinary regression analysis which is population oriented. In other words, multilevel models take into consideration variation that is not only generalised to the independent variables, such as variation across individuals and enumeration areas in this current study. Many are the advantages of multilevel analysis (Snijders & Bosker, 2000; Singer & Willett, 2003) over ordinary regression analysis. It is also noteworthy that there are limited studies of this nature on major depressive disorder among the elderly in Nigeria.

1.3.2 Significance

Increased somatic illness and mortality from suicide are the most serious consequences of late-life depression (DHHS, 1999). With the increasing populations of aging people (aged over 60 years) in Africa, which has been projected, by the United Nations, to reach the 212 million mark by 2050 (UN Ageing Chart, 2009); late life major depressive disorder is becoming a pandemic and claiming so many lives and thus makes this study extremely valuable. Also, most studies on MDD among the elderly people in Nigeria have used cross-sectional designs which are descriptive in nature and have not been followed up to investigate the effects of individual and environmental factors predicting MDD among the elderly people, over time. This study will account for the effects of both environmental and individual factors predicting this debilitating mental illness among ageing Nigerians over time. Therefore, the results of the study will provide relevant guidance for stakeholders on which measures to focus on, in order to prevent a late life depression and thus reduce its public health burden. These stakeholders include the public and private sectors, policymakers, legal and health practitioners, researchers, consumers, family members, and advocacy groups.

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1.4 Research Objectives

1.4.1 General Objective

This study determines the factors associated with major depressive disorders (MDD) among ageing Nigerians.

1.4.2 Specific Objectives

The specific objectives of this study are to:

1) Determine the point prevalence of major depressive disorder by various characteristics among ageing Nigerians.
2) Identify various factors predicting major depressive disorder among ageing Nigerians.
3) Estimate the variability within area and individual levels of factors predicting major depressive disorder among the elderly.

1.5 Research Questions

1) What is the point prevalence of major depressive disorder by various characteristics among ageing Nigerians, over the years?
2) Does a higher tendency to a given factor in a previous year lead to major depressive disorder among ageing Nigerians, in the following years?
3) Do environmental and individual factors considerably contribute to major depressive disorder among ageing Nigerians during the study period?

CHAPTER TWO

LITTERATURE REVIEW

2.1 Issues on Ageing in Nigeria

Many are the challenges, varying from health to social issues (AFRAN, 2008; Mudiare, 2013), elderly people face in Nigeria – the country with the largest population of elderly people over the age of 60 years in Sub Saharan Africa. Mudiare (2013) observed that, elderly people are abused and neglected both physically and psychologically by family members and other caregivers. Some of them have challenges of poverty and diseases such as stroke, depression, dementia, Alzheimer's and Parkinson's. Because of their frailty, they depend on their families and other caregivers for care and in the process are abused. These abuses include, but are not limited to, neglect, exploitation, abandonment and sexual abuse. On the other hand, Okoye and Asa (2011) pointed out that providing care to the elderly, takes a huge toll, both physically and emotionally on the caregiver. However, with a disorder of the like of MDD there is likely an increase in the physical, emotional and psychological pain experienced by both the receiver and the caregiver.

2.2 Major Depressive Disorder among the Elderly

Major Depressive Disorder (MDD) is a common but serious mental health problem of older people which is associated with considerable morbidity and co-morbidity. It is a known fact that the cost of treatment of somatic illnesses, such as diabetes (Finkelstein *et al*, 2003), are substantially higher for those with MDD. Also, the limited understanding of the aetiology, risk factors and course of MDD poses a great challenge for its early prevention. Furthermore, prevention researches on major depressive disorder in late life - which are mostly driven by refined understanding of its aetiology and risk factors - until recent times, have always lagged behind those on its assessment, diagnosis and treatment. Depression remains an important problem in older patients with multiple medical problems, where the under-recognition and under-treatment of depression is especially common (Charlson and Peterson, 2002).

2.3 Prevalence of Major Depressive Disorder among the Elderly

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important to understand its prevalence as well as determinants among older people in Nigeria and other countries.

The baseline analysis of the Ibadan Study of Ageing (ISA), from a cohort of 2149 participants aged 65 and above, revealed that the prevalence of 12-month MDD using the Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV) criteria was 7·1% (5·9–8·3) (Gureje, Kola & Afolabi, 2007). Meanwhile, Afolabi *et al* (2008) observed that the prevalence of depression using a pre-tested interviewer-administered questionnaire that incorporated Zung's Depression Scale, among 250 newly registered patients attending the Family Practice Clinic at Wesley Guild Hospital, Ilesha, Nigeria was 59.6%. Of these, one hundred and seven (42.8%) had mild depression, forty (16.0%) had moderate depression and only two (0.8%) had severe depression. Depression was found to be commoner in the age groups from 45 years and above. The subjects age range, in this study, was between 16 to 84 years, with a mean age of 49.66 ± 14.95 years. Also, there were 74 males and 176 females in the sample population, showing a male to female ratio of 1:2.4. Out of one hundred and forty nine depressed subjects, 104 females (69.8%) had depression, while depression was present in 45 males (30.2%).

In Korea, Kim, Choe, and Chae (2009) found out that the prevalence of depression, using the Korean version of the short form of Geriatric Depression Scale (SGDS-K), among 295 community-dwelling elderly was 63%, while 21% of them had severe depressive symptoms. Whereas in Thailand, Haseen and Prasartkul (2011) determined the prevalence of depression using the Thai validated Euro-D scale among 1001 elderly respondents living in Kanchanaburi to be 28.5%.

Among 150 elderly GOPD attendees at UPTH, Port Harcourt, Nigeria, Onya and Stanley (2013) observed, using the Geriatric Depression Scale, that 42 (28%) of the patients were found to be depressed among which 34 (80.9%) were female. However, the prevalence of symptom-based depression in the past 12 months was 4.0% in a sample of 3,840 individuals aged 50 years or above in South Africa (Peltzer and Phaswana-Mafuya, 2013). These studies reveal that prevalence of depression varies by setting and screening/diagnostic tools.

2.4 Predictors of Major Depressive Disorder among the Elderly

2.4.1 Social, Demographic, Economic and Lifestyle Factors

The analysis of the Ibadan Study of Ageing (ISA), at baseline, revealed that elderly people with MDD had impaired quality of life and functioning in home, work, and social roles. It was also found out that Female sex (odds ratio (OR) = 1·9) and increasing levels of urbanisation of residence (OR=1·4) were associated with the disorder (Gureje, Kola & Afolabi, 2007). This finding was supported by a study in Port Harcourt, Nigeria where female sex, older age groups, urban dwelling (especially with children), poor family support, marital disharmony, widowhood, bereavement, poor educational background and low social status were found to be risk factors for depressive illness in the elderly. Also, prior history of depression, stressful life events, regular usage of anti-depressant drugs, anti-hypertensive, anti-diabetic and anti-oncotic agents were found to predict depression. Ironically, unemployment and living alone were not found to predict depression among the elderly (Onya and Stanley, 2013). In addition to that, the study conducted by Afolabi *et al* (2008) showed age, low educational status and poverty as significantly associated with depression. Also, substance use was significantly more common among depressed subjects than the non-depressed group.

In a previous study, the effects of age, gender, education, marital status, social isolation, functional impairment, financial strain, and alcohol use were examined among community residents aged 50 years or more, using two waves of data from a panel study for a subgroup of the 1994 and 1995 surveys of the Alameda County (California) Study. The study revealed that being female as well as older age, social isolation, low education, financial strain, and functional impairment were significant correlates of depression (Roberts *et al*., 2000).

Also, 1408 (66%) of the 2149 initial respondents at baseline, of the ISA, were successfully followed up for approximately 39 months (November 2003 to December 2007). The main objective of the study was to determine the incidence and risk factors of MDD among aging Nigerians, paying particular attention to the group with no prior lifetime history of MDD at baseline and who were also free of dementia at follow-up (n=892). The results showed that 308 persons had developed incident MDD, representing a rate of 104.3 [95% confidence interval (CI) 93.3–116.6] per 1000 person-years. Compared to male participants, the age-adjusted hazard for female participants was 1.63 (95% CI 1.30–2.06). Lifetime or current

sub-syndromal symptoms of depression at baseline did not increase the risk of incident MDD. Among females, but not males, rural residence and poor social network were risk factors for incident MDD. Physical health status at baseline did not predict new onset of MDD. Social factors, in particular those relating to social isolation, also constituted a risk for incident MDD (Gureje, Oladeji and Abiona, 2011).

However, unlike all the studies above, a study in South Africa did not find any significant socio-economic (gender, population group, socio-economic status, geo-locality), behaviour (dietary habits, physical activity), and cognitive impairment differences in relation to depression prevalence (Peltzer and Phaswana-Mafuya, 2013).

Furthermore, Kim, Choe, and Chae (2009) in a bid to examine the relationship between depressive mood, physical and socio-environmental variables of community-dwelling elderly observed that perceived health status alone accounted for 17.3% of depression in the regression analysis. With subsequent addition of hand-grip strength and social activities in the analysis, perceived health status increased to 22.6% and 25.2% respectively. Therefore, perceived health status was a significant and powerful factor explaining depression among the Korean elderly. Also, hand-grip strength and social activities predicted depression among elderly Korean. Whereas, in Thailand, Haseen and Prasartkul (2011) identified that infirmity, disability and serious life events were the three major predictors of depression for older people.

2.4.2 Health Factors

The association between sleep disturbances and depression was examined, using two waves of data from a panel study for a subgroup of the 1994 and 1995 surveys of the Alameda County (California) Study, by Roberts and colleagues (2000). The study revealed that sleep disturbances were significant correlates of depression. When sleep problems and depression were examined prospectively, with controls for the effects of the other variables, sleep problems in 1994 predicted depression in 1995. However, other symptoms of major depressive episodes—anhedonia, feelings of worthlessness, psychomotor agitation or retardation, mood disturbance, thoughts of death—were much stronger predictors of future major depression.

The study conducted by Peltzer and Phaswana-Mafuya (2013) in South Africa revealed that functional disability, lack of quality of life, and chronic conditions (angina, asthma, arthritis, and nocturnal sleep problems) were associated with self-reported depression symptoms in the past 12 months

2.4.3 Co-morbidities

A large number of studies were reviewed in order to identify what is known about medical co-morbidity and late-life depression. Also, the extent to which co-morbidity has been controlled for in studies of late-life depression in medical outpatients, inpatients, and patients with specific co-morbid diseases, including cancer and cardiovascular disease were considered. It was hypothesized that patients with the greatest co-morbidity are at especially high risk for depressive symptoms and poor outcomes, and that if co-morbidity is not adequately measured there is important potential for confounding. The study revealed that a large number of studies assessing the relationship between depression and medical burden have focused on patients with cardiac disease, and recent research has focused on the role of depression as an independent risk factor for cardiac disease, mortality, and functional status in elderly patients. In particular, among coronary bypass surgery patients, depressive symptoms were found to occur most commonly in those with the highest co-morbidity (Charlson and Peterson, 2002).

Proctor and colleagues (2003) examined physical illness among elderly patients hospitalized for treatment of major depression, the impact of co-morbidity on functional status, and the burden of co-morbidity on post-discharge service needs in the USA. Data were abstracted from the hospital charts of older adults hospitalized for depression in the gero-psychiatric unit of a large urban hospital and discharged home between March 1997 and May 2000. The Cumulative Illness Rating Scale for Geriatrics was used to measured medical co-morbidity while a psychiatrist confirmed DSM-IV for Axis I diagnosis of depression, and the Geriatric Depression Scale measured depression severity. The findings proved that approximately three-fourths of depressed elderly patients had at least one co-morbid condition requiring first-line treatment; nearly half had two, and one-fourth had three or more. Co-morbid physical illness and cognitive impairment was significantly and negatively associated with elderly patients' functional impairment at discharge. An interesting observation also made

was that depressed patients with higher medical co-morbidity had significantly more needs for services after they left acute care.

The relative association of depression severity and chronicity, other comorbid psychiatric conditions, and coexisting medical illnesses with multiple domains of health status were examined among primary care patients with clinical depression (Noël *et al.*, 2004). A cross-sectional study, as part of a treatment effectiveness trial, was conducted in 8 diverse health care organizations. Patients aged 60 years and older who met diagnostic criteria for major depression or dysthymia participated in the baseline survey. The survey instrument included questions on socio-demographic characteristics, depression severity and chronicity, neuroticism, and the presence of 11 common chronic medical illnesses, as well as questions screening for panic disorder and posttraumatic stress disorder. Also, measures of 4 general health indicators (physical and mental component scales of the SF-12, Sheehan Disability Index, and global quality of life) were included. Separate mixed-effect regression linear models predicting each of the 4 general health indicators were conducted. It was found that depression severity was significantly associated with all 4 indicators of general health after controlling for socio-demographic differences, other psychological dysfunction, and the presence of 11 chronic medical conditions. Although study participants had an average of 3.8 chronic medical illnesses, depression severity made larger independent contributions to 3 of the 4 general health indicators (mental functional status, disability, and quality of life) than the medical co-morbidities (Noël *et al.*, 2004).

CHAPTER THREE

METHODOLOGY

3.1 Study Design

The study is a retrospective analysis of data from the Ibadan Study of Ageing (ISA) conducted by Oye Gureje (Professor of Psychiatry, University of Ibadan, Nigeria). It was a community-based longitudinal survey containing data that addresses the profile and determinants of healthy and successful ageing.

3.2 Description of the Ibadan Study of Ageing (ISA)

The study comprised two main components which were supported by the Welcome Trust, namely:

- A baseline cross-sectional study conducted between November 2003 and August 2004, and
- A longitudinal cohort study conducted in three annual waves namely 2007, 2008 and 2009.

Only a brief account of the study is given here. Ample information about the study is provided elsewhere (Gureje (ISA), Retrieved May 2014; Gureje, Ogunniyi & Kola, 2006; Gureje, Kola & Afolabi, 2007).

3.2.1 Study Setting

The study was conducted in eight contiguous states in the south-western and north-central regions (Lagos, Ogun, Osun, Oyo, Ondo, Ekiti, Kogi and Kwara). These states as at the time of baseline (2003/2004) accounted for about 22% of the Nigerian population (approximately 25 million people).

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The study population comprised elderly people aged 65 years or above who resided in the study setting.

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3.2.3 Study Units

The study units were elderly people aged 65 years or above residing in households and fluent in Yoruba, the language of study.

3.2.4 Inclusion Criteria

One elderly respondent aged 65 years or above was selected per household. Each participant was also informed about his right to decline the study at any time. Only respondents who had provided consent, mostly verbal due to illiteracy or by choice, were interviewed.

3.2.5 Exclusion Criteria

Whenever there was more than one person eligible for the study in a household, the Kish table selection method (Kish, 1965) was used to select the one respondent with no replacement for refusals. The table, which was developed by Leslie Kish in 1949 (Kish, 1965), comprises pre-assigned random numbers which are used to find the person to be interviewed.

3.2.6 Sample Design and Sampling Techniques

Respondents (one per household) were selected by a multistage cluster sampling of households within enumeration areas (geographical units demarcated by the National Population Commission) within each state. They were adequately informed about the study, invited to participate, and assured of their right to decline participation in the study. On this basis of selection procedure, face-to-face interviews were successfully done at baseline with 2152 of 2908 respondents (of which 2149 were complete), giving a response rate of 74.2%. Respondents were subsequently followed up from 2007 to 2009.

3.2.7 Ethical Considerations

The study was approved by the University of Ibadan and University College Hospital, Ibadan joint ethical review board.

3.3 Data Collection and Structure

3.3.1 Data Collection

All respondents were interviewed face-to-face by 24 trained interviewers, all of whom had at least 12 years (high school) education. Many of them had been involved in field surveys and had experience of face-to-face interviews. Nevertheless, they had a 2-weeks training done by Professor Oye Gureje (which included item-by-item description of questionnaires and role play). Six supervisors, all of whom were university graduates and had survey experience, underwent the same level of training and monitored the day-to-day implementation of the survey.

All respondents completed a questionnaire which comprised socio-demographic, social engagement and health characteristics. The instrument was translated in Yoruba with iterative back-translation methods. See section 3.4 for further details about the study variables.

3.3.2 Data Structure

The data was structured in a three-level hierarchical form. There were four years repeated measurement (units *i*) for each of the 2149 participants/individuals (clusters *j*) who were themselves clustered in 43 enumeration areas/environments (super-clusters *k*). Figure 1 shows the structure of the hierarchical model.

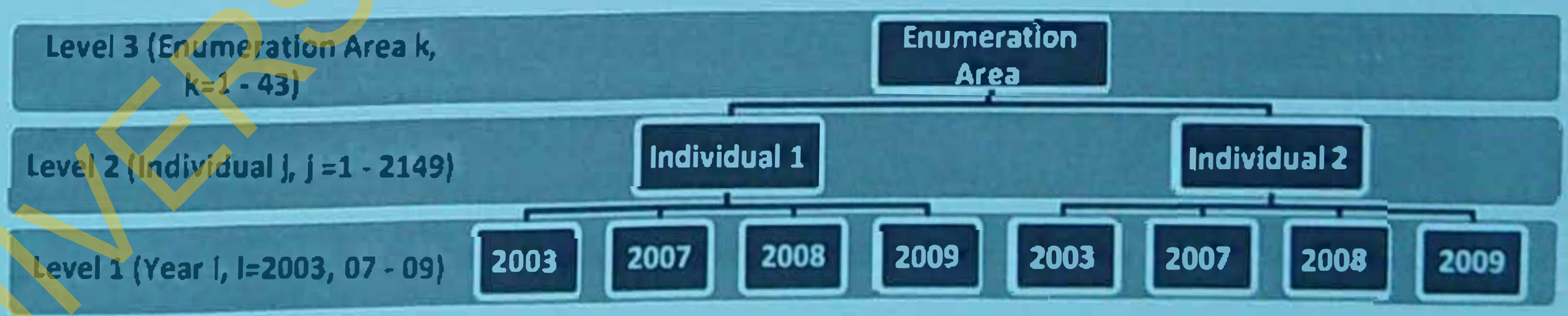

Figure 1: Hierarchical Structure of the data

3.4 Study Variables

3.4.1 Dependent Variable

Depression – MDD (Yes, No) at baseline and follow-up was assessed using the Geriatric Depression Scale (GDS), a scale first developed in 1982 (Yesavage *et al*, 1982). The scale is a well validated instrument. It was found to have a 92% Sensitivity and 89% specificity when evaluated against other diagnostic criteria such as the Hamilton Rating Scale for Depression (HRS-D) and the Zung Self Rated Depression Scale (SDS; Yesavage *et al*, 1982).

The GDS is a commonly used instrument for the assessment of depression among the elderly owing to its simplicity. It comprises 30-itemized questions which are simply answered (yes/no). Of the 30 questions, 20 indicate the presence of depression when answered 'yes' and the remaining ten 1, 5, 7, 9, 15, 19, 21, 27, 29 and 30 respectively indicate depression when answered 'no'. A cumulative score of depression, for each participant, is obtained by assigning 1 to each response indicating depression and 0 otherwise. Cumulative scores within the range of 0 - 9, 10 - 19 and 20 - 30 are considered 'Normal', 'Moderate depression' and 'Severe depression' respectively. For the purpose of this study depression was classified as "yes" for scores in the range of 10 – 30 and "no" for scores in the range of 0 - 9.

3.4.2 Independent Variables

Independent variables were measured at 3 levels as shown below (Figure 2). Variables at level 1 were Year, Age, Marital Status, Chronic Medical Condition, Depression, Self Reported Health, Family Contact, Friends Contact, Family Activity and Community Activity. Level 2 variables were Identity Number and Sex, while level 3 variables were Enumeration Area and Site.

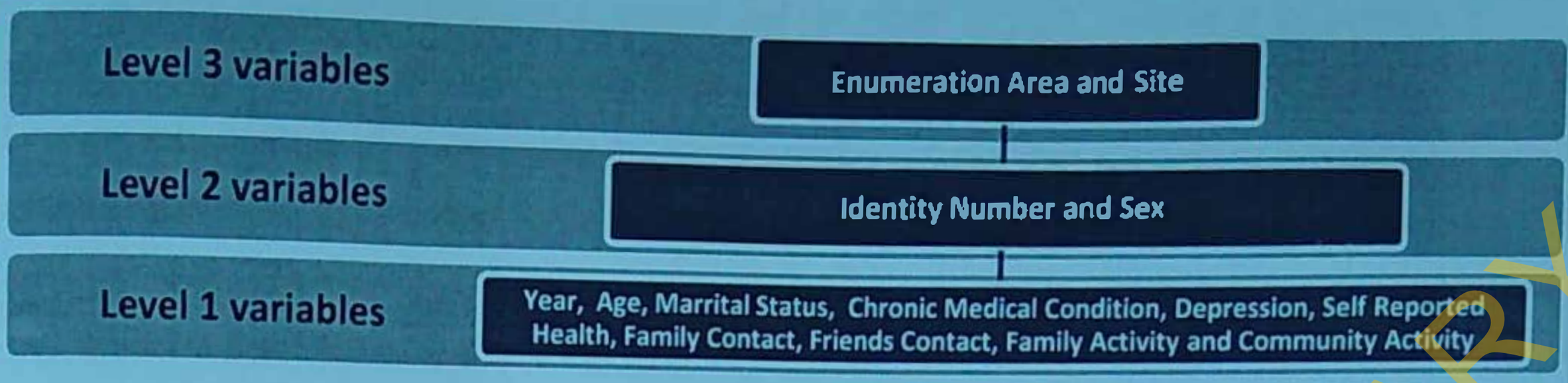

Figure 2: Distribution of the independents variables across the levels

3.4.2.1 Level 1 Variables

Year (2003, 2007, 2008, and 2009) was computed to represent the sequence of measurements of other variables i.e. dependent and independents variables.

Demographic Variables included were Age in years (four categories i.e. 65-69, 70-74, 75-79, and 80+) and Marital Group Status (two categories i.e. Married, Not married).

Health Variables included were Chronic Medical Condition (Yes, No), and Self Reported Quality of Health (Yes, No) which was a self perception of one's own health. Participants were considered to a have Chronic Medical Condition if they have been diagnosed of either Hypertension or Diabetes.

Social Engagement Variables included were Involvement in Family Activities (Yes, No), Involvement in Peoples Activities (Yes, No), Regular Family Contacts (Yes, No) and Regular Friends Contacts (Yes, No).

3.4.2.2 Level 2 (Individual) Characteristics

Identity Number was assigned to each participant during the baseline study.

Demographic Variable included was Sex (Male/Female).

3.4.2.3 Level 3 (Environmental/Area) Characteristics

Environmental level variables identified were Enumeration Areas (1 to 43) and Site representing Residence (three categories i.e. rural, semi-urban, and urban).

A fixed effect variable is of primary interest and the effect of such variable is its average effect in the entire population of elderly Nigerians, expressed by the regression coefficient. Even though, random effects variables are not of primary interest, they are used to investigate differences between individuals and enumeration areas in the effects of fixed effect variables on depression.

On one hand, variables such as Site, Age, Sex, Marital Group Status, Self Reported Quality of Health, Involvement in Peoples Activities, Regular Family Contacts, Regular Friends Contacts, Chronic Medical Condition, and Involvement in Family Activities are considered as fixed effects variables. On the other hand, variables such as Year, Identity Number, and Enumeration Area are considered as random effects variables.

3.5 Data Management and Analysis

3.5.1 Data Management

The point prevalence and proportions of the elderly with major depressive disorder by selected factors was presented frequency tables. Frequency tables were also used to present the distributional pattern of respondents by socio-demographic characteristic while a bar chart was used to present the overall point prevalence of elderly Nigerians with MDD.

Ignoring the hierarchical structure of the data produces both conceptual and statistical problems, as discussed earlier. Therefore, in order to take the clustering of the data into consideration, a three-level logistic model (due to the fact that Depression – the outcome variable was dichotomised) was employed for the analysis.

The type of data structure in this study is generally referred to as the multilevel model of change. The lowest level consists of measurements made on four occasions (i.e. four years) nested within 2149 individuals within 43 enumeration areas. This model requires a repeated measurement or panel design. SPSS version 20 was used to restructure the data from a Multiple-Variable (wide) structure to a Multiple-Record (long) structure. The multilevel logistic model was fitted with STATA version 12.

3.5.2 Model Assumptions and Specifications

3.5.2.1 Model Assumptions

An interesting thing about the assumptions of multilevel models is that they are virtually identical to those for ordinary regression--only that there are more error terms to be evaluated. Failing to meet the assumptions of a proposed statistical model may render the results and conclusions of such analysis invalid. Thus, assessing assumptions is essential to assure that the conclusions are valid.

For the multilevel logistic model for binary response, the major assumptions are:

1) Distributional assumption: y_{ijk} takes on values 0 or 1 (i.e. the probability of success $(y_{ijk} = 1)$ is identical for all individual within clusters). $y_{ijk} \sim \text{Bernoulli}(p_{ijk})$ with a logit link i.e. logit $\{\Pr(y_{ijk} = 1|X_{ijk})\} = \text{logit}\,(p_{ijk})$, (see Equations 1 and 2 below) where p_{ijk} is the systematic component of the model.

2) Observations between clusters are independent, whereas pairs of observations within clusters have a common correlation, i.e. observations within the same individual, as well as, individuals within the same enumeration area are correlated. But observations between different individuals (enumeration areas) are not correlated.

3) The random effects u_{jk} and d_k are normally distributed, with mean zero (i.e. each random effect can be estimated using maximum likelihood) and are independent for different groups.

4) Random effects and model predictors at all levels are independent

In this study, the first assumption held because Depression – the outcome variable, was dichotomised.

It was also assumed that the each individual and area had its own underlying level of depression (at each year) which varied from individual to individual and from enumeration area to enumeration area. This implied a certain correlation structure to the levels and repeated measures in the sense that the random effects u_{jk} and d_k respectively accounted for the interdependencies of the observations within individuals and enumeration areas, therefore the second, third and fourth assumptions held as well.

3.5.2.2 Model Specifications

In the following model specifications, y_{ijk} represents the dependent variable and $X_{ijk} \equiv (x_{1ijk}, x_{2ijk}, \dots, x_{qijk})^T$ is a vector containing Q fixed effect predictors such as Site, Age, Sex, Marital Group Status, Self Reported Quality of Health, Involvement in Peoples Activities, Regular Family Contacts, Regular Friends Contacts, Chronic Medical Condition, and Involvement in Family Activities. Identity Number (represented by $u_{jk} \sim N(0, \sigma_u^2)$) and Area (represented by $d_k \sim N(0, \sigma_d^2)$) are random intercepts which were assumed to be independent of each other varying over the participants (level 2) and the enumeration areas (level 3) respectively. In other words it is assumed that there was a random heterogeneity in participants' underlying risk of MDD that persists throughout the entire duration of the study. The models are all specified as random-intercept. The unconditional and the fixed effects models were given by:

- **An unconditional (empty) random intercept three-level logistic model (Model 0)**

In this model, no predictor is included. It serves as a baseline for comparing other models. It first assesses the mean of the outcome variable and then the amount of outcome variation that exists in intra-, individual and environmental levels. This latter information is important as it helps determine which level (i.e., Level 1, time variant; or Level 2 and 3, time invariant) of predictors to add when fitting the subsequent models. If the variation is high, it suggests that certain amount of outcome variation could be explained by the predictors at that level. This model considers that the overall level of depression is allowed to vary over individuals and enumeration areas with no controlling factors and covariates.

$y_{ijk} \sim$ Bernoulli (p_{ijk}), with

$$\text{logit}\{\Pr(y_{ijk} = 1 | X_{ijk})\} = \text{logit}(p_{ijk}) = \beta_0 + u_{jk} + d_k \quad (1)$$

Here $X_{ijk} \equiv \{\phi\}^T$ is an empty matrix.

- **A three-level logistic fixed effects random intercept model (Models 1, 2 and 3)**

These models consider that the overall level of depression is allowed to vary over individuals and enumeration areas after controlling for other factors and covariates. Fixed effects variables are included in this model:

y_{ijk}~Bernoulli (p_{ijk}), with

$$\text{logit}\{\Pr(y_{ijk}=1|X_{ijk},u_{jk},d_k)\} = \text{logit}(p_{ijk})$$

$$= \beta_0 + \beta_1 x_{1ijk} + \beta_2 x_{2ijk} + \cdots + \beta_q x_{qijk} + u_{jk} + d_k \quad (2)$$

N.B.: Note that there is no term for the level 1 error variance, since in binary variables the variance is completely determined by the mean. It is also worthy to mention that the above models can be viewed as latent-response models which assumed that underlying the observed dichotomous response y_{ijk} (whether the participant is depressed or not), there is a latent continuous response y^*_{ijk}, representing the propensity to be depressed as compared to not being depressed. If this latent response is greater than 0, the observed response is 1:

$$y_{ijk} = \begin{cases} 1 & \text{if } y^*_{ijk} > 0 \\ 0 & \text{otherwise} \end{cases}$$

The model (2) above can then be specified for the latent response y^*_{ijk} as

$$y^*_{ijk} = \beta_0 + \beta_1 x_{1ijk} + \beta_2 x_{2ijk} + \cdots + \beta_s x_{sijk} + u_{jk} + d_k + \epsilon_{ijk} \quad (3)$$

where ϵ_{ijk} is a residual error term that has a logistic distribution with variance $\pi^2/3$.

3.5.3 Different Types of Intra-class Correlation Coefficients for the Latent-Responses

In a two-level logistic model, one can only consider a single intra-class correlation coefficient (ICC) say,

$$\rho \equiv \text{Cor}\left(y^*_{ij}, y^*_{i'j} \middle| X_{ij}, X_{i'j}\right) = \text{Cor}(u_{ij}, u_{i'j}) = \frac{\sigma_u^2}{\sigma_u^2 + \pi^2/3}$$

Unlike the two-level logistic model, one can consider more than 1 type of ICC for pairs of responses in a three-level logistic model:

For the same enumeration area k, but two different participants say j and j', one obtain

$$\rho(\text{en. area}) \equiv \text{Cor}\left(y^{*}_{ijk}, y^{*}_{i'j'k} \middle| X_{ij}, X_{i'j'k}\right) = \frac{\sigma_d^2}{\sigma_u^2 + \sigma_d^2 + \pi^2/3}$$

In contrast for the same participant j (implying the same enumeration area k), one obtain

$$\rho(\text{participant, en. area}) \equiv \text{Cor}\left(y^{*}_{ijk}, y^{*}_{i'j'k} \middle| X_{ij}, X_{i'j'k}\right) = \frac{\sigma_u^2 + \sigma_d^2}{\sigma_u^2 + \sigma_d^2 + \pi^2/3}$$

The ICC (ρ) quantifies the variation within the same participant (enumeration area) (Larsen & Merlo, 2005). In other words, it directly measures the 'closeness' of observations on (in) the same participant (enumeration area) relative to closeness of observations on (in) different participants (enumeration areas). Analogously, ρ can also be thought of as R^2 (the coefficient of determination) in linear regression.

3.5.4 Modelling Procedure for the Analysis of Objective 2 and 3

Model 0: The unconditional random-intercept model (Equation 1 above) was fitted firstly to serve as baseline for comparing other models.

Model 1: In this model, all fixed effects variables at level 1 i.e. age, marital group status, self reported quality of health, involvement in peoples activities, regular family contacts, regular friends contacts, chronic medical condition, and involvement in family activities were included in model 0 in order to develop a fixed effects random-intercept model for level 1 variables.

Model 2: Here, model 1 was adjusted for the fixed effect variable at level 2 i.e. sex. This helped to investigate the extent to which gender influenced the prediction of MDD among ageing Nigerians, over the years.

Model 3: Finally, model 2 was adjusted for the fixed effect variable at level 3 i.e. site. This helped to investigate the extent to which the areas of residence influenced the prediction of MDD among ageing Nigerians, over the years.

Each model, models 0, 1, 2 and 3, determined its respective Individual (level 2) variance σ_u^2 and Enumeration Area / Environmental (Level 3) variance σ_d^2. From these variances, the

variability ρ(participant, en. area) and ρ(en. area) respective to within individual and within area factors predicting MDD were estimated. These enabled to account for the combined effect of all omitted area-specific and subject-specific (time-constant) covariates that caused some areas and subjects to be more prone to depression than others.

The results of the fixed part of the models were presented as odds ratios together with their 95% confidence intervals (95% CI); while for the random part of the models, the ICC for each random effect was presented.

The models were compared, to determine which one of them fit best the data, using the deviance statistic -2 × Log Likelihood (-2LL) test; on the assumption that the model with the least -2LL fit best the data.

CHAPTER FOUR

RESULTS

4.1 Distributional pattern of Respondents by Socio-Demographic Characteristics

4.1.1 Distributional pattern of Respondents by Site

Five hundred and fifty five (25.8%) of the 2,149 participants dwelled in urban areas while the remaining 870 (40.5%) and 724 (33.7%) respectively dwelled in semi-urban and rural areas (Table 1).

4.1.2 Distributional pattern of Respondents by Sex

Of the 2,149 study participants, 1,157 (53.8%) were females while the remaining 992 (46.2%) were males (Table 1).

4.1.3 Distributional pattern of Respondents by Age group

Seven hundred and twelve participants (31.1%) of the 2,149 who took part in the study were in the 65-69 years age group at baseline. The remaining participants were 493 (22.9%), 296 (13.8%) and 648 (30.2%) respectively in the 70-74, 75-79 and 80 years and older age groups (Table 1).

Table 1: Baseline distributional pattern of respondents by socio-demographic characteristics

Characteristic	n (%)
Site	
Urban	555 (25.8)
Semi-urban	870(40.5)
Rural	724 (33.7)
Gender	
Female	1,157 (53.8)
Male	992 (46.2)
Age group (years)	
65-69	712 (31.1)
70-74	493 (22.9)
75-79	296 (13.8)
80+	648 (30.2)
Total	2,149

4.2 Point Prevalence of MDD by Selected Factors among Ageing Nigerians (2003-2009)

At baseline (2003), only 2,081 participants of the 2,149 who took part in the study had complete records. In 2007, 2008 and 2009 only 1,328; 1,030 and 942 participants respectively had complete records. The prevalence of MDD by socio-demographic and health factors at each visit is presented in table 2.

Table 2: Yearly Prevalence of MDD by Selected Factors among ageing Nigerians (2003; 2007-2009)

	Major Depressive Disorder n (%)			
Year	2003	2007	2008	2009
Site				
Urban	146 (27.19)	49 (15.46)	57 (23.95)	73 (32.30)
Semi-urban	281(33.41)	100 (17.73)	99 (22.71)	119 (29.90)
Rural	237 (33.71)	95 (21.25)	113 (31.74)	99 (31.13)
Gender				
Female	345 (31.17)	134 (19.03)	151 (28.22)	169 (34.77)
Male	319 (32.75)	110 (17.63)	118 (23.84)	122 (26.75)
Age group (years)				
65-69	195 (28.89)	22 (10.14)	23 (21.70)	
70-74	149 (31.17)	74 (18.64)	83 (23.99)	76 (24.13)
75-79	93 (31.96)	45 (17.51)	52 (25.87)	87 (33.59)
80+	227 (35.64)	103 (22.54)	111 (29.44)	128 (34.78)
Marital Status				
Married	320 (30.45)	119 (17.98)	106 (21.54)	114 (25.28)
Not married	344 (33.40)	125 (18.77)	160 (30.08)	177 (36.20)
Self reported health				
Bad	110 (63.95)	27 (55.10)	45 (65.22)	28 (60.87)
Good	539 (28.58)	215 (16.97)	219 (23.00)	260 (29.21)
Chronic medical condition				
Bad	261 (42.65)	22 (7.94)	42 (16.15)	
Good	403 (27.43)	222 (21.12)	227 (29.48)	264 (35.44)

4.2.1 General Point Prevalence of MDD among Ageing Nigerians (2003; 2007-2009)

The prevalence of MDD in 2003 was 31.91% (664/2,081). It considerably dropped to 18.37% (244/1328) in 2007 and slightly rose to 26.12% (269/1030) in 2008 and rose further to 30.89% (291/942) in 2009 (Figure 3). An overall combined MDD prevalence of 27.34% was estimated from the yearly prevalence.

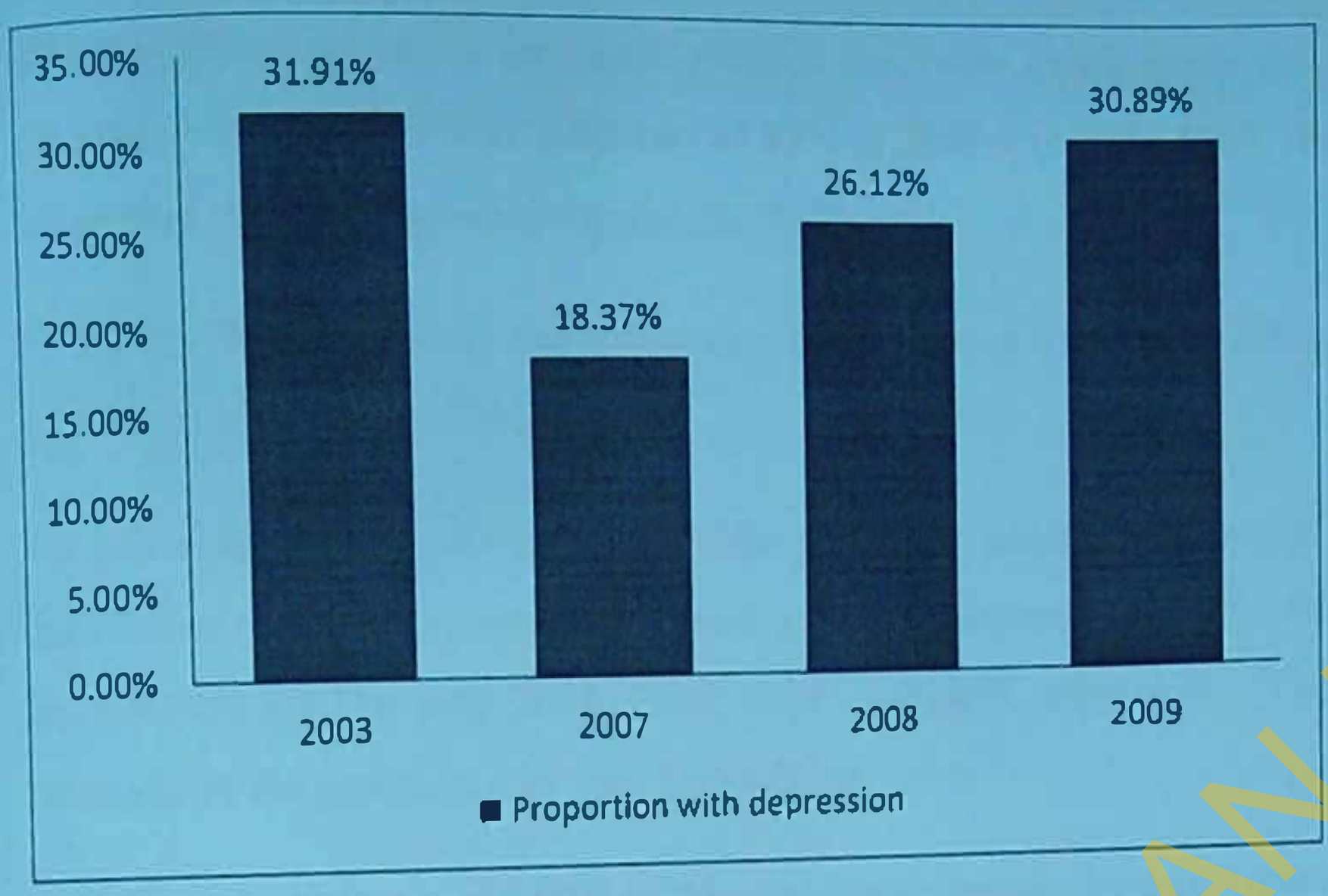

Figure 3: Bar chart of elderly Nigerians with MDD by year

4.2.2 Point Prevalence of MDD by Site among Ageing Nigerians (2003; 2007-2009)

In the urban areas, the prevalence of MDD in 2003 was 27.19%, decreased to 15.46% in 2007 and rose to 23.95% in 2008, to increase further to 32.30% in 2009. Among the semi-urban area dwellers, the prevalence of MDD was 33.41% in 2003, decreased in 2007 to 17.73% and rose to 22.71% in 2008 and increased further to 29.90% in 2009. The prevalence of MDD among rural dwellers in 2003 was 33.71%, decreased to 21.25% in 2007 and rose back to 31.74% in 2008, to slightly drop to 31.13% in 2009 (Table 2).

4.2.3 Point Prevalence of MDD by Gender among Ageing Nigerians (2003; 2007-2009)

Compared to female respondents (31.17%), the prevalence of MDD among male respondents was a bit higher (32.75%) in 2003. In contrast to the baseline prevalence, the prevalence of MDD from 2007 to 2009 was lower for male participants (17.63%, 23.84% and 26.75% respectively) compared to female participants (19.03%, 28.22% and 34.77% respectively). These estimates are found in Table 2.

4.2.4 Point Prevalence of MDD by Age Group among Ageing Nigerians (2003; 2007 - 09)

Among the different age groups, the prevalence of MDD from 2003 to 2008 for respondents in the 65-69 years group was 28.89%, 10.14% and 21.70% respectively; by 2009 there were no more participants from this group.

The prevalence of MDD for participants in the 70-74 years group was 31.17% in 2003, 18.64% in 2007, 23.99% in 2008 and 24.13% in 2009; except in 2007, these estimates were lower than that of the general population of elderly.

In the 75-79 years group, the prevalence of MDD was 31.96% in 2003, 17.51% in 2007, 25.87% in 2008 and 33.59% in 2009.

For participants in the 80 years and older group, the point prevalence of MDD was higher than that of the general population at each year. The estimates were 35.64%, 22.54%, 29.44% and 34.78% for the year 2003, 2007, 2008 and 2009 respectively. Table 2 provides the estimates of the prevalence by year for each age group.

4.2.5 Point Prevalence of MDD by Marital Status among Ageing Nigerians (2003; 07-09)

The prevalence of MDD remained persistently higher at each year for respondents who were not married compared to those who were married. The estimates were 33.40%, 18.77%, 30.08% and 36.20% for the year 2003, 2007, 2008 and 2009 respectively for respondents who were not married compared to 30.45%, 17.98%, 21.54% and 25.28% respectively at each visit for married participants (Table 2).

4.2.6 Point Prevalence of MDD by Self Reported Quality of Health among Ageing Nigerians (2003; 2007-09)

The prevalence of MDD remained persistently higher at each year for respondents who felt that their quality of health was bad compared to those who felt that it was good. The estimates were 63.95%, 55.10%, 65.22% and 60.87% in 2003, 2007, 2008 and 2009 respectively for respondents who reported bad quality of health compared to 28.58%, 16.97%, 23.00% and 29.21% respectively at each year for respondents who reported good quality of health (Table 2).

4.2.7 Point Prevalence of MDD by Chronic Medical Condition among Ageing Nigerians (2003; 2007-2009)

The prevalence of MDD for respondents who had a chronic medical condition was very high in 2003 (42.65%). It reduced drastically in 2007 (7.94%) and then increased to 16.15% in 2008. By the year 2009 there were no more participants from this group.

Whereas among those who did not have a chronic medical condition, compared to those that had, the prevalence of MDD was low (27.43%) in 2003. However, in subsequent years the prevalence of MDD among those who did not have a chronic medical condition became consistently higher than those who had. The estimates were 21.12%, 29.48% and 35.44% in 2007, 2008 and 2009 respectively (Table 2).

4.3 Mixed Effect Logistic Models of the Predictors of MDD among Ageing Nigerians over the Years

Table 3 presents the fixed and random parts estimates for the unconditional, empty or null model (model 0), the model with level 1 fixed effect variables (model 1), the model with level 1 and level 2 fixed effect variables (model 2), and the full model (model 3) comprising fixed effect variables at levels 1, 2 and 3.

Table 3: Multilevel Logistic Models of the Predictors MDD among Ageing Nigerians

FIXED PART	Model 0 OR (95% CI)	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
Level 1 Variables				
Age group				
65-69		Reference	Reference	Reference
70-74		1.01 (0.80-1.25)	1.00 (0.80-1.25)	1.00 (0.80-1.25)
75-79		1.12 (0.87-1.44)	1.11 (0.86-1.43)	1.10 (0.86-1.42)
80+		1.06 (0.84-1.33)	1.05 (0.84-1.33)	1.05 (0.83-1.32)
Marital status				
Married		Reference	Reference	Reference
Not married		1.02 (0.86-1.20)	1.12 (0.90-1.38)	1.12 (0.91-1.39)
Family contact				
Yes		Reference	Reference	Reference
No		2.92 (1.27-6.71)*	2.92 (1.27-6.73)*	2.91 (1.26-6.70)*
Friend contact				
Yes		Reference	Reference	Reference
No		1.31 (1.04-1.65)*	1.32 (1.05-1.66)*	1.32 (1.05-1.67)*
Family activity				
Yes		Reference	Reference	Reference
No		2.08 (1.64-2.65)*	2.08 (1.64-2.64)*	2.07 (1.63-2.63)*
Community activity				
Yes		Reference	Reference	Reference
No		1.91 (1.52-2.40)*	1.92 (1.53-2.41)*	1.93 (1.54-2.43)*
Self Reported Health				
Bad		Reference	Reference	Reference
Good		0.25 (0.19-0.33)*	0.25 (0.19-0.34)*	0.25 (0.19-0.34)*
Chronic medical condition				
Bad		Reference	Reference	Reference
Good		0.88 (0.74-1.05)	0.88 (0.74-1.05)	0.88 (0.74-1.05)
Individual Variable				
Sex				
Female			Reference	Reference
Male			1.17 (0.94-1.45)	1.16 (0.94-1.44)
Environmental Variable				
Site				
Urban				Reference
Semi-urban				1.23 (0.93-1.63)
Rural				1.25 (0.93-1.70)
Intercept	0.32 (0.25-0.39)*	0.92 (0.62-1.35)	0.81 (0.53-1.24)	0.70 (0.44-1.11)
RANDOM PART				
Individual variance σ_u^2 (SE)	0.93 (0.14)	0.68 (0.13)	0.68 (0.13)	0.67 (0.13)
Enum. area variance σ_d^2 (SE)	0.34 (0.11)	0.25 (0.08)	0.25(0.08)	.25 (0.08)
ρ(individual, en. area)	0.28	0.22	0.22	0.22
ρ(en. area)	0.07	0.06	0.06	0.06
Deviance (-2LL)	6034.06	5511.04	5409.00	5406.40

* $p<0.05$; and LL implies Log Likelihood Estimate

4.3.1 The Unconditional Model

In the absence of any predictor but conditioned to individual and environmental (enumeration area) random effect, the value of the intercept (0.32) was statistically significant (OR=0.32, 95%CI: 0.25-0.39).

A variance of 0.93 at the individual level implied an ICC of 0.28 for observations collected on the same participants; that meant, there was a 28% correlation of the 'closeness' of observations on the same participant relative to closeness of observations on different participants within the same area.

Similarly, a variance of 0.34 at the area level implied an ICC of 0.07 for individuals in the same enumeration area; that meant 7% of the differences in the prevalence of MDD among the elderly were attributable to differences between enumeration areas. The deviance (-2LL) of this model was 6034.06 (Table 3).

4.3.2 Model with Level I Characteristics

When all fixed effects variables at level I i.e. age, marital group status, self reported quality of health, involvement in peoples activities, regular family contacts, regular friends contacts, chronic medical condition, and involvement in family activities were included in model 0, the value of the intercept increased to 0.92 and was no more statistically significant (OR=0.92, 95%CI: 0.62-1.35).

There was no statistically significant association of age group with MDD. Compared to respondents in the 65-69 years age group, there were respectively 1% (OR=1.01, 95%CI: 0.80-1.25), 12% (OR=1.12, 95%CI: 0.87-1.44) and 6% (OR=1.06, 95%CI: 0.84-1.33) increased risk to have MDD for respondents in the 70-74, 75-79 and 80+ years groups belonging to the same enumeration area.

Participants who were not married compared to married participants belonging to the same enumeration area were 2% more likely to report MDD (OR=1.02, 95%CI: 0.86-1.20). This association was not statistically significant.

Respondents who did not keep regular contact with family members were 3 times more likely to report MDD compared to respondents, belonging to the same enumeration area, who kept regular family contact (OR=2.92, 95%CI: 1.27-6.71). This association was statistically significant.

There was a statistically significant association of regular friends contact with MDD. Elderly people who did not keep regular contact with friends were 31% more likely to report MDD compared to elderly people, belonging to the same enumeration area, who kept regular contact with friends (OR=1.31, 95%CI: 1.04-1.65).

Respondents who did not participate in family activity were 2 times more likely to report MDD compared to respondents, belonging to the same enumeration area, who participated in family activity (OR=2.08, 95%CI: 1.64-2.65). This association was statistically significant.

In the same manner, respondents with no participation in community activity had 91% higher risk to MDD compared to respondents, belonging to the same enumeration area, who participated in community activity (OR=1.91, 95%CI: 1.52-2.40). This association was statistically significant.

Furthermore, participants who felt good about their quality of health were 4 (1/0.25) times less likely to be diagnosed of MDD compared to participants, belonging to the same enumeration area, who felt bad about their quality of health (OR=0.25, 95%CI: 0.19-0.33). This association was also statistically significant.

Respondents with no chronic medical condition had a 12% lesser risk of MDD compared to respondents, belonging to the same enumeration area, who had a chronic medical condition (OR=0.88, 95%CI: 0.74-1.05). However, this association was not statistically significant.

A variance of 0.68 at the individual level implied an ICC of 0.22 for observations collected on the same participants; that meant, there was a 22% correlation of the 'closeness' of observations on the same participant relative to closeness of observations on a different participant within the same area.

Similarly, a variance of 0.25 at the area level implied an ICC of 0.06 for individuals in the same enumeration area; that meant 6% of the differences in the prevalence of MDD among the elderly were attributable to differences between enumeration areas (Table 3).

Adding level 1 variables to model 0, the deviance (-2LL) reduced from 6034.06 in model 0 to 5511.04 in model 1, meaning that this model fitted the data better than the previous one.

4.3.3 Model Adjusted for Sex

When model 1 was adjusted for sex, the value of the intercept, which decreased to 0.81, was still not statistically significant (OR=0.81, 95% CI: 0.53-1.24).

Except for the fact that participants who were not married compared to a married participants, belonging to the same enumeration area, were now 12% more likely to report MDD (OR=1.12, 95%CI: 0.90-1.38). It was observed that the effect of each level 1 variable, in this model, was much the same as in model 1. However, sex was not found to be statistically significantly associated with MDD (Table 3).

Considering participants who had the same individual effects in their underlying risk of MDD, the odds for male participants was 1.17 (OR=1.17, 95%CI: 0.93-1.42) times as large compared to a female participants.

The variances at both individual and area levels in this model were similar to those observed in model 1. However, the deviance (-2LL) from 5511.04 in model 1 decreased to 5409.00 in model 2, meaning that this model fitted the data better than the previous one.

4.3.3 Model Adjusted for Site

When model 2 was adjusted for site, the value of the intercept, which further reduced to 0.70, was still not statistically significant (OR=0.70, 95% CI: 0.44-1.11).

In this model, the effect of each level 1 and 2 variables was very similar to model 2. However, site was not found to be statistically significantly associated with MDD.

Considering participants who had the same area effects in their underlying risk of MDD the odds for semi-urban area dwellers and a rural area dwellers was respectively 1.23 times (OR=1.23, 95%CI= 0.93-1.63) and 1.25 times (OR=1.25, 95%CI: 0.93-1.70) as large compared to participants dwelling in urban areas.

Furthermore, the deviance (-2LL) decreased from 5409.00 in model 2 to 5406.40 in model 3, meaning that this model fitted the data better than the previous one. Therefore, this model best explained the study (Table 3).

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 Discussion

This study determined and accounted for both area and individual factors predicting MDD among ageing Nigerians. The results revealed that, the overall prevalence of MDD among ageing people living in the Yoruba-speaking states of Nigeria was high. These findings are similar to prevalence of MDD observed in eastern Nigeria (28%) in which the Geriatric Depression Scale (GDS) was also used (Onya and Stanley, 2013). However, compared to studies by Kim, Choe, and Chae (2009) in Korea (63%) these estimates are smaller, but higher when compared to the studies by Peltzer and Phaswana-Mafuya (2013) in South Africa (4%) and the baseline of the ISA (7.1%; Gureje, Kola & Afolabi, 2007). This may be due to the fact that the GDS is not strong enough for complete diagnosis of MDD among the elderly, therefore overestimating the prevalence of MDD in this current study.

The estimates of prevalence in each site, found in this study, were high and are consistent with the ones found by Guerra (2012) in a comparative study of low and middle income countries. The prevalence of MDD was higher in rural areas when compared to urban and semi-urban. This may be due to difficulties encountered by rural dwellers in easy access health care facilities whenever they feel sick. Even so, the prevalence in each site was higher when compared to the estimates obtained by Gureje, Kola and Afolabi (2007).

The prevalence of MDD among male respondents, in this study, was also high and consistent with the prevalence of 30.2% obtained by Afolabi and colleagues (2008). However, the prevalence among female respondents, which was also high in this study, seem lower when compared to the findings of Afolabi and colleagues (2008) and Onya and Stanley (2013) in which it was respectively 68.8% and 80.9%.

The prevalence of MDD across the age groups was consistent with the baseline estimate for each age group obtained by Gureje, Kola and Afolabi (2007). The prevalence of MDD was higher for participants in the 80 years and older age group when compared to other age groups. This is consistent with the fact that MDD among the elderly is often worsened as they increase with age (Onya and Stanley, 2013). It was observed that there were no more

participants in the 65-69 years age group in 2009 likely because of attrition, death or they moved to older age groups.

Prevalence of MDD was far higher among respondents who perceived that their quality of health was bad when compared to those who have good perception of their quality of health. This may be as a result of the severely devastating effects of depression on their quality of health (Fiske, Wetherell & Gatz, 2009). Likewise, prevalence of MDD for respondents who had a chronic medical condition was high. It was observed that in 2009 no participant reported any chronic medical condition probably due to participants' death, attrition, or improvement in health status. However, Peltzer and Phaswana-Mafuya (2013) found lower prevalence of depression among elderly South Africans living with chronic medical conditions. The prevalence of MDD was respectively 3.8%, 11.5%, 16.4%, 6%, 4.3%, 7% and 14.6% for elderly South Africans living with high blood pressure, stroke, angina, diabetes, obesity, arthritis and asthma.

Similar to the study by Gureje, Oladeji and Abiona (2011), this study revealed that social factors, in particular those relating to social isolation, constitute stronger risk of MDD than any other socio-demographic factor. Elderly people who did not keep regular contact with family members were more likely to report MDD compared to elderly people, belonging to the same enumeration area, who kept regular family contact. Respondents who did not keep regular contact with friends were more likely to report MDD compared to respondents, belonging to the same enumeration area, who kept regular contact friends. Respondents who did not participate in family activity were more likely to report MDD compared to respondents, belonging to the same enumeration area, who participated in family activity. In the same manner, respondents with no participation in community activity had higher risk to MDD compared to respondents, belonging to the same enumeration area, who participated in community activity.

Furthermore, as observed by Kim, Choe, and Chae (2009) among the elderly Koreans, this study also show that perceived health status was a significant and powerful factor explaining depression among elderly Nigerians. Participants who felt good about their quality of health were less likely to be diagnosed of MDD compared to a participant, belonging to the same enumeration area, who felt bad about their quality of health.

This study went further to reveal that there was a high correlation of the 'closeness' of

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This study went further to reveal that there was a high correlation of the 'closeness' of observations on the same participant relative to closeness of observations on different

participants within the same area. Likewise, the differences in the prevalence of MDD among the elderly were attributable to significantly high differences between enumeration areas.

5.2 Conclusion

In conclusion, the study revealed that regular family contact, regular friend contact, family activity, community activity, and self reported quality of health were significantly associated with MDD among elderly Nigerians. It was also observed that the effects of individual and environmental factors contributed to the onset of late life depression during the period of study.

Nigeria has the largest population of elderly people over the age of 60 years in Sub Saharan Africa. It is therefore necessary for stakeholders to adequately address various issues affecting the elderly especially these affecting their physical and psychological wellbeing by setting appropriate measures in this regard. In this regard, elderly Nigerians living with depression are therefore advised to engage themselves the more in social activities so as to reduce new onset of depression.

5.3 Recommendation

Accurately identifying risk factors of late life depression will definitely go a long way in preventing early, the onset of this debilitating illness among this underserved population. However, there are some peculiarities of these factors in certain settings which could be accounted for by demographic, social, economic situations and cultural values in these areas. Thus, these need to be considered in order to design appropriate interventions to reduce the occurrence of late life depression.

There is also need for more epidemiologic and clinical research to identify the relative contributions of the risk of depression. But, from a methodological perspective, these studies are to be designed and analysed appropriately. Likewise, it is observed that co-morbid diseases are very common among the elderly, therefore there is need to consider such diseases when developing programmes addressing issues among the elderly people with depression as that will improve their quality of life.

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