LINEAR MIXED EFFECT MODELLING OF FACTORS ASSOCIATED WITH ADOLESCENTS QUALITY OF LIFE

By

ADEGBENRO ABIODUN ADEYINKA

B. Sc. (Hons.) Statistics (Bowen University)

Matric No: 188210

A DISSERTATION SUBMITTED TO THE DEPARTMENT OF EPIDEMIOLOGY AND MEDICAL STATISTICS, FACULTY OF PUBLIC HEALTH, COLLEGE OF MEDICINE, UNIVERSITY OF IBADAN, NIGERIA

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF A MASTERS OF SCIENCE DEGREE (M.Sc.) IN BIOSTATISTICS

November, 2016

LINEAR MIXED EFFECT MODELLING OF FACTORS ASSOCIATED WITH ADOLESCENTS QUALITY OF LIFE

By

ADEGBENRO ABIODUN ADEYINKA

B. Sc. (Hons.) Statistics (Bowen University)

Matric No: 188210

A DISSERTATION SUBMITTED TO THE DEPARTMENT OF EPIDEMIOLOGY AND MEDICAL STATISTICS, FACULTY OF PUBLIC HEALTH, COLLEGE OF MEDICINE, UNIVERSITY OF IBADAN, NIGERIA

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF A MASTERS OF SCIENCE DEGREE (M.Sc.) IN BIOSTATISTICS

November, 2016

CERTIFICATION

I certify that this research work was duly carried out directly under our supervision and also meets the regulations governing the award of the degree of M.Sc. Biostatistics of the Department of Epidemiology and Medical Statistics, Faculty of Public Health, College of Medicine, University of Ibadan.

....

Dr O. M. Akpa.

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

Department of Epidemiology and Medical Statistics,

Faculty of Public Health,

College of Medicine, University of Ibadan.

..........................13/07/2019

Dr R. F. Afolabi.

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

Department of Epidemiology and Medical Statistics,

Faculty of Public Health,

College of Medicine, University of Ibadan.

DEDICATION

To my immediate family, this is for you.

ATTESTATION

I understand the nature of plagiarism, and I am aware of the University's policy on this. I certify that this dissertation reports work by me has not been presented to any other University or body.

Signature.............................. Date.........................

ACKNOWLEDGEMENTS

After an intense period of Learning, I feel blessed to have learnt under great professionals and colleges. The fact that I was associated with these brilliant minds brings me joy. Writing this dissertation has had an enormous effect on me and I would like to reflect on the individuals that helped me through the whole process.

Firstly, I would like to acknowledge my parents Mr Olelekan and Mrs Adekunbi Adegbenro, without whom I would not have existed. For their prayers, love, care, moral and financial supports, God bless them. Their little boy is gradually getting there!

I would like to extend my unprecedented gratitude to my fatherly supervisor, Dr O.M Akpa, for his guidance and love through my program. It still baffles me that a man so simple and easy could be so knowledgeable. To be sincere, I was scared the first time I met him but he turned out to be the best thing that ever happened to me at University of Ibadan. His focus and commitment geared me to the full fulfillment of my potentials. He didn't just teach me academics alone, he taught me in all aspect of life itself. To me he is not just my mentor but a concerned father, a caring brother and a wonderful friend. I feel blessed and rather fortunate that our paths crossed.

My upmost appreciation goes to my loving and approachable Lecturer Dr R.F Afolabi, for his fatherly support and advice since my degree days. His advice made me stick to statistics and I will forever be grateful. Maybe we`ll meet again in Ph.D.

I also appreciate all other lecturers in the Department for the knowledge and skill they passed to me throughout my postgraduate study.

I would like to express my appreciation to my sibling, Barrister Atinuke Abioye Adegbenro, Abayomi Adegbenro, Adebimpe Adegbenro and my little sister Adepeju Adegbenro. Their love kept me going.

To my colleges, Adekunbi Ogunmokun, Olaniyi Olutola, Emeka Nwimo, Owoeye Olamiposi, Akinsanya Adebisi, Adepoju Fatima, Lamidi Wasiu, Aghoghovia Samuel and others that are too numerous to mention I am grateful to you all and I'll miss you dearly.

My unrestricted appreciation goes to my girlfriend Miss Oluwatumininu Adebesin, for her tolerance, support and patience through the years. Your love gives me hope.

Finally, I give all praises, glory, honour and adoration to God Almighty who has been my fortress and shield ever since I was born till now. May His name be praised forever. Hallelujah!

LIST OF ABBREVATION AND ACRONYMS

AIDS	Acquired Immune Deficiency Syndrome
APFI	Adolescents' psychosocial functioning Inventory
AR1	Autoregressive (1)
AYA	Adolescents and Young Adults
BRP	Behaviour and Relationship Problems
CADI	Cardiff Acne Disability Index
CDLQ	Children's Dermatology life Quality
CF	Cystic Fibrosis
CS	Compound Symmetry
DID	Defined Inhabitants per Day
END	Environment Domain
GPD	General Psychosocial Dysfunctions
HAART	Highly Active Antiretroviral Therapy
HIV	Human Immunodeficiency Virus
LME	Linear Mixed Effect
LMIC	Lower-middle-income countries
MEPIN	Medical Education Partnership Initiative in Nigeria
ML	Maximum likelihood
MLR	Multinomial logistic regression
NBS	National Bureau of Statistics
OCD	Obsessive Compulsive Disorder
OCS	Optimism and Coping Strategies
PF	Psychosocial Functioning
PHD	Physical Health Domain
PSD	Psychological Domain
QOL	Quality of life
REML	Restricted maximum likelihood
RNA	Ribonucleic acid
SD	Standard deviation
SES	Socioeconomic status
SPSS	Statistical Package for Social Sciences
SRD	Social Relationship Domain
UN	United Nations
UNICEF	United Nations Children's Fund
VC	Variance Components
WHO	World Health Organization
WHOQOL-BREF	WHO-Quality of Life-BREF

TABLE OF CONTENTS

LIST OF TABLES

ABSTRACT

The world currently consists of 1.2 billion adolescents, which makes 18% of the world's population. Psychosocial or behavioural problem has been attributed to around 20 percent of the world's adolescents. Adolescents have been seen to be affected by depression which is the largest contributor to the global burden of disease, with suicide being one of the three leading causes of mortality in them. This study was conducted to investigate the effect of psychosocial functioning and socio-demographic factors on the quality of life of Adolescents using a linear mixed effect model.

A secondary data which was gotten from a cross sectional study conducted among adolescents in Benue state Nigeria was used in this study. The adapted WHO-Quality of Life was administered to 2,095 Secondary school adolescents between the ages of 10-19years to assess their psychosocial functioning and Quality of life of whom 63% were within the ages of 13-17 years. The Adolescents psychosocial functioning inventory (APFI) was used to assess the adolescents' psychosocial functions. Chi square and multinomial logistic regression were used to assess the effect of selected socio demographics on the QOL. Also, linear regression was used to assess the effect of psychosocial functions on the QOL. A linear mixed effects model was used to model the effect of the psychosocial functions on the QOL considering the selected socio demographics, using different methods of estimation and different covariance structures.

A complete data of 1963 adolescents was extracted. The participants were 14.71±2.05 years with males being slightly older (14.82±2.19) than females (14.58±1.86). Majority of the adolescents came from monogamous families (67.9%) with (74.8%) of their parents staying together. The study findings showed that family status (X^2 =5.45, P= 0.02) had an effect on the QOL, also, mother's highest level of education had a significant effects on the QOL of adolescents (OR=0.63, 95%C.I=0.40-0.98). Adolescents whose mothers have no formal education were 37% times less likely to have a Poor QOL relative to Adolescents whose mothers have some kind of formal education using High QOL as the reference. Akaike's information criterion was used to select the best fit linear mixed effect model. The best fit model used the restricted maximum method of estimation with the variance component covariance structure. In this model Optimism Coping Strategy (OCS) and General Psychosocial Dysfunctions (GDP) were significant (p=0.01, p= <0.001, AIC= 15386.898) respectively while the Behavior and relationship problems (BRP) was not significant.

The results suggested that only OCS, GDP, family status and mother's highest level of education have significantly effects on the QOL of adolescents and that restricted maximum likelihood with variance components provided the best model.

Keywords: Adolescents Quality of life, Psychosocial functioning, Multinomial Logistic Regression, Linear mixed effect modeling.

Word count: 444

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Adolescents definition by the World Health Organization and United Nations, are individuals aged 10-19 years (WHO, 2014). The world currently consists of 1.2 billion adolescents, which makes up to 18% of the world's population. A large percentage (88%) of adolescents are situated in the developing world, with more than half living in South Asia or East Asia and Pacific region (David and Brazier, 2011).The Quality of Life (QOL) is defined as the condition of complete or a full physical, mental, and social wellbeing and not just the absence of disease or frailty (Post, 2014).

In this phase of life, iniquities are often glaring. Unfortunately, some inequalities prevent the poorest and most marginalized adolescents from progressing their education with secondary schooling, and it predisposes them to such protection abuses like early sex, child marriage and violence, thereby, hindering them from reaching their potential to the fullest capacity. If denied their rights to basic things like quality education, protection, health care and participation, adolescents may remain or become impoverished, neglected, excluded and disempowered – which increases the risk that the same incidence will also occur to their children.

Previously, focus was on the prevention of communicable disease of childhood which has yielded significant improvement in that regard. Now leaders all over the world are recognizing the importance of addressing and focusing on the second decade of life, adolescence, for the sustainability and consolidation of the previous achievements made during the first ten years of children's lives (David and Brazier, 2011).

The link between the complete dependency of childhood and the total independence of adulthood is represented by this important phase of life. The period of adolescence is characterized by enormous changes brought into existence by the interplay of hormones during puberty.

Although, the survival of children is threatened in many areas during their earliest years for example, by infectious diseases, birth complications and under-nutrition, mortality rates for adolescents aged 10–14 is the lowest compared to any other age cohort. Rates for young people aged 15–24, while slightly higher, are still low. Females have lower rates of mortality in adolescence than males, though the difference in industrialized countries is much more marked than in developing countries. However, AIDS, accidents, early pregnancy, unsafe abortions, risky behaviours such as tobacco consumption and drug use, mental health issues and violence are some of the risks to adolescent survival and health. (UN 2008; David and Brazier, 2011).

Psychosocial or behavioural problem has been attributed to around 20 percent of the world's adolescents. People aged 15–19 have been seen to be affected by depression which is the largest contributor to the global burden of disease, with suicide being one of the three leading causes of mortality among people aged 15–35 (David and Brazier, 2011). Seventy one thousand adolescents are estimated to globally commit suicide annually, with forty times as many attempting suicide. Before age 14, about half of adolescents' lifetime mental disorders begin, which increases to 70 per cent by age 24. In the past 20–30 years, the prevalence of mental disorders among adolescents has increased; which is ascribed to disrupted family structures, increasing youth unemployment and families' utopian educational and vocational aspirations for their children (David and Brazier, 2011).

A small minority of young people with mental health problems receive basic assessment and care, while most suffer needlessly, unable to access appropriate resources for recognition, support and treatment in many countries. Most mental health needs are unmet, even in wealthier societies and in many developing countries despite the substantial progress in developing effective interventions, the rate of unmet need is nearly 100 per cent. Thus, the issue of psychosocial problems in young people presents a major public health challenge worldwide. The development and progression of mental disorders can be forestalled by preventive efforts, and early intervention can minimize their severity. The early recognition of Young peoples' mental health needs makes them function better socially, perform better in school and are more likely to develop into well-adjusted and productive adults than those whose needs are unmet. (WHO 2001, 2005, 2008, 2009 and Patel, Vikram, et al 2007).

Nigeria has an estimated population of 174 million people, and about 22% of these are adolescents, accounting for an adolescent population of 38 million. Amazingly, this number is greater than the entire population of Canada, and more than the sum of the estimated population of Benin, Niger, and Chad, which are the three northernmost boundaries of Nigeria. (Central

Intelligence Agency, 2014; United Nations Children's Fund Statistics, 2011). This is a large population whose health needs must be known, because the effects of poor health during the teenage years can last for a lifetime.

1.2 Problem statement

Adolescents are currently 18 per cent of the world's population, but they receive far less attention on the world stage than their percentage merit. The gap of information on psychosocial functioning and quality of life of children and adolescents with no known health problems is a big limitation. When considering the effect of this limitation, there is a tendency to measure the impact of psychosocial functioning on the quality of life of well-functioning adolescents: teenagers with no known health problems. Adolescents are the healthiest of the population, with their leading causes of their deaths being accidents, suicide and homicide (Brown et al, 2002).

Not only the quality of life of adults but also the quality of life of children and adolescents can be viewed as an important outcome criterion when evaluating medical interventions within the medical health services system. The use of medical assistance affects not only somatic, but also emotional and social parameters, it is therefore important to investigate the state of children and adolescents from their own point of view (Ravens-Sieberer et al., 2014). Although research on quality of life (QOL) in adults has progressed over recent years, quality of life in children has not been extensively researched. The positive and healthy psychosocial development is influenced by some factors, which could be individual or ecological (Bronfenbrenner 2001, 2005; Ravens-Sieberer, 2007).

Several factors influence the quality of life of children and adolescents. These factors (some) can be categorized into two which are social characteristics and personal characteristics. Furthermore, studies on the subjective well-being of children and adolescents are recent and should place emphasis on the relationship between demographic variables (e.g. age, gender, family type and socioeconomic status), intrapersonal characteristics (e.g. self-concept, self-esteem, extraversion, locus of internal control, life orientation stile, optimism versus negativism) and health behaviors (Gaspar & Matos, 2008; Gaspar, Matos, Ribeiro and Leal, 2006; Gaspa, 2009; Gaspar et al., 2009, 2010).

In addition, the prevalence of psychosocial disorder among adolescents has increased in the past 20–30 years; this increase is ascribed to impeded family structures, increasing youth unemployment and families' unrealistic educational and vocational aspirations for their children. (David and Brazier, 2011)

Finally, timely psychosocial interventions can make important mollifying contributions to mood disorders like depression and anxiety as well as behaviour problems. Therefore, it is ever so important to assess the psychosocial functioning of children and adolescents for early detection of disorders and provide appropriate interventions (Akpa, Bamgboye and Baiyewu 2015).

1.3 Justification

Adolescents experience many changes in their interactions with their family, peers, society, and themselves (Choudhoury et al., 2006). Adolescents are stronger and healthier compared to younger children, having already benefited from basic education. This group of individuals is among the hardest and potentially most costly to reach with protection and essential services. It hardly seems sagacious in these fiscally restricted times, to focus greater attention on them (UNICEF, 2011).

Adolescent health was chosen as a topic for this research due to the many changes that presents themselves during this crucial period as a precursor to overall well-being in adult life. Understanding the factors that influence how adolescents' psychosocial well-being is affected may guide in the formation of interventions to reduce the risk of a bad impact (Maldonado 2012). While only a few studies on the quality of life of children and adolescents are available for reference, studies on the socio-demographic indicators or determinants are not available, especially in developing countries (Gbiri and Akingbohungbe, 2011). A study assessing the QOL and Psychosocial Functioning (PF) of adolescents in Nigeria using Linear mixed effect model (Random effects) are completely unavailable in literature.

In addition, a rationale for socio-behavioral or biomedical research is so that it results to discovery of information that can guide the effective implementation and delivery of appropriate preventive and therapeutic services to the particular population studied (Folayan et al. 2015). Therefore, research on factors associated with adolescents' quality of life can lead to the development of interventions that can maximize adolescents' potentials.

1.4 Objectives

1.4.1 Broad objectives:

Using Linear mixed effect model to investigate the effect of psychosocial functioning (fixed effect) and socio-demographic factors (random effect) on the quality of life of Adolescents.

1.4.2 Specific objectives:

i) To determine whether there is a significant variation in the quality of life of Adolescents across selected socio-demographic disparities.

ii) To investigate the effect of psychosocial functioning on quality of life.

iii) To assess the mixed effect model that accurately describes the quality of life of Adolescents in Benue state.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Adolescence is a period of emotional, physical, and social development (Balkrishnan et al., 2006). The Quality of Life (QOL) of children and adolescents is a concern amongst health professionals and is just being recently examined (Koot, 2002). Children and Adolescents' QOL perceptions are influenced by several factors which vary from personal and family factor to demographics (e.g. age, gender and socio economic status), (Caldera and Hart, 2004).

2.2 Adolescents quality of life specific to disease conditions or life situation

2.2.1 Hiv and aids estranged adolescents

The enormity of the HIV epidemic in Sub-Saharan Africa has deprived many children of their parents. According to UNICEF, over 12 million children have lost a single or both parents due to AIDS in this area of the world (UNICEF, 2006).

Most of these children are taken care of in the extended family or the community. Usually, grandparents, aunts and uncles become or continue to be caregivers (Foster 2002; Williamson, Foster et al. 2005). The impact of HIV on the mental and social health status of children has been explored in studies and project activities. A particular focus in Africa has been the consequences of parental loss and orphanhood on the well-being of children. The findings of these studies as well as reports declaring that the entire African continent is reeling under a state of orphan crisis, however, are ambiguous and not easily interpreted.

Many sources highlight that AIDS related distress of children starts before becoming an orphan. The lengthy exposure to malady and suffering of a beloved person endangers the healthy development of a child. Living with and taking care of parents dying from AIDS can be a source of severe distress.

Furthermore, the ill parent(s) might not be able to provide adequate nutrition and care for the child. Children often face the hardship of losing both parents in a short period of time. The progressive illness or the parental death might lead to school dropout because the child must do farm work so as to contribute to the household income (Behrendt and Serigne, (2008); Mallmann et al., 2003; Ueyama et al., 2007).

2.2.2 Orphanhood

Several studies confirmed that orphans have been supported well in the past by the traditional social security system. However, more recent studies from regions with prevalence rates above 10% highlight that the steadily rising number of orphans in some communities have led to severe economic difficulties for foster families.

As they struggle to support children, they look to disadvantage fostered ones and to give better treatment to their biological offspring. Also, reports show that orphans are likely to be more exposed to poverty, exploitation, abuse, malnutrition and that orohans also have poorer access to health care and schooling than non-orphans (World Bank, 2002; USAID 2013; UNICEF 2004; UNAIDS 2006; Ueyama et al., 2007).

Also, in 2003, UNICEF reported that orphans are generally poorer and less healthy than their non-orphaned counterpart (UNICEF, 2003). The review of the existing literature, however, clearly shows that results vary across data sources. A study from South Africa, for instance, showed negative relationships between orphanhood and school enrollment and also between orphanhood and health status (Case and Ardington, 2006). Studies from other countries such as Kenya (health) and Rwanda (school enrollment), on the contrary, could not confirm these findings (Lindblade et al., 2003; Chatterji et al., 2005). The comparison of orphans and non-orphans by using data from the Demographic and Health Surveys from Sub-Saharan countries couldn't also reveal significant differences between orphans and non-orphans (Ainsworth and Filmer, 2006).

Furthermore, Ueyama highlights that longitudinal studies are more likely to detect negative correlations between orphan-status and schooling results than cross-sectioned studies. It was also observed that maternal death negatively impacted school enrolment and health than paternal death (Ueyama, 2007).

The impact of the loss of parents and possible hardships of life as an orphan on the mental health of children has been investigated with the help of a comparative approach in several studies. In these surveys, orphans are matched up to non-orphans in order to be able to evaluate the impact of parental loss. Three studies applying such a design were conducted in Uganda.

The first, conducted in 1996 in the Rakai district investigated the psychological effect of orphanhood in a sample of 193 children. According to their findings, non-orphans were more cheerful about the future while orphans showed significantly higher levels of depression. Despite higher levels of depression, however, orphans reported better adjustment capacity than non-orphans. The results were interpreted as having a benefit-driven bias by participants because they feared losing assistance from the non-governmental organization that financed the study, preferred giving a positive image of the orphaned children (Sengendo and Nambi 1997).

The second study, implemented in two districts of Kampala investigated the impact of AIDS-related parental loss on the self-esteem of children and on their sociability behaviours at school. A sample size of 70 orphans was compared with a sample of 70 non-orphans. Orphans and non-orphans differed not in terms of relationships (sociability) at school; orphans had even marginally higher skills than non-orphans counterpart. Also, in terms of self-confidence, on the other hand, orphans scored notably lower than non-orphans (Kiirya, 2005).

In the third study, 123 orphans were compared to a control sample of 110 children in rural Uganda with their ages ranging from 11 -15 years. Results showed that orphans have greater level of anxiety, depression and anger compared to non-orphans (Atwine et al., 2005).

A study in Tanzania compared 41 orphans aged between 10 and 14 to the same number of non-orphans. The research team found similar results as the third study in Uganda. The orphans had significantly higher scores on the applied internalizing problem scale measuring mood, pessimism, somatic symptoms, anxiety, sense of failure, emotional links and suicidal tendencies than the non-orphans (Makama et al., 2002).

In addition, all studies regarding either social or psychological impact of parental loss have been carried out in East and countries in the southern part of Africa. The results of surveys looking into social factors are inconsistent and should rather be presented by country or even by regions within a country. Policy reports generalizing insights from one particular area to the entire African country could be misleading.

2.2.3 Epilepsy estranged adolescents

Epileptic children and adolescents had lower levels of wellbeing and functioning in psychological, social, physical, family and school domain in comparism to healthy controls (Miller et al., 2003; Montanaro et al., 2004; Modi et al., 2009; Haneef et al., 2010; Baca et al., 2010).

The emotional response of adolescents to a chronic illness like epilepsy may differ across cultures. Adequate monitoring, education targeting the reduction of felt stigma, and family intervention programs are needed for early intervention (Adewuya and Ola 2004).

2.2.4 Quality of life of adolescents with cystic fibrosis (CF)

The expectation of life of individuals with CF has increased to 33 years. Therefore, issues like quality of life and psychological wellbeing, which were previously thought not to be of much importance compared to physical well-being, are now seen as cogent factors.

Young people who were diagnosed late and those who are not close to their families may need additional psychosocial support. Although, young people scored highly on the QOL scale, family bonds, expressiveness and organization were seen to associate with better psychological functioning in them. Adolescents affected by CF were seen to psychologically function well and to be well-adjusted. (Szyndler et al., 2005).

2.2.5 Quality of life of adolescents affected by cancer

Adolescents and young adults (AYA) who survived cancer experience lots of unique challenges and QOL effects that lasts beyond cancer diagnosis and treatment. Cancer treatments and continuous improvements in technology have resulted in improved survival rates, the late effects identification and issues relating to survivorship with QOL moving to the forefront of cancer research. Compared with the general population, AYA cancer survivors were more likely to have worse or impaired QOL, heedless of other socio demographic factors. Although health care professionals were likely to underestimate or overestimate the health preferences and support needs of AYAs, these perceptions varied across disciplines and levels of experience. (Quinn et al., 2015).

2.2.6 Childhood depression and quality of life

Researchers in Nigeria (Gbiri and Akingbohungbe (2011); Adewuya et al., (2008); Olisah et al., (2011)) have analyzed the causal relationship between childhood depression and quality of life. The occurrence of depression in childhood and adolescence can negatively impact development, school and work performance. It can also substantially increase the risk of substance abuse and suicide (Brown et al., 2008).

Adolescents had significantly higher scores in health, community, participation, emotional and productivity domains. After controlling for age and gender, the higher the depression scores, the lower the educational attainments of the participants. Poor QOL was predicted by depression, seizure frequency at presentation and seizure frequency at onset and age. Seizure frequency was also predicted by parents' socio-economic status. (CA Gbiri and Akingbohungbe, 2011).

2.2.7 Acne in relation to quality of life of adolescents

Acne presents itself as a significant adolescent problem which may lead to emotional and psychological effects. The implications for acne treatment and impact of acne on psychological parameters are not fully understood. Acne has a significant impact on QOL and self-esteem (Dunn et al., 2011).

However, Acne was seen to be more prevalent and severe in boys compared to girls in a study involving 600 high school students and was 63.6 percent prevalent in the population (Uslu G et al., 2008). Another cross sectional survey was done among 200 Adolescents aged 15-18 years in which the Children's Dermatology life Quality Index (CDLQI) and the Cardiff Acne Disability Index (CADI) were used in which Acne was reported in 83 percent of the participants. It was concluded that acne significantly affects QOL in some participants (Walker et al., 2006).

2.3 Studies involving the psychosocial functioning of adolescents specific to disease conditions and life situations

Sil et al., (2013) explored the influence of family environment on long-term psychosocial functioning of adolescents with juvenile fibromyalgia (JFM). They found that adolescents with JFM from controlling family environments are at an increased risk of poorer emotional functioning. Also, In an investigation among indian students Singh et al investigated the mental health and psychosocial functioning in adolescents. They found that 46.4% of the adolescents flourished, 51.2% had moderate metal health, and only 2.4% languished. It was also discovered that a higher number of female and younger adolescents flourished compared to male and older adolescents.

Futhermore, Adnan Adil and saba Ghayas in 2008 assessed the impact of parental death on adolescents' psychosocial functioning. They found that adolescents who lost a parents reported extreme psychosocial problems compared to those who had both parents existing. In addition, Lewinsohn et al., (2003) researched on the psychosocial functioning of young adults who have experienced and recovered from major depressive disorders during adolescents and discovered that adolescent major depressive disorder had an association with most young adult functioning measures and these associations were not owing to interactions with adolescent comorbidity, but deviations in global functioning and mental health treatment were as a result of major depressive disorder recurrence.

2.4 Chi square test

This starts by assuming there is no relationship between two variables and the alternative hypothesis that a relationship exists between the two variables. The chi square statistic is given by

$$\chi^2 = \sum_i \frac{(O_i - E_i)^2}{E_i}$$

Where,

O_i is the observed number of cases in each cell of the cross classification table, this represents the number of participants that take on each of the various combinations of values for the two variables. Chi square assumes that observations are independent of each other.

E_i is the expected number of cases in each cell of the cross classification table.

Many researchers have used chi square test in various fields (Akpa and Bamgboye, (2015); Vilar et al., (2015); Methúsalemsdóttir, (2013); Yamaguchi et al., (2013)). Particularly, Vilar et al aimed at comparing the quality of life, self-esteem and other psychosocial variables among adolescents with and without acne vulgaris and found that the median score of the QOL in children's dermatology index differed amongst students with and without acne vulgaris.

2.5 Multiple Linear Regression

The Multiple Linear Regression is an extension of the normal linear regression. It is simply a Linear Regression but with two or more indicator variables (Rollin Brant, 2007). The Model is given by:

$$y_{ij} = \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 \ldots \beta_n x_n + \varepsilon_{ij}$$

Where:

y_{ij} = The Outcome or Dependent variable.

$x_1 \ldots x_n$ = The Predictor or Independent variables

$\beta_1 \ldots \beta_n$= The Coefficients

ε_{ij} = Error term.

Assumptions:

Multiple linear regression has some certain assumption which are very important. The population mean of the dependent variable within strata defined by the independent variables follows an additive linear pattern and is normally distributed. Also the dependent observations are assumed to be statistically independent (Brant, 2007).

In a study done in (2013) by Giannakopoulos et al. to examine the relationship between parental health status and health related quality of life of adolescents taking into consideration some other variables like the role of gender, socioeconomic status, presence of chronic medical needs and social support on the relationship. A multiple linear regression was used to assess the set of covariates that best explains the adolescents QOL.

2.6 Multinomial Logistic regression (MLR)

Multinomial logistic regression (MLR) is the linear regression analysis to conduct when dealing with a nominal dependent variable with more than two levels (polytomous). It is an extension to Binary logistic regression which has just two categories (dichotomous). Multinomial logistic regression (MLR) is a predictive analysis which describes and explains the relationship which occurs between a nominal outcome variable and continuous or categorical predictors. The MLR estimates a different binary logistic regression model for each of those dummy variables. This results in a K-1 binary logistic regression models. Each model depicts the effect of the indicator on the probability of success in that category comparing to the reference category. Each model has its own intercept and regression coefficients which permits the indicators to affect each category differently (Grace-Martin, 2016). This model is given by:

$$Logit(y_i = 1) = ln\left(\frac{p(y=1)}{p(y=k)}\right) = \beta_1 X_i$$

$$Logit(y_i = 2) = ln\left(\frac{p(y=2)}{p(y=k)}\right) = \beta_2 X_i$$

...

$$Logit(y_i = k) = ln\left(\frac{p(y=k-1)}{p(y=k)}\right) = \beta_{k-1} X_i$$

Exponentiating both sides and solving for probabilities we got:

$$p(y_i = 1) = p(y = k)e^{\beta_1 Xi}$$

$$p(y_i = 2) = p(y = k)\, e^{\beta_2 Xi}$$

...

$$p(y_i = k - 1) = p(y = k)e^{\beta_{k-1} Xi}$$

Considering the fact that sum of all probability of all k=1

$$p(y_i = k) = \frac{1}{1+\sum_{k=1}^{k-1} e^{\beta_k Xi}}$$

Then find the other probabilities:

$$p(y_i = 1) = \frac{e^{\beta_1 Xi}}{1+\sum_{k=1}^{k-1} e^{\beta_k Xi}}$$

$$p(y_i = 1) = \frac{e^{\beta_2 Xi}}{1+\sum_{k=1}^{k-1} e^{\beta_k Xi}}$$

...

$$p(y_i = k-1) = \frac{e^{\beta_{k-1} X i}}{1+\sum_{k=1}^{k-1} e^{\beta_k X i}}$$

Assumptions

The model assumes that outcome variables cannot be precisely predicted from the indicator variables of any case. It also assumes that the independent variables have a single value for each case that is the data is case specific.

In 2003, Peng and Nichols used the MLR to predict adolescents behavioral risks and found that gender, dropping from school intension, the structure of the family, self-esteem and emotional risk were significant predictors collectively.

2.7 Studies involving linear mixed effect modeling (LME)

2.7.1 Studies involving socio-economic and socio-demographic status

Researchers are often faced with the collection of correlated data in applied sciences. This comprehensive term encompasses a wide range of data structures, such as multivariate observations, repeated measurements, longitudinal data, clustered data and spatially correlated data (Verbeke and Molenberghs, 2000; Maldonado, 2012).

Maldonado investigated the impact of family socioeconomic status (SES) and maternal self-esteem on Adolescent self-esteem development, the impact of anxiety disorders on adolescent self-esteem development and explored the efficacy of religious service attendance in reducing depressive symptoms using LME which was used to model the self-esteem trajectory over time, with age considered as the time variable. The approach was taken given that the continuous outcome, self-esteem, was measured repeatedly over time.

Self-esteem measurements for each participant were expected to be correlated which makes the LME model the most appropriate because it takes into account both within-subject variation and between-subject variation.

He came up with a basic Linear Mixed Effects models with random-effects for both intercept and slope as:

$$yij = (\beta_{0i} + b_{oi}) + (\beta_1 + b_{1i})age_{ij} + e_{ij},$$

Where, $e_{ij} \sim N(0, \sigma^2)$.

To determine any potential influence on self-esteem development, Gender, race and SES were then added to the model as fixed covariates.

He concluded that self-esteem increased over time by 0.08 units each year and also that there were no significant gender differences in the effect of any anxiety (overanxious disorder, Obsessive–Compulsive Disorder (OCD), simple phobia, social phobia and separation anxiety disorder) on self-esteem. No SES or race differences in the anxiety effect on self-esteem were also found. For more results, please refer to Lizmarie Gabriela Maldonado, 2012.

Also, in an hypothesis generating analysis aimed to determine which clinical and demographic variables were associated with weight gain during extended treatment with risperidone, Calarge et al., 2012 used mixed regression to investigate weight gain over the long-term risperidone treatment period in children and adolescents. Risperdal is the trade name for Risperidone which is an antipsychotic medication used in treating bipolar disorder, schizophrenia, and irritability in individuals with autism (Hasnain,Vieweg, Hollet, 2012). The effect of risperidone dose was seen to reduce as treatment extended while the effect of psychostimulants appeared more significant, also the rate of change in weight z score before and within the first 12 weeks of the use of the treatment, birth weight, physical activity, parental weight, dietary intake and postnatal growth did not independently predict future changes (Calarge et al., 2012). For more results please check Calarge et al., 2012

2.7.2 Studies involving medication use and disease enlightenment

Girma et al., 2011 aimed at illustrating the use of mixed-effects models to study country-specific outpatient antibiotic use in Europe, using quarterly and yearly antibiotic use. The paper focused on the outpatient use of Tetracyclines for the period 1997–2009 with the observed country-specific trends for yearly and quarterly tetracycline use in the defined inhabitants per day (DID). Mixed effect model was used so as to shed light into the pattern of antibiotics use in Europe. Correlations among measurements done on the same experimental unit was modeled using random effects and through the additional specification of a covariance structure. Different countries observations were assumed to be independent and correlation was expected to exist in observations within countries (Girma et al., 2011). The model was defined as:

$$Yij = (\beta_0 + b_{oi}) + (\beta_1 + b_{1i})t_{ij} + \varepsilon_{ij}$$

$$b_i \sim N(0, D)$$

Where,

β_0 is the global intercept (average outpatient tetracycline use in Europe in 1997)

β_1 is the global slope describing the marginal linear time trend (t) of the time series (average change in outpatient tetracycline use DID per year in Europe from 1997 to 2009)

$b_i = (b_{1i}, b_{0i})$ is a vector of country-specific random effects (for intercept and slope)

ε_i is a vector of unexplained error terms ε_{ij} (independent and normally distributed with mean vector zero and covariance matrix $\sum_i$)

The trend of tetracycline overall use decreased significantly, there was a strong positive relationship between the random intercept and random slope for amplitude, which indicated that countries with higher tetracycline use at the baseline are observed to have high seasonal variation. They also identified significant differences in total outpatient tetracycline use between countries in Europe. (Girma et al., 2011)

In a study done to elucidate linear mixed effects models in a way of understanding the association between alcohol consumption and the progression of HIV/AIDS by Finucane et al., 2007 a LME model was applied to a previously published dataset of HIV infected individuals with a history of alcohol problem who are receiving highly active antiretroviral therapy (HAART). (Finucane et al., 2007)

A model which had RNA (Ribonucleic acid) levels as the outcome was proposed. The model was illustrated by considering a study with only two time-points and two levels of drinking. In this study, subject's predicted log (RNA+1) level at time-point j would be given by:

$$E(RNA_{ij}|t_i, drk_{ij}, b_i) = \beta_0 + \beta_1 t_{i1} + \beta_2 t_{i2} + \beta_3 drk_{ij} + b_{0i} + b_{1i} t_{ij}$$

β_0 is the average intercept of the population.

t_1 and t_2 are dummy variables for time; β_1 and β_2 being their associated fixed effect regression parameters.

$drk_{ij} = 1$ if the person used alcohol at time j, $drk_{ij} = 0$ if person i abstained at time j; β_3 describes the population effect of alcohol use on log(RNA +1) levels.

b_{0i} is the subject i's random intercept.

b_{1i} is subject i's random slope.

The results depicted a significant interaction between alcohol use and adherence to HAART with subjects who use alcohol and are not fully adherent to their HIV medications having higher log RNA (Ribonucleic acid) viral load levels than fully adherent non-drinkers, fully adherent alcohol users, and non-drinkers who were not fully adherent (Finucane et al., 2007).

2.8 Reliability of the Adapted WHO Quality of Life-BREF (WHOQOL-BREF) and the Adolescents Psychosocial Functioning Inventory (APFI)

The psychometric validation of the WHOQOL-BREF has attracted the attention of health researchers. The studies from these researches yielded different results (Min et al., 2002). Catro et al., (2007) and Usefy et al., (2008) tested the internal consistency of the domains and reported that it yielded a satisfactory Cronbach's alpha (0.92 and 0.82 respectively). And in a study done on adolescents the Cronbach's alpha yielded low results but after dropping negatively scored items.it rose significantly (Atwasthi et al., 2010).

Furthermore, in a study done by Akpa, Bamgboye and Baiyewu in 2015, the cronbachs alpha was used as a tool to assess the reliability of the items and subscales of the APFI. It yielded an overall reliability of the APFI scale (0.83) with the three subscales: Optimism and Coping Strategy (OCS), Behaviour and Relationship Problems (BRP), and General Psychosocial Dysfunctions (GPD) yielding (0.59 for OCS, 0.57 for BRP and 0.90 for GPD).

CHAPTER THREE

METHODS

3.1 Study design

A secondary data analysis from a cross-sectional survey funded by Fogarty international through the Medical Education Partnership Initiative in Nigeria (MEPIN) in 2012 Benue state, North Central Nigeria among adolescents in the state.

3.2 Study area

Primary survey was done in Benue state involving a Local Government Area from each of her senatorial districts. These districts are Wannune, Vandekeya, Oju and Makurdi (the state capital).

Benue state is a 34,059Km^2 area situated at the North central geo political zone of Nigeria. It is the 7^{th} most populous state in Nigeria which in the 2006 population census had an estimated 4.3million people (Wikipedia, 2015). The state has 23 local government areas with youths within the ages of 15-35years making up half of her total population. (NBS, 2012).

3.3 Study population

An adapted WHO-Quality of Life-BREF (WHOQOL-BREF) was administered to 2,095 Secondary school adolescents between the ages of 10-19years to assess their psychosocial functioning and Quality of life.

3.4 Data collection

The Data was drawn from a cross sectional study conducted among Benue state adolescents in Nigeria. Relevant data such as socio demographics and Quality of life (Adapted WHO-QOL BREF) (Skevington et al., 2004) were drawn with respect to each adolescent.

Also the Adolescents' psychosocial functioning Inventory (APFI) (Akpa and Gbamgoye, 2015) was used to assess the psychosocial functioning of the adolescents.

3.5 Measures

Two instruments used in this study were gotten from a study sponsored by the Medical Education Partnership Initiative in Nigeria (MEPIN) project. These instruments are the Socio-Demographic characteristics of respondents and an adapted World Health Organization Quality of Life-Bref (WHOQOL-BREF). In addition, the APFI subscales were used also to assess the psychosocial functioning of Adolescents.

3.5.1 Socio-Demographic characteristics of respondents

A demographic survey questionnaire was completed by respondents which included socio demographics such as: Current Age, Gender, Religion, Area of residence, Tribe, Family types, Family status, Father's level of education, Father's occupation, Mother's level of education and Mother's occupation. These socio-demographics could have an impact on the Quality of life of these Adolescents.

3.5.2 The Adolescents Psychosocial Functioning Inventory (APFI)

The Adolescents' psychosocial functioning Inventory (APFI) (Akpa and Gbamgoye 2015) is a 23 items instrument in which 3 main subscales were extracted from. The Adolescents' Psychosocial Functioning Inventory (APFI) addresses relevant challenges and expectations of adolescents in the Lower-middle-income countries (LMIC) settings. The APFI was constructed to bridge the gap in knowledge that most of the existing measures of psychosocial functioning among adolescents are developed outside LMIC. It consists of three subscales which are: Optimism and Coping Strategies (OCS), General Psychosocial Dysfunctions (GPD) and Behaviour and Relationship Problems (BRP). The items were measured on a 3-points Likert-type response scale where 0 = not at all, I = sometimes and 2 = very often.

3.5.3 APFI Method of scoring

The WHOQOL BREF scoring was used in assigning scores to the domains of the APFI. After all items were re-coded a raw score was calculated for each item and domain. These scores were generated through a simple arithmetic addition of the items within each domain to give a domain raw score. The raw scales were then transformed to a 0-100 scale to allow for easy interpretation (WHO, 1996; WHO, 1998; Issa and Baiyewu, 2006). The following formula was used for the transformation:

$$\text{Transformed scale} = \left[\frac{(\text{Actual raw score} - \text{Lowest possible raw score})}{\text{Possible raw score range}}\right] * 100 \qquad (i)$$

Univariate and bivariate analyses were performed by changing the transformed QOL scores into three categories using the mean ($\bar{X}$) and standard deviation (SD). These categories are 'Poor' (if score $<\bar{X} - SD$), 'Moderate' (if $\bar{X} - SD \leq score \leq \bar{X} + SD$) and 'High' (if score $\geq \bar{X} + SD$) (Issa and Baiyewu, 2006). And to ease the purpose of bivariate analysis, these scores were further dichotomized using the mean ($\bar{X}$) and standard deviation (SD) into 'Poor' (if score $< \bar{X} - SD$) and 'Good' (if score $\geq \bar{X} - SD$).

3.5.4 Adapted WHO Quality of Life-BREF. (WHOQOL-BREF)

The WHO defines QOL as 'an individual's perception of their position in life in the context of the culture and value systems in which they live, and in relation to their goals, expectations, standards and concerns'(WHO,1994). The WHOQOL-BREF has good to excellent psychometric properties of its reliability and performed well in initial tests of validity (Skevington et al., 2004). An adapted form of the World Health Organization Quality of life-BREF (WHO-BREF) was used to assess the QOL of the respondents. It is a 24 item questionnaire which consists of four domains. These domains are: The Physical Health Domain (PHD), Social Relationship Domain (SRD), Psychological Domain (PSD) and Environment Domain (END) with seven, three, six and eight items respectively.

3.5.5 WHOQOL BREF Method of scoring

The WHOQOL BREF scoring was also used in assigning scores to the domains of the adapted WHOQOL BREF. The items were re-coded and a raw score was also calculated for each item and domain. The scores were generated using a simple arithmetic addition of the items within each domain to give a domain raw score. The raw scales were then transformed to a 0-100 scale to ease interpretation using equation (i) above.

3.6 Data management and statistical techniques

For this study only adolescents within the ages of 10-19 were considered for analysis. Information for 132(6.3%) of the students who were above 19 years were excluded from the analysis which resulted in a sample size of 1,963 students.

SPSS was also used for descriptive statistics. Normality of the extracted variables was assessed to know if they are appropriate for a multivariate analysis through Skewness and Kurtosis.

$$\text{Transformed scale} = \left[\frac{(Actual\ raw\ score - Lowest\ possible\ raw\ score)}{Possible\ raw\ score\ range}\right] * 100 \qquad (i)$$

Univariate and bivariate analyses were performed by changing the transformed QOL scores into three categories using the mean ($\bar{X}$) and standard deviation (SD). These categories are 'Poor' (if score $<\bar{X} - SD$), 'Moderate' (if $\bar{X} - SD \leq score \leq \bar{X} + SD$) and 'High' (if score $\geq \bar{X} + SD$) (Issa and Baiyewu, 2006). And to ease the purpose of bivariate analysis, these scores were further dichotomized using the mean ($\bar{X}$) and standard deviation (SD) into 'Poor' (if score $< \bar{X} - SD$) and 'Good' (if score $\geq \bar{X} - SD$).

3.5.4 Adapted WHO Quality of Life-BREF. (WHOQOL-BREF)

The WHO defines QOL as 'an individual's perception of their position in life in the context of the culture and value systems in which they live, and in relation to their goals, expectations, standards and concerns'(WHO,1994). The WHOQOL-BREF has good to excellent psychometric properties of its reliability and performed well in initial tests of validity (Skevington et al., 2004). An adapted form of the World Health Organization Quality of life-BREF (WHO-BREF) was used to assess the QOL of the respondents. It is a 24 item questionnaire which consists of four domains. These domains are: The Physical Health Domain (PHD), Social Relationship Domain (SRD), Psychological Domain (PSD) and Environment Domain (END) with seven, three, six and eight items respectively.

3.5.5 WHOQOL BREF Method of scoring

The WHOQOL BREF scoring was also used in assigning scores to the domains of the adapted WHOQOL BREF. The items were re-coded and a raw score was also calculated for each item and domain. The scores were generated using a simple arithmetic addition of the items within each domain to give a domain raw score. The raw scales were then transformed to a 0-100 scale to ease interpretation using equation (i) above.

3.6 Data management and statistical techniques

For this study only adolescents within the ages of 10-19 were considered for analysis. Information for 132(6.3%) of the students who were above 19 years were excluded from the analysis which resulted in a sample size of 1,963 students.

SPSS was also used for descriptive statistics. Normality of the extracted variables was assessed to know if they are appropriate for a multivariate analysis through Skewness and Kurtosis.

Variables having their estimates of Skewness and Kurtosis between ± 1 and ± 1.5 respectively were seen to be normally distributed. The statistical methods used for the analysis are:

3.6.1 Chi square analysis

Chi square was used for bivariate analysis which was done to assess the association between Socio demographic variables like Gender, Area of residence, Family status, Father's highest level of education, Mother's highest level of education and Quality of life and its significance. The quality of life was categorized into Poor QOL and Good QOL to ease this analysis.

3.6.2 Multiple Linear Regression

An analysis was done to assess the effects of Age, Optimism and Coping Strategies (OCS), General Psychosocial Dysfunctions (GPD), Behaviour and Relationship Problems (BRP) of the participants on the QOL. The outcome variable was the Quality of Life and the predictors were the Age, OCS, GDP and BRP. This is depicted by the following model:

$$\text{Quality Of Life} = \beta_1 Age + \beta_2 OCS + \beta_3 GDP + \beta_4 BRP + \varepsilon$$

Where:

y_{ij} = The Adolescents Quality of Life

$\beta_1 \ldots \beta_4$ = The Coefficients

$x_1(Age)$ = Age of Adolescent

$x_2(OCS)$ = Optimism and Coping Strategies (OCS)

$x_3(GDP)$ = General Psychosocial Dysfunctions (GPD)

$x_4(BRP)$ = Behaviour and Relationship Problems (BRP)

3.6.3 Multinomial Logistic regression (MLR)

Multinomial logistic regression was used for multivariate analysis. The analysis was done to see if there is an association between Socio demographics like Area of Residence, Family status, Father's highest level of education, Mother's highest level of education and three categories of Quality of life. These Categories are Poor QOL, Moderate QOL and Good QOL. Poor QOL was used as the reference category for this analysis.

3.7 Statistical model

Correlated data sometimes arise in statistical analyses, this may be due to the grouping of subjects or to repeated measurements on each subject over time, or to multiple related outcome measures at one point in time. Mixed model analysis gives a general and flexible approach in these situations, due to the fact that it allows correlation patterns to be explicitly modeled (Jiang 2007). Linear mixed-effects model is an extension of the linear regression model for data that are collected and summarized in groups. The model describes the relationship between an outcome variable and independent variables, having coefficients that can vary with respect to one or more grouping variables.

A mixed-effects model consists of two parts which are the fixed effects and random effects. Fixed-effects terms are usually the typical linear regression part, and the random effects are associated with individual experimental units drawn at random from a population (Fikret, 2011; Verbeke and Molenberghs, 2000).

The random effects have prior distributions whereas fixed effects do not. Mixed-effects models can represent the covariance structure connected to the grouping of data by associating the common random effects to observations with the same level of a grouping variable. The standard form of a linear mixed-effects model is:

$$y = X\beta + Zb + \varepsilon$$

Where

- y - the n-by-1 response vector, and n is the number of observations.
- X - an n-by-p fixed-effects design matrix.
- β - a p-by-1 fixed-effects vector.
- Z - an n-by-q random effectS design matrix.
- b - a q-by-1 random-effects vector.
- ε - the n-by-1 observation error vector.

Linear mixed effects (LME) models simply models the fixed and random effects as having a linear form. It can accommodate complex features of longitudinal data such as between-subject variation, within-subject variation, time dependent covariates and missing data whereas traditional methods are limited by statistical assumptions (Davis, 2002). More importantly, the approach allows for explicit modeling of the variation between subjects and within subjects. Similar to the General Linear Model, a response variable is contributed to by additive fixed and random effects (and an error term). Using the familiar notation, the linear mixed effect model takes the form:

$$y_{ij} = \beta_1 x_{1ij} + \beta_2 x_{2ij} \dots \beta_p x_{pij} + b_{i1} z_{1ij} + b_{i2} z_{2ij} \dots b_{ip} z_{pij} + \varepsilon_{ij}$$

Where:

- $y =$ is the value of the outcome variable for a particular ij case
- $\beta_1 \dots \beta_p$ =The fixed effect coefficients(similar to regression coefficients)
- $x_{1_{ij}} \dots x_{p_{ij}}$ = are the fixed effect variables (predictors) for observation j in group i (usually the first is reserved for the intercept/constant; $x_{1ij} = 1$)
- $b_{i1} \dots b_{ip}$ = are the random effect coefficients which are assumed to be multivariate normally distributed
- $z_{1_{ij}} \dots z_{p_{ij}}$ = are the random effect variables (predictors)
- ε_{ij} = is the error for case j in group i where each group's error is assumed to be multivariate normally distributed.

After the model specification, the model parameters were then estimated through the following model:

$$y_{ij} = \beta_1 x_{1ij} + \beta_2 x_{2ij} \dots \beta_p x_{pij} + b_{i1} z_{1ij} + b_{i2} z_{2ij} \dots b_{ip} z_{pij} + \varepsilon_{ij}$$

Where:

- y = Adolescent's score on the quality of life scale.
- $\beta_1 \dots \beta_p$ = The APFI coefficients (The fixed effect coefficients)
- $x_{1_{ij}} \dots x_{p_{ij}}$ = The OCS,GDP and BRP of the particular adolescent(the fixed effects)
- $b_{i1} \dots b_{ip}$ = Coefficients of the socio demographic variables (The random effect coefficients)

- $z_{1_{ij}} \dots z_{p_{ij}} =$ The Area of Residence, Family Status, Father's Highest level of Education and Mother's Highest level of Education of the particular adolescent (the random effects)
- $\varepsilon_{ij} =$ The adolescent error.

3.7.1 Assumptions of LME

The linear mixed-effects model must satisfy some assumptions, it assumes that the observations follow a linear regression in which some of the regression parameters are fixed (the same for all subjects), while others are random (specific to each subject) (Verbeke and Molenberghs, 2009).

The random-effects follow a normal distribution with mean zero and general covariance matrix D (Davis, 2002; Verbeke and Molenberghs, 2009). The error terms also follow a normal distribution with mean zero and covariance $\sigma^2 I$ where I is the identity matrix. Lastly, the random-effects are independent of each other and of the error terms (Davis, 2002; Verbeke and Lesaffre, 1996). That is, the covariance between the random-effects and the error terms is zero.

3.8 Methods of parameter estimation

The Restricted maximum likelihood (REML) and the maximum likelihood (ML) are the two common methods for parameter estimation. These methods are based on maximizing the marginal likelihood function (Verbeke and Molenberghs, 2009).

3.8.1 Maximum likelihood method for parameter estimation (ML)

This method of estimation contains both regression coefficients and the variance components (fixed-effects and random-effects) terms in the likelihood function. This has the conditional response of the response variable y given α, b, φ and σ^2 as

$$y \mid b, \alpha, \varphi, \sigma^2 \sim N(X\alpha + Zb, \sigma^2 I_n)$$

And the likelihood of y given α, φ and σ^2 is

$$P(y \mid \alpha, \varphi, \sigma^2) = \int P(y \mid b, \alpha, \varphi, \sigma^2)\, P(b \mid \varphi, \sigma^2) db,$$

Where

$P(y \mid \varphi, \sigma^2) = \frac{1}{(2\pi\sigma^2)^{q/2}} \frac{1}{|D(\varphi)|^{1/2}} \exp\left\{-\frac{1}{2\sigma^2} b^T D^{-1} b\right\}$ and

$$P(y|\ b,\alpha,\varphi,\sigma^2) = \frac{1}{(2\pi\sigma^2)^{n/2}} \exp\left\{-\frac{1}{2\sigma^2}(y - X\alpha - Zb)^T(y - X\alpha - Zb)\right\}.$$

Assuming $\wedge(\varphi)$is the lower triangular cholesky factor of $D(\varphi)$ and $\Delta(\varphi)$is the inverse of $\wedge(\varphi)$. Then,

$$D(\varphi)^{-1} = \Delta(\varphi)^T\Delta(\varphi).$$

Define

$$r^2(\alpha, b, \varphi) = b^T\Delta(\varphi)^T\Delta(\varphi)b + (y - X\alpha - Zb)^T(y - X\alpha - Zb).$$

And assuming b^* is the value of b that satisfies

$$\frac{\partial r^2(\alpha,b,\varphi)}{\partial b} \quad \frac{\partial r^2(\alpha,b,\varphi)}{\partial b}\Big|_{b^*} = 0$$

for given $\beta$and φ. Then, the likelihood function is

$$P(y|\ \alpha,\varphi,\sigma^2) = (2\pi\sigma^2)^{-n/2}|\ D(\varphi)|^{-1/2} \exp\left\{-\frac{1}{2\sigma^2}r^2(\alpha, b^*(\alpha),\varphi)\right\}\frac{1}{|\ \Delta^T\Delta+Z^TZ|^{1/2}}.$$

$P(y|\ \alpha,\varphi,\sigma^2)$ is first maximized with respect to α and σ^2 for a given φ. Thus the optimized solution $\hat{\alpha}(\varphi)$ and $\hat{\sigma}^2(\varphi)$ are gotten as functions of φ. Then, Substituting these solutions into the likelihood function procedures $P\big(y|\ \hat{\alpha}(\varphi),\varphi,\hat{\sigma}^2(\varphi)\big)$. The expression is called a profile likelihood where α and $\sigma^2(\varphi)$ have been profiled out. $P\big(y|\ \hat{\alpha}(\varphi),\varphi,\hat{\sigma}^2(\varphi)\big)$ is a function of φ, and the algorithm then optimizes it with respect to φ. After it finds the optimal estimate of φ, the estimates of α and σ^2 are given by $\hat{\alpha}(\varphi)$ and $\hat{\sigma}^2(\varphi)$.

The ML method treats coefficients as fixed but unknown quantities when the variance components are estimated, but does not take into account the degrees of freedom (DF) lost by estimating the fixed effects. This causes ML estimates to be biased having smaller variances. Nevertheless, an advantage of ML over REML is that it is possible to compare two models in terms of their fixed and random effects terms. If REML is used to estimate the parameters, only two models can be compared, which are nested in their random-effects terms, with the same fixed effects design.

3.8.2 Restricted Maximum likelihood method for parameter estimation (REML)

Restricted maximum likelihood estimation contains only the variance components, which is the parameters that parameterize the random-effects terms in the linear mixed-effects model. The β coefficient is estimated in a second step. Assuming uniform improper prior distribution for β and integrating the likelihood $P(y|\ \alpha, \varphi, \sigma^2)$ with respect to β results in the restricted likelihood $P(y|\ \varphi, \sigma^2)$. That is,

$$P(y|\ \varphi, \sigma^2) = \int P(y|\ \alpha, \varphi, \sigma^2)\, P(\alpha) d\alpha = \int P(y|\ \alpha, \varphi, \sigma^2)\, d\alpha.$$

The algorithm first profiles out $\hat{\sigma}_R^2$ and maximizes remaining objective function with respect to φ to determine $\hat{\varphi}_R$. The restricted likelihood is then maximized with respect to σ^2 to determine $\hat{\sigma}_R^2$. Then, α is estimated by finding its expected value with respect to the posterior distribution

$$P(\alpha|\ y, \hat{\varphi}_R, \hat{\sigma}_R^2)$$

REML accounts for the degrees of freedom lost by estimating the fixed effects, and makes a less biased estimation of random effects variances. The estimates of φ and σ^2 are less sensitive to outliers in the data and invariant to the value of α compared with ML estimates. Using REML to estimate the parameters can only compare two models that have the identical fixed-effects design matrices and are nested in their random effects terms.

3.8.3 Covariance structures

There exist a handful of covariance structures but for this analysis, the following covariance structures were used (IBM, 2013):

I) **Variance component (VC)**

This was done to make each variance differ, and all covariances = 0. It is the standard variance components and is the default for most statistical softwares.

$$\begin{bmatrix} \sigma_A^2 & 0 & 0 \\ 0 & \sigma_B^2 & 0 \\ 0 & 0 & \sigma_{AB}^2 \end{bmatrix}$$

II) Autoregressive(1) AR(1)

The AR(1) structure was used so as to have homogeneous variances and correlations that decline exponentially with distance. This means that the variability that occurs in a measurement was constant irrespective of when it was measured. It also means that two measurements that are right next to each other in time are going to be closely correlated (depending on the value of ρ), but that as measurements get farther and farther apart they are less correlated.

$$\begin{bmatrix} 1 & \rho & \rho^2 \\ \rho & 1 & \rho \\ \rho^2 & \rho & 1 \end{bmatrix}$$

III) Compound symmetry (CS)

In this structure, the variances are homogenous and there is a correlation between two separate measurements but the correlation is constant regardless of how far apart the measurements are.

$$\begin{bmatrix} \sigma^2 + \sigma_1^2 & \sigma_1^2 & \sigma_1^2 \\ \sigma_1^2 & \sigma^2 + \sigma_1^2 & \sigma_1^2 \\ \sigma_1^2 & \sigma_1^2 & \sigma^2 + \sigma_1^2 \end{bmatrix}$$

IV) Unstructured

This structure was used so as to allows every term to be different which makes it the most permissive of all the covariance structures.

$$\begin{bmatrix} \sigma_1^2 & \sigma_{12} & \sigma_{13} \\ \sigma_{12} & \sigma_2^2 & \sigma_{23} \\ \sigma_{13} & \sigma_{23} & \sigma_3^2 \end{bmatrix}$$

V) Toeplitz

This structure was used to allow all measurements next to each other have the same correlation but measurements two apart have the same correlation different from the first and likewise measurements three apart have the same correlation different from the first two and so on. The AR(1) is a special case of this structure but its correlations do not necessarily have the same pattern as in the AR(1).

$$\begin{bmatrix} \sigma^2 & \sigma_1 & \sigma_2 \\ \sigma_1 & \sigma^2 & \sigma_1 \\ \sigma_2 & \sigma_1 & \sigma^2 \end{bmatrix}$$

3.9 Exploratory Data Analysis

A scatter plot was done through SPSS to assess the overall direction of the raw data because it is important to note if the trend is linear or nonlinear. In this case, the data was linear.

3.9.1 Model Building Process

A linear model was fitted to the data. This resulted from the result of the exploratory data analysis which showed that the data is in a linear form. The random effects were established and then the fixed effects were added to form a mixed effect model. Then through significance testing, model comparison (through Akaike's Information Criteria, AIC) and relevance of covariates, a final model was achieved.

CHAPTER FOUR

RESULTS

4.1 Socio-demographic characteristics of Participants

The complete data for a total of 1963 participants was extracted. Participants were 14.71±2.05 years with Males being slightly older (14.82±2.19 years) than females (14.58±1.86 years). Most of the respondents were in their mid-adolescence (63.0%) with only a few (9.5%) in their late adolescence.

Table 4.1 shows that Male participants were 54% of the total population while Female were 46%. Majority of the respondents came from Monogamous families (67.9%) with (74.8%) of their parents staying together. Adolescents who live in urban areas were slightly more than half of the total population (52.2%).

Table 4.1: Socio demographic distribution of Respondents (N=1963)

Variable		Frequency	Percentages (%)
Gender			
	Male	1065	54.3
	Female	895	45.7
Age			
	Early Adolescents(<13 years)	541	27.6
	Mid-Adolescents(13-17years)	1236	63.0
	Late Adolescents(18-19 years)	186	9.5
Religion			
	Christianity	1880	96.3
	Islam	69	3.5
	Others	3	0.2
Tribe			
	TIV	1124	57.8
	Idoma	142	7.3
	Igede	375	19.3
	Others	304	15.6
Area of Residence			
	Rural Area	882	47.8
	Urban Area	965	52.2
Family type			
	Monogamy	1289	67.9
	Polygamy	608	32.1
Family Status			
	Parents are together	1427	74.8
	Parents are divorced	81	4.2
	Parents live apart	136	7.1
	Single parent	265	13.9
Father's highest level of education			
	No formal education	225	11.9
	Primary	227	12.0
	Secondary	447	23.7
	Tertiary	704	37.2
	Others	287	15.2
Mother's highest level of education			
	No formal education	289	15.3
	Primary	367	19.5
	Secondary	486	25.8
	Tertiary	521	27.6
	Others	222	11.8
Father's occupation			
	Farming	641	33.4
	Trading	149	7.8
	Civil servant	742	38.7
	Emlpoyee of private organisation	144	7.5
	Others	242	12.6
Mother's occupation			
	Farming	619	32.5
	Trading	532	27.9
	Civil servant	442	23.2
	Emlpoyee of private organisation	126	6.6
	Others	188	9.9

4.2 Variation in the quality of life of participants across socio demographic disparities

Table 4.2 shows the association between socio demographics and two categories of the QOL of adolescents. In this table, the Area of residence ($X^2 = 1.64$, p = 0.20), Father's level of education ($X^2 = 2.05$, p = 0.15) and Mother's level of education ($X^2 = 2.34$, p = 0.13) did not significantly influence the quality of life of participants. Only family status ($X^2 = 5.45$, p = 0.02) influenced the quality of life of respondents in which Adolescents whose parents were together and had Poor QOL were more (80.1%) than Adolescents with Poor QOL whose parents are not together (19.9%). Adolescents whose parents are together and had Good QOL were more (73.4%) compared to Adolescents with Good QOL but their parents are not together (26.6%).

Table 4.2 Variation in the quality of life of participants across socio demographic disparities

Socio demographics	Good QOL (%)	Poor QOL (%)	X^2	P value
Gender				
Male	868(53.3)	169(59.5)	3.81	0.051
Female	762(46.7)	115(40.5)		
Area of Residence				
Rural Area	115(44.1)	746(48.3)	1.64	0.20
Urban Area	146(55.9)	797(51.7)		
Family Status				
Parents are together	221(80.1)	1172(73.4)	5.45	0.02*
Parents are not together	55(19.9)	424(26.6)		
Father's highest level of education				
No formal education	26(9.4)	196(12.5)	2.05	0.15
Some kind of formal education	250(90.6)	1377(87.5)		
Mother's highest level of education				
No formal education	34(12.3)	249(15.9)	2.34	0.13
Some kind of formal education	242(87.7)	1315(84.1)		

4.3 Multinomial Logistic Regression of the association between Socio demographics and Quality of Life of participants

In Table 4.3, the result for the multinomial logistic regression was presented. Among the adolescents, the odds of having a Poor QOL was significant in adolescents whose mothers have no formal education relative to adolescents whose mothers had some kind of education (OR=0.63, 95%CI=0.40-0.98). That is, adolescents whose mothers have no formal education were about 37% less likely to have a poor QOL relative to adolescents whose mothers have some kind of formal education background. As shown in the table, other associations were not significant.

Table 4.3 Multinomial Logistic Regression of the association between Socio demographics and the Quality of Life of participants

Socio demographics	β	S.E	P value	OR	95% C.I
Area of Residence: Rural					
Poor QOL	-0.28	0.16	0.09	0.76	0.55-1.04
Moderate QOL	-0.15	0.13	0.25	0.86	0.67-1.11
Family Status: Parents are together					
Poor QOL	-0.23	0.19	0.23	1.26	0.86-1.84
Moderate QOL	-0.13	0.15	0.39	0.88	0.66-1.18
Father's highest level of education: No formal education					
Poor QOL	-0.40	0.26	0.12	0.67	0.40-1.11
Moderate QOL	-0.05	0.19	0.79	0.95	0.65-1.38
Mother's highest level of education: No formal education					
Poor QOL	-0.46	0.23	0.04	0.63	0.40-0.98*
Moderate QOL	-0.22	0.17	0.18	0.80	0.58-1.11

Reference category: High QOL,

"*" signifies significance

4.4 Assessing the effect of Age and Psychosocial functioning on the Quality of life of participants

Table 4.4 shows the effects of the Age of respondents and the different domains of the adolescents psychosocial functioning Inventory on the different domains of the adapted WHOQOL-Bref and the overall QOL of respondents. The Age ($p = 0.05$), Optimism and Coping Strategy ($p = 0.001$) and General Psychosocial Dysfunctions ($p < 0.001$) significantly affected the overall QOL of participants. Only Behaviour and Relationship Problems ($p = 0.32$) had no significant effect on the overall QOL Respondents. The Age and APFI domains also had a significant effect on the PHD, PSD and the END domains of the Adapted WHOQOL-Bref. Also, Age and GDP had no significant effect of the SRD domain of the adapted WHOQOL-Bref but the OCS and BRP domains had significant effects.

Table 4.4 Assessing the effect of Age and Psychosocial functioning on Quality of Life of Participants

OL	AGE		Psychosocial functioning					
			OCS		GDP		BRP	
	β (95%CI)	P	β (95%CI)	P	β (95%CI)	P	β (95%CI)	P
HD	-0.69(-1.24,-0.13)	0.02	-0.06(-1.41,-0.20)	0.009	-0.22(-1.17,-0.79)	<0.001	-0.001(-0.72,0.68)	0.96
SD	-0.45(-0.87,-0.03)	0.04	-0.03(-0.82,0.12)	0.148	-0.08(-0.40,-0.12)	0.001	0.03(-0.24,0.85)	0.27
RD	-0.20(-0.72,0.33)	0.46	-0.08(-1.61,-0.43)	0.001	-0.004(-0.20,0.17)	0.86	0.05(0.09,1.46)	0.03
ND	-0.56(-1.06,-0.07)	0.03	-0.08(-1.60,-0.49)	<0.001	-0.10(-0.57,-0.23)	<0.001	0.01(-0.46,-0.82)	0.58
ER LL OL	-0.46(-0.91, -0.002)	0.05	-0.83(-1.34 , -0.32)	0.001	0.49(-0.65 , -0.34)	<0.001	0.30(-0.29 – 0.88)	0.32

4.5 Linear mixed effect model

4.5.1 Linear Mixed effect model of Psychosocial functioning and Socio demographics using Maximum likelihood method of estimation and Variance Components Covariance structure.

Table 4.5.1 shows four models with each model having a socio demographic as the random effect. OCS (p= 0.003, <0.001, 0.001, 0.002) and GPD (p= <0.001, <0.001, <0.001, <0.001) were seen to affect the QOL but BRP had no significant effect on the QOL.

Table 4.5.1 Linear Mixed effect model of Psychosocial functioning and Socio demographics using Maximum likelihood method of estimation and Variance Components Covariance structure.

Variable	Model 1		Model 2		Model 3		Model 4	
	β (95%CI)	P	β (95%CI)	P	β (95%CI)	P	β (95%CI)	P
Fixed Parts								
OCS	-0.79 (-1.31,-0.27)	0.003	-0.94 (-1.44,-0.42)	<0.001	-0.88 (-1.40,-0.36)	0.001	-0.83 (-1.35,-0.32)	0.002
GPD	-0.52(-0.68,-0.36)	<0.001	-0.52(-0.68,-0.36)	<0.001	-0.49(-0.65,-0.33)	<0.001	-0.48(-0.64,-0.32)	<0.001
BRP	0.25(-0.35-0.86)	0.402	0.23(-0.39,0.83)	0.441	0.30(-0.30-0.89)	0.333	0.34(-0.25,0.94)	0.259
Random Part								
Area of Residence	2		-		-		-	
Family Status	-		2		-		-	
Father's Education	-		-		2		-	
Mother's Education	-		-		-		2	
Levels	2		2		2		2	
Observations	1849		1917		1894		1885	
AIC	16467.916		17067.394		16913.993		16794.886	

4.5.2 Linear Mixed effect model of Psychosocial functioning and Socio demographics using Restricted Maximum likelihood method of estimation and Variance Components Covariance structure.

Table 4.5.2 also shows four models with each model having a socio demographic as the random effect. Restricted maximum likelihood method of estimation was used. The OCS (p= 0.003, <0.001, 0.001, 0.001) and GPD (p= <0.001, <0.001, <0.001, <0.001) for the four models respectively affected the QOL but BRP had no significant effect on the QOL.

4.5.2 Linear Mixed effect model of Psychosocial functioning and socio demographics using restricted maximum likelihood method of estimation and variance components covariance structure

Variable	Model 5 β (95%CI)	P	Model 6 β (95%CI)	P	Model 7 β (95%CI)	P	Model 8 β (95%CI)	P
Fixed Parts								
OCS	-0.79(-1.31,-0.26)	0.003	-0.92(-1.43,-0.41)	<0.001	-0.85(-1.37,-0.33)	0.001	-0.81(-1.33,-0.29)	
GPD	-0.52(-0.68,-0.36)	<0.001	-0.52(-0.68,-0.36)	<0.001	-0.49(-0.66,-0.33)	<0.001	-0.48(-0.64,-0.32)	
BRP	0.26(-0.35-0.86)	0.402	0.23(-0.36,0.82)	0.45	0.30(-0.30,0.90)	0.327	0.36(-0.24,0.96)	
Random Part								
Area of Residence	2		-		-		-	
Family Status	-		2		-		-	
Father's Education	-		-		2		-	
Mother's Education	-		-		-		2	
Levels	2		2		2		2	
Observations	1849		1917		1894		1885	
AIC	16464.014		17062.518		16876.569		16790.81	

4.5.3 Linear Mixed effect model of Psychosocial functioning and socio demographics using maximum likelihood method of estimation and compound symmetry covariance structure

Table 4.5.3 shows four models with each model taking a socio demographic variable as the random effect. Maximum likelihood method of estimation was used. The OCS (p= 0.004, <0.001, 0.001, 0.003) and GPD (p= <0.001, <0.001, <0.001, <0.001) for the four models respectively affected the QOL but BRP had no significant effect on the QOL.

Table 4.5.3 Linear Mixed effect model of Psychosocial functioning and socio demographics using maximum likelihood method of estimation and compound symmetry covariance structure

Variable	Model 9 β (95%CI)	P	Model 10 β (95%CI)	P	Model 11 β (95%CI)	P	Model 12 β (95%CI)	P
Fixed Parts								
OCS	-0.76(-1.29,-0.24)	0.004	-0.91(-1.43,-0.40)	<0.001	-0.85(-1.37,-0.33)	0.001	-0.79(-1.32,-0.27)	0.003
GPD	-0.52(-0.68,-0.36)	<0.001	-0.52(-0.68,-0.36)	<0.001	-0.49(-0.66,-0.33)	<0.001	-0.48(-0.64,-0.32)	<0.001
BRP	0.26(-0.35,0.86)	0.402	0.23(-0.36,0.82)	0.45	0.30(-0.30,0.90)	0.324	0.36(-0.24,0.96)	0.236
Random Part								
Area of Residence	2		-		-		-	
Family Status	-		2		-		-	
Father's Education	-		-		2		-	
Mother's Education	-		-		-		2	
Levels	2		2		2		2	
Observations	1849		1917		1894		1885	
AIC	16470.097		17068.525		16883.151		16797.217	

4.5.4 Linear Mixed effect model of Psychosocial functioning and socio demographics using restricted maximum likelihood method of estimation and compound symmetry covariance structure

Table 4.5.4 shows four models with each model taking a socio demographic variable as the random effect. Restricted maximum likelihood method of estimation was used. The OCS (p= 0.003, <0.001, 0.001, 0.002) and GPD (p= <0.001, <0.001, <0.001, <0.001) for the four models respectively affected the QOL but BRP had no significant effect on the QOL.

Table 4.5.4 Linear Mixed effect model of Psychosocial functioning and socio demographics using restricted maximum likelihood method of estimation and compound symmetry covariance structure

Variable	Model 13 β (95%CI)	P	Model 14 β (95%CI)	P	Model 15 β (95%CI)	P	Model 16 β (95%CI)	P
Fixed Parts								
OCS	-0.79(-1.31,-0.26)	0.003	-0.92(-1.43,-0.41)	<0.001	-0.85(-1.37,-0.33)	0.001	-0.81(-1.33,-0.29)	0.002
GPD	-0.52(-0.68,-0.36)	<0.001	-0.52(-0.68,-0.36)	<0.001	-0.49(-0.66,-0.33)	<0.001	-0.48(-0.64,-0.32)	<0.001
BRP	0.26(-0.35,0.86)	0.402	0.23(-0.37,0.82)	0.450	0.30(-0.30,0.90)	0.327	0.36(-0.24,0.96)	0.243
Random Part								
Area of Residence	2		-		-		-	
Family Status	-		2		-		-	
Father's Education	-		-		2		-	
Mother's Education	-		-		-		2	
Levels	2		2		2		2	
Observations	1849		1917		1894		1885	
AIC	16466.014		17064.517		16878.569		16792.807	

4.5.5 Linear Mixed effect model of Psychosocial functioning and socio demographics using maximum likelihood method of estimation and toeplitz covariance structure

Table 4.5.5 shows four models with each model taking a socio demographic variable as the random effect. Maximum likelihood method of estimation was used. The OCS (p= 0.003, <0.001, 0.001, 0.002) and GPD (p= <0.001, <0.001, <0.001, <0.001) for the four models respectively affected the QOL but BRP had no significant effect on the QOL.

Table 4.5.5 Linear Mixed effect model of Psychosocial functioning and socio demographics using maximum likelihood method of estimation and toeplitz covariance structure

Variable	Model 17 β (95%CI)	P	Model 18 β (95%CI)	P	Model 19 β (95%CI)	P	Model 20 β (95%CI)	P
Fixed Parts								
OCS	-0.79(-1.31,-0.27)	0.003	-0.92(-1.43,-0.41)	<0.001	-0.88(-1.40,-0.36)	0.001	-0.84(-1.35,-0.32)	0.002
GPD	-0.52(-0.68,-0.36)	<0.001	-0.52(-0.68,-0.36)	<0.001	-0.49(0.65,-0.33)	<0.001	-0.48(-0.64,-0.32)	<0.001
BRP	0.26(-0.35,0.86)	0.402	0.23(-0.36,0.82)	0.449	0.30(-0.30,0.89)	0.333	0.34(-0.25,0.94)	0.26
Random Part								
Area of Residence	2		-		-		-	
Family Status	-		2		-		-	
Father's Education	-		-		2		-	
Mother's Education	-		-		-		2	
Levels	2		2		2		2	
Observations	1849		1917		1894		1885	
AIC	16469.915		17068.480		16882.714		16796.886	

4.5.6 Linear Mixed effect model of Psychosocial functioning and socio demographics using restricted maximum likelihood method of estimation and toeplitz covariance structure

Table 4.5.6 shows four models with each model taking a socio demographic variable as the random effect. Restricted maximum likelihood method of estimation was used. The OCS ($p = 0.003$, <0.001, 0.001, 0.002) and GPD ($p = <0.001$, <0.001, <0.001, <0.001) for the four models respectively affected the QOL but BRP had no significant effect on the QOL.

Table 4.5.6 Linear Mixed effect model of Psychosocial functioning and socio demographics using restricted maximum likelihood method of estimation and toeplitz covariance structure

Variable	Model 21		Model 22		Model 23		Model 24	
	β (95%CI)	P	β (95%CI)	P	β (95%CI)	P	β (95%CI)	P
Fixed Parts								
OCS	-0.79(-1.31,-0.26)	0.003	-0.92(-1.43,-0.41)	<0.001	-0.85(-1.37,-0.33)	0.001	-0.81(-1.33,-0.29)	0.002
GPD	0.52(-0.68,-0.36)	<0.001	-0.52(-0.68,-0.36)	<0.001	-0.49(-0.66,-0.33)	<0.001	-0.48(-0.64,-0.32)	<0.001
BRP	0.26(-0.35,0.86)	0.402	0.23(-0.36,0.82)	0.450	0.30(-0.30,0.90)	0.327	0.36(-0.24,0.96)	0.243
Random Part								
Area of Residence	2		-		-		-	
Family Status	-		2		-		-	
Father's Education	-		-		2		-	
Mother's Education	-		-		-		2	
Levels	2		2		2		2	
Observations	1849		1917		1894		1885	
AIC	16466.014		17064.518		16878.569		16792.808	

4.5.7 Linear Mixed effect model of Psychosocial functioning and socio demographics using maximum likelihood method of estimation and unstructured covariance structure

Table 4.5.7 shows four models with each model taking a socio demographic variable as the random effect. Maximum likelihood method of estimation was used. The OCS (p= 0.004, <0.001, 0.001, 0.002) and GPD (p= <0.001, <0.001, <0.001, <0.001) for the four models respectively affected the QOL but BRP had no significant effect on the QOL.

Table 4.5.7 Linear Mixed effect model of Psychosocial functioning and socio demographics using maximum likelihood method of estimation and unstructured covariance structure

Variable	Model 25 β (95%CI)	P	Model 26 β (95%CI)	P	Model 27 β (95%CI)	P	Model 28 β (95%CI)	P
Fixed Parts								
OCS	-0.76(-1.29,-0.24)	0.004	-0.91(-1.43,-0.40)	<0.001	-0.87(-1.39,-0.35)	0.001	-0.83(-1.34,-0.31)	
GPD	-0.52(-0.68,-0.36)	<0.001	-0.52(-0.68,-0.36)	<0.001	-0.49(-0.65,-0.33)	<0.001	-0.48(-0.64,-0.32)	
BRP	0.26(-0.35,0.86)	0.402	0.23(-0.36,0.82)	0.451	0.30(-0.30,0.90)	0.331	0.35(-0.25,0.95)	
Random Part								
Area of Residence	2		-		-		-	
Family Status	-		2		-		-	
Father's Education	-		-		2		-	
Mother's Education	-		-		-		2	
Levels	2		2		2		2	
Observations	1849		1917		1894		1885	
AIC	16472.100		17070.639		16885.419		16799.348	

4.5.8 Linear Mixed effect model of Psychosocial functioning and socio demographics using restricted maximum likelihood method of estimation and unstructured covariance structure

Table 4.5.8 shows four models with each model taking a socio demographic variable as the random effect. Restricted maximum likelihood method of estimation was used. The OCS ($p=$ 0.003, 0.001, 0.002) and GPD ($p=$ <0.001, <0.001, <0.001) for three of the four models respectively affected the QOL but BRP had no significant effect on the QOL.

Table4.5.8 Linear Mixed effect model of psychosocial functioning and socio demographics using restricted maximum likelihood method of estimation and unstructured covariance structure

Variable	Model 29 β (95%CI)	P	Model 30 β (95%CI)	P	Model 31 β (95%CI)	P	Model 32 β (95%CI)	P
Fixed Parts								
OCS	-0.79(-1.31,-0.26)	0.003	-0.90(-1.42,-0.39)	0.001	-0.85(-40532.9,4053)	1.00	-0.81(-1.33,-0.29)	0.002
GPD	-0.52(-0.68,-0.36)	<0.001	-0.52(-0.68,-0.36)	<0.001	-0.49(-10549.,10548.)	0.67	-0.48(-0.64,-0.32)	<0.001
BRP	0.26(-0.35,0.86)	0.402	0.23(-0.37,0.82)	0.457	0.30(-0.92,1.52)	0.42	0.36(-0.24,0.96)	0.243
Random Part								
Area of Residence	2		-		-		-	
Family Status	-		2		-		-	
Father's Education	-		-		2		-	
Mother's Education	-		-		-		2	
Levels	2		2		2		2	
Observations	1849		1917		1894		1885	
AIC	16468.014		17068.804		16880.569		16794.808	

*** Not significant.

4.5.9 Linear Mixed effect model of Psychosocial functioning and socio demographics using maximum likelihood method of estimation and First-order Autoregressive covariance structure

Table 4.5.9 shows four models with each model taking a socio demographic variable as the random effect. Maximum likelihood method of estimation was used. The OCS (p= 0.003, <0.001, 0.001, 0.002) and GPD (p= <0.001, <0.001, <0.001, <0.001) for the four models respectively affected the QOL but BRP had no significant effect on the QOL.

Table4.5.8 Linear Mixed effect model of psychosocial functioning and socio demographics using restricted maximum likelihood method of estimation and unstructured covariance structure

Variable	Model 29 β (95%CI)	P	Model 30 β (95%CI)	P	Model 31 β (95%CI)	P	Model 32 β (95%CI)	P
Fixed Parts								
OCS	-0.79(-1.31,-0.26)	0.003	-0.90(-1.42,-0.39)	0.001	-0.85(-40532.9,4053)	1.00	-0.81(-1.33,-0.29)	0.002
GPD	-0.52(-0.68,-0.36)	<0.001	-0.52(-0.68,-0.36)	<0.001	-0.49(-10549., 10548.)	0.67	-0.48(-0.64,-0.32)	<0.001
BRP	0.26(-0.35,0.86)	0.402	0.23(-0.37,0.82)	0.457	0.30(-0.92,1.52)	0.42	0.36(-0.24,0.96)	0.243
Random Part								
Area of Residence	2		-		-		-	
Family Status	-		2		-		-	
Father's Education	-		-		2		-	
Mother's Education	-		-		-		2	
Levels	2		2		2		2	
Observations	1849		1917		1894		1885	
AIC	16468.014		17068.804		16880.569		16794.808	

*** Not significant.

4.5.1.0 Linear Mixed effect model of Psychosocial functioning and socio demographics using restricted maximum likelihood method of estimation and first-order Autoregressive covariance structure

Table 4.5.1.0 shows four models with each model taking a socio demographic variable as the random effect. Restricted maximum likelihood method of estimation was used. The OCS (p= 0.003, <0.001, 0.001, 0.002) and GPD (p= <0.001, <0.001, <0.001, <0.001) for the four models respectively affected the QOL but BRP had no significant effect on the QOL.

Table 4.5.1.0 Linear Mixed effect model of Psychosocial functioning and socio demographics using restricted maximum likelihood method of estimation and first-order Autoregressive covariance structure

Variable	Model 37 β (95%CI)	P	Model 38 β (95%CI)	P	Model 39 β (95%CI)	P	Model 40 β (95%CI)	P
Fixed Parts								
OCS	-0.79(-1.31,-0.26)	0.003	-0.92(-1.43,-0.41)	<0.001	-0.85(-1.37,-0.33)	0.001	-0.81(-1.33,-0.29)	-0.81
GPD	-0.52(-0.68,-0.36)	<0.001	-0.52(-0.68,-0.36)	<0.001	-0.49(-0.66,-0.33)	<0.001	-0.48(-0.64,-0.32)	-0.48
BRP	0.26(-0.35,0.86)	0.402	0.23(-0.36,0.82)	0.450	0.30(-0.30,0.90)	0.327	0.31(-0.24,0.96)	0.31
Random Part								
Area of Residence	2		-		-		-	
Family Status	-		2		-		-	
Father's Education	-		-		2		-	
Mother's Education	-		-		-		2	
Levels	2		2		2		2	
Observations	1849		1917		1894		1885	
AIC	16466.014		17064.518		16878.569		16792.810	

4.5.1.1 Linear Mixed effect model of Psychosocial functioning and two socio demographics using maximum likelihood method of estimation and variance components covariance structure

Table 4.5.1.1 shows six models with each model taking two socio demographic variable as the random effects. Maximum likelihood method of estimation was used. The OCS (p= 0.001, 0.007, 0.007, 0.001, 0.002, 0.002) and GPD (p= <0.001, <0.001, <0.001, <0.001, <0.001, <0.001) for the six models respectively affected the QOL but BRP had no significant effect on the QOL.

Table 4.5.1.1 Linear Mixed effect model of Psychosocial functioning and two socio demographics using maximum likelihood method of estimation and variance components covariance structure

Variable	Model 41 β (95%CI)	P	Model 42 β (95%CI)	P	Model 43 β (95%CI)	P	Model 44 β (95%CI)	P
Fixed Parts								
OCS	-0.86(-1.38,-0.33)	0.001	-0.73(-1.27,-0.20)	0.007	-0.73(-1.26,-0.20)	0.007	-0.87(-1.39,-0.34)	0.001
GPD	-0.54(-0.71,-0.38)	<0.001	-0.53(-0.69,-0.36)	<0.001	-0.51(-0.67,-0.34)	<0.001	-0.52(-0.68,-0.36)	<0.001
BRP	0.21(-0.40,0.82)	0.506	0.24(-0.37,0.86)	0.440	0.29(-0.32,0.91)	0.351	0.25(-0.36,-0.85)	0.426
Random Part								
Area of Residence	2		2		2		-	
Family Status	2		-		-		2	
Father's Education	-		2		-		2	
Mother's Education	-		-		2		-	
Levels	4		4		4		4	
Observations	1815		1791		1784		1855	
AIC	16160.765		15967.997		15907.205		16573.661	

	Model 45 β	P	Model 46 β	P
Fixed Parts				
OCS	-0.81(-1.33,-0.29)	0.002	-0.81(-1.33,-0.29)	0.002
GPD	-0.51(-0.67,-0.34)	<0.001	-0.48(-0.65,-0.32)	<0.001
BRP	0.30(-0.30,0.91)	0.327	0.28(-0.32,0.89)	0.364
Random Part				
Area of Residence	-		-	
Family Status	2		-	
Father's Education	-		2	
Mother's Education	2		2	
Levels	4		4	
Observations	1847		1854	
AIC	16455.799		16525.547	

4.5.1.2 Linear Mixed effect model of Psychosocial functioning and two socio demographics using restricted maximum likelihood method of estimation and variance components covariance structure

Table 4.5.1.2 shows six models with each model taking two socio demographic variable as the random effects. Restricted maximum likelihood method of estimation was used. The OCS ($p = 0.001, 0.009, 0.007, 0.002, 0.003, 0.003$) and GPD ($p = <0.001, <0.001, <0.001, <0.001, <0.001, <0.001$) for the six models respectively affected the QOL but BRP had no significant effect on the QOL.

Table 4.5.1.2 Linear Mixed effect model of Psychosocial functioning and two socio demographics using restricted maximum likelihood method of estimation and variance components covariance structure

Variable	Model 47 β (95%CI)	P	Model 48 β (95%CI)	P	Model 49 β (95%CI)	P	Model 50 β (95%CI)	P
Fixed Parts								
OCS	-0.86(-1.38,-0.33)	0.001	-0.71(-1.25,-0.18)	0.009	-0.73(-1.26,-0.20)	0.007	-0.85(-1.38,-0.32)	0.002
GPD	-0.54(-0.71,-0.38)	<0.001	-0.53(-0.69,-0.36)	<0.001	-0.51(-0.67,-0.34)	<0.001	-0.52(-0.68,-0.36)	<0.001
BRP	0.21(-0.40,-0.82)	0.507	0.24(-0.38,0.86)	0.443	0.29(-0.32,0.91)	0.351	0.24(-0.36,0.84)	0.432
Random Part								
Area of Residence	2		2		2		-	
Family Status	2		-		-		2	
Father's Education	-		2		-		2	
Mother's Education	-		-		2		-	
Levels	4		4		4		4	
Observations	1815		1791		1784		1855	
AIC	16156.751		15963.882		15903.131		16529.572	

	Model 51 β	P	Model 52 β	P
Fixed Parts				
OCS	-0.80(-1.32,-0.27)	0.003	-0.79(-1.32,-0.27)	0.003
GPD	-0.51(-0.67,-0.34)	<0.001	-0.48(-0.65,-0.32)	<0.001
BRP	0.30(-0.31,0.91)	0.332	0.29(-0.32,0.89)	0.354
Random Part				
Area of Residence	-		-	
Family Status	2		-	
Father's Education	-		2	
Mother's Education	2		2	
Levels	4		4	
Observations	1847		1854	
AIC	16450.804		16521.539	

4.5.1.3 Linear Mixed effect model of Psychosocial functioning and two socio demographics using maximum likelihood method of estimation and compound symmetry covariance structure

Table 4.5.1.3 shows six models with each model taking two socio demographic variable as the random effects. Maximum likelihood method of estimation was used. The OCS (p= 0.003, 0.016, 0.013, 0.002, 0.003, 0.004) and GPD (p= <0.001, <0.001, <0.001, <0.001, <0.001, <0.001) for the six models respectively affected the QOL but BRP had no significant effect on the QOL.

Table 4.5.1.3 Linear Mixed effect model of Psychosocial functioning and two socio demographics using maximum likelihood method of estimation and compound symmetry covariance structure

Variable	Model 53 β (95%CI)	P	Model 54 β (95%CI)	P	Model 55 β (95%CI)	P	Model 56 β (95%CI)	P
Fixed Parts								
OCS	-0.81(-1.34,-0.28)	0.003	-0.66(-1.21,-0.12)	0.016	-0.69(-1.23,-0.15)	0.013	-0.84(-1.36,-0.31)	0.002
GPD	-0.54(-0.71,-0.38)	<0.001	-0.53(-0.70,-0.36)	<0.001	-0.51(-0.68,-0.35)	<0.001	-0.52(-0.68,-0.36)	<0.001
BRP	0.20(-0.40,0.81)	0.510	0.24(-0.37,0.86)	0.442	0.30(-0.32,0.92)	0.338	0.24(-0.36,0.85)	0.433
Random Part								
Area of Residence	2		2		2		-	
Family Status	2		-		-		2	
Father's Education	-		2		-		2	
Mother's Education	-		-		2		-	
Levels	4		4		4		4	
Observations	1815		1791		1784		1855	
AIC	16163.433		15971.200		15910.279		16536.341	

	Model 57 β	P	Model 58 β	P
Fixed Parts				
OCS	-0.79(-1.31,-0.26)	0.003	-0.77(-1.30,-0.24)	0.004
GPD	-0.51(-0.67,-0.34)	<0.001	-0.48(-0.65,-0.32)	<0.001
BRP	0.30(-0.31,0.91)	0.332	0.29(-0.31,0.90)	0.341
Random Part				
Area of Residence	-		-	
Family Status	2		-	
Father's Education	-		2	
Mother's Education	2		2	
Levels	4		4	
Observations	1847		1854	
AIC	16457.373		16528.544	

4.5.1.4 Linear Mixed effect model of Psychosocial functioning and two socio demographics using restricted maximum likelihood method of estimation and compound symmetry covariance structure

Table 4.5.1.4 shows six models with each model taking two socio demographic variable as the random effects. Restricted maximum likelihood method of estimation was used. The OCS (p= 0.002, 0.011, 0.013, 0.008, 0.003, 0.003) and GPD (p= <0.001, <0.001, <0.001, <0.001, <0.001, <0.001) for the six models respectively affected the QOL but BRP had no significant effect on the QOL.

Table 4.5.1.4 Linear Mixed effect model of Psychosocial functioning and two socio demographics using restricted maximum likelihood method of estimation and compound symmetry covariance structure

Variable	Model 59 β (95%CI)	P	Model 60 β (95%CI)	P	Model 61 β (95%CI)	P	Model 62 β (95%CI)	P
Fixed Parts								
OCS	-0.82(-1.35,-0.29)	0.002	-0.63(-1.12,-0.14)	0.011	-0.64(-1.11,-0.16)	0.008	-0.81(-1.27,-0.35)	0.001
GPD	-0.54(-0.71,-0.38)	<0.001	-0.53(-0.68,-0.14)	<0.001	-0.51(-0.66,-0.37)	<0.001	-0.52(0.66,-0.38)	<0.001
BRP	0.21(-0.40,0.82)	0.510	0.24(-0.31,0.79)	0.392	0.32(-0.22,0.86)	0.245	0.24(-0.28,0.77)	0.365
Random Part								
Area of Residence	2		2		2		-	
Family Status	2		-		-		2	
Father's Education	-		2		-		2	
Mother's Education	-		-		2		-	
Levels	4		4		4		4	
Observations	1815		1791		1784		1855	
AIC	16159.084		16030.052		15997.029		16623.686	

	Model 63 β	P	Model 64 β	P
Fixed Parts				
OCS	-0.80(-1.33,-0.28)	0.003	-0.80(-1.32,-0.27)	0.003
GPD	-0.51(-0.67,-0.34)	<0.001	-0.48(-0.65,-0.32)	<0.001
BRP	0.30(-0.31,0.91)	0.330	0.28(-0.32,0.89)	0.357
Random Part				
Area of Residence	-		-	
Family Status	2		-	
Father's Education	-		2	
Mother's Education	2		2	
Levels	4		4	
Observations	1847		1854	
AIC	16452.845		16523.549	

4.5.1.5 Linear Mixed effect model of Psychosocial functioning and two socio demographics using maximum likelihood method of estimation and toeplitz covariance structure

Table 4.5.1.5 shows six models with each model taking two socio demographic variable as the random effects. Maximum likelihood method of estimation was used. The OCS (p= 0.001, 0.007, 0.007, 0.002, 0.003, 0.002) and GPD (p= <0.001, <0.001, <0.001, <0.001, <0.001, <0.001) for the six models respectively affected the QOL but BRP had no significant effect on the QOL.

Table 4.5.1.5 Linear Mixed effect model of Psychosocial functioning and two socio demographics using maximum likelihood method of estimation and toeplitz covariance structure

Variable	Model 65 β (95%CI)	P	Model 66 β (95%CI)	P	Model 67 β (95%CI)	P	Model 68 β (95%CI)	P
Fixed Parts								
OCS	-0.86(-1.38,-0.33)	0.001	-0.73(-1.27,-0.20)	0.007	-0.73(-1.26,-0.20)	0.007	-0.84(-1.36,-0.31)	0.002
GPD	-0.54(-0.71,-0.38)	<0.001	-0.53(-0.69,-0.36)	<0.001	-0.51(-0.67,-0.34)	<0.001	-0.52(-0.68,-0.36)	<0.001
BRP	0.21(-0.40,0.82)	0.506	0.24(-0.37,0.86)	0.440	0.29(-0.32,0.91)	0.351	0.24(-0.36,0.85)	0.432
Random Part								
Area of Residence	2		2		2		-	
Family Status	2		-		-		2	
Father's Education	-		2		-		2	
Mother's Education	-		-		2		-	
Levels	4		4		4		4	
Observations	1815		1791		1784		1855	
AIC	16166.818		15973.997		15913.205		16540.071	

	Model 69 β	P	Model 70 β	P
Fixed Parts				
OCS	-0.79(-1.32,-0.27)	0.003	-0.81(-1.33,-0.29)	0.002
GPD	-0.51(-0.67,-0.34)	<0.001	-0.48(-0.65,-0.32)	<0.001
BRP	0.30(-0.31,0.90)	0.333	0.28(-0.32,0.89)	0.364
Random Part				
Area of Residence	-		-	
Family Status	2		-	
Father's Education	-		2	
Mother's Education	2		2	
Levels	4		4	
Observations	1847		1854	
AIC	16460.821		16531.547	

Table 4.5.1.5 Linear Mixed effect model of Psychosocial functioning and two socio demographics using maximum likelihood method of estimation and toeplitz covariance structure

Variable	Model 65 β (95%CI)	P	Model 66 β (95%CI)	P	Model 67 β (95%CI)	P	Model 68 β (95%CI)	P
Fixed Parts								
OCS	-0.86(-1.38,-0.33)	0.001	-0.73(-1.27,-0.20)	0.007	-0.73(-1.26,-0.20)	0.007	-0.84(-1.36,-0.31)	0.002
GPD	-0.54(-0.71,-0.38)	<0.001	-0.53(-0.69,-0.36)	<0.001	-0.51(-0.67,-0.34)	<0.001	-0.52(-0.68,-0.36)	<0.001
BRP	0.21(-0.40,0.82)	0.506	0.24(-0.37,0.86)	0.440	0.29(-0.32,0.91)	0.351	0.24(-0.36,0.85)	0.432
Random Part								
Area of Residence	2		2		2		-	
Family Status	2		-		-		2	
Father's Education	-		2		-		2	
Mother's Education	-		-		2		-	
Levels	4		4		4		4	
Observations	1815		1791		1784		1855	
AIC	16166.818		15973.997		15913.205		16540.071	

	Model 69 β	P	Model 70 β	P
Fixed Parts				
OCS	-0.79(-1.32,-0.27)	0.003	-0.81(-1.33,-0.29)	0.002
GPD	-0.51(-0.67,-0.34)	<0.001	-0.48(-0.65,-0.32)	<0.001
BRP	0.30(-0.31,0.90)	0.333	0.28(-0.32,0.89)	0.364
Random Part				
Area of Residence	-		-	
Family Status	2		-	
Father's Education	-		2	
Mother's Education	2		2	
Levels	4		4	
Observations	1847		1854	
AIC	16460.821		16531.547	

.5.1.6 Linear Mixed effect model of Psychosocial functioning and two socio demographics using restricted maximum likelihood method of estimation and toeplitz covariance structure

Table 4.5.1.6 shows six models with each model taking two socio demographic variable as the random effects. Restricted maximum likelihood method of estimation was used. The OCS (p= 0.001, 0.007, 0.010, 0.001, 0.001, 0.005) and GPD (p= <0.001, <0.001, <0.001, <0.001, <0.001, <0.001) for the six models respectively affected the QOL but BRP had no significant effect on the QOL.

Table 4.5.1.6 Linear Mixed effect model of Psychosocial functioning and two socio demographics using restricted maximum likelihood method of estimation and toeplitz covariance structure

Variable	Model 71 β (95%CI)	P	Model 72 β (95%CI)	P	Model 73 β (95%CI)	P	Model 74 β (95%CI)	P
Fixed Parts								
OCS	-0.86(-1.38,-0.33)	0.001	-0.73(-1.27,-0.20)	0.007	-0.71(-1.25,-0.17)	0.010	-0.91(-1.43,-0.38)	0.001
GPD	-0.54(-0.71,-0.38)	<0.001	-0.53(-0.69,-0.36)	<0.001	-0.51(-0.68,-0.34)	<0.001	-0.52(-0.68,-0.35)	<0.001
BRP	0.21(-0.40,0.82)	0.507	0.24(-0.37,0.86)	0.441	0.30(-0.32,0.91)	0.349	0.26(-0.35,0.86)	0.404
Random Part								
Area of Residence	2		2		2		-	
Family Status	2		-		-		2	
Father's Education	-		2		-		2	
Mother's Education	-		-		2		-	
Levels	4		4		4		4	
Observations	1815		1791		1784		1855	
AIC	16162.751		15969.930		15909.071		16537.323	

	Model 75 β	P	Model 76 β	P
Fixed Parts				
OCS	-0.86(-1.38,-0.34)	0.001	-0.76(-1.29,-0.23)	0.005
GPD	-0.51(-0.67,-0.34)	<0.001	-0.48(-0.65,-0.32)	<0.001
BRP	0.32(-0.29,0.92)	0.306	0.30(-0.31,0.90)	0.338
Random Part				
Area of Residence	-		-	
Family Status	2		-	
Father's Education	-		2	
Mother's Education	2		2	
Levels	4		4	
Observations	1847		1854	
AIC	16459.006		16527.274	

4.5.1.7 Linear Mixed effect model of Psychosocial functioning and two socio demographics using maximum likelihood method of estimation and unstructured covariance structure

Table 4.5.1.7 shows six models with each model taking two socio demographic variable as the random effects. Maximum likelihood method of estimation was used. The OCS (p= 0.004, 0.021, 0.018, 0.002, 0.004, 0.003) and GPD (p= <0.001, <0.001, <0.001, <0.001, <0.001, <0.001) for the six models respectively affected the QOL but BRP had no significant effect on the QOL.

Table 4.5.1.7 **Linear Mixed effect model of Psychosocial functioning and two socio demographics using maximum likelihood method of estimation and unstructured covariance structure**

Variable	Model 77 β (95%CI)	P	Model 78 β (95%CI)	P	Model 79 β (95%CI)	P	Model 80 β (95%CI)	P
Fixed Parts								
OCS	-0.79(-1.32,-0.26)	0.004	-0.64(-1.18,-0.10)	0.021	-0.66(-1.20,-0.11)	0.018	-0.82(-1.35,-0.30)	0.002
GPD	-0.55(-0.71,-0.38)	<0.001	-0.53(-0.70,-0.37)	<0.001	-0.51(-0.68,-0.35)	<0.001	-0.52(-0.68,-0.36)	<0.001
BRP	0.20(-0.41,0.81)	0.513	0.24(-0.37,0.86)	0.439	0.31(-0.31,0.93)	0.325	0.24(-0.36,0.84)	0.433
Random Part								
Area of Residence	2		2		2		-	
Family Status	2		-		-		2	
Father's Education	-		2		-		2	
Mother's Education	-		-		2		-	
Levels	4		4		4		4	
Observations	1815		1791		1784		1855	
AIC	16179.628		15988.575		15927.497		16552.813	

	Model 81 β	P	Model 82 β	P
Fixed Parts				
OCS	-0.77(-1.30,-0.25)	0.004	-0.81(-1.34,-0.28)	0.003
GPD	-0.51(-0.67,-0.35)	<0.001	-0.48(-0.65,-0.32)	<0.001
BRP	0.30(-0.30,0.91)	0.328	0.28(-0.33,0.89)	0.364
Random Part				
Area of Residence	-		-	
Family Status	2		-	
Father's Education	-		2	
Mother's Education	2		2	
Levels	2		2	
Observations	1847		1854	
AIC	16473.269		16543.547	

1.8 Linear Mixed effect model of Psychosocial functioning and two socio demographics ng restricted maximum likelihood method of estimation and unstructured covariance ucture

ble 4.5.1.8 shows six models with each model taking two socio demographic variable as the ndom effects. Restricted maximum likelihood method of estimation was used. The OCS (p= 002, 0.011, 0.001, 0.002, 0.003) and GPD (p= <0.001, <0.001, <0.001, <0.001, <0.001, 0.001) for five of the six models respectively affected the QOL but BRP had no significant fect on the QOL in the models.

Table 4.5.1.8 **Linear Mixed effect model of Psychosocial functioning and two socio demographics using restricted maximum likelihood method of estimation and unstructured covariance structure**

Variable	Model 83 β (95%CI)	P	Model 84*** β (95%CI)	P	Model 85 β (95%CI)	P	Model 86 β (95%CI)	P
Fixed Parts								
OCS	-0.77(-1.26,-0.29)	0.002	-0.73(-8314,8314)	0.999	-0.65(-1.15,-0.15)	0.011	-0.81(-1.29,-0.33)	0.001
GPD	-0.55(-0.70,-0.40)	<0.001	-0.53(-7341,7340)	0.513	-0.51(-0.66,-0.36)	<0.001	-0.52(-0.67,-0.37)	<0.001
BRP	0.20(-0.35,0.76)	0.474	0.24(-1.41,1.89)	0.535	0.32(-0.25,0.88)	273	0.24(-0.30,0.79)	0.385
Random Part								
Area of Residence	2		2		2		-	
Family Status	2		-		-		2	
Father's Education	-		2		-		2	
Mother's Education	-		-		2		-	
Levels	4		4		4		4	
Observations	1815		1791		1784		1855	
AIC	16219.582		15981.930		15960.974		16590.82	

	Model 87 β	P	Model 88 β	P
Fixed Parts				
OCS	-0.76(-1.24,-0.28)	0.002	-0.74(-1.23,-0.26)	0.003
GPD	-0.51(-0.66,-0.36)	<0.001	-0.49(-0.63,-0.34)	<0.001
BRP	0.30(-0.25,0.86)	0.285	0.30(-0.25,0.85)	0.287
Random Part				
Area of Residence	-		-	
Family Status	2		-	
Father's Education	-		2	
Mother's Education	2		2	
Levels	4		4	
Observations	1847		1854	
AIC	16510.001		16578.476	

1.9 Linear Mixed effect model of Psychosocial functioning and two socio demographics ng maximum likelihood method of estimation and first-order autoregressive covariance ucture

ble 4.5.1.9 shows six models with each model taking two socio demographic variable as the dom effects. Maximum likelihood method of estimation was used. The OCS (p= 0.002, 0.007, 007, 0.001, 0.003, 0.002) and GPD (p= <0.001, <0.001, <0.001, <0.001, <0.001, <0.001) for e six models respectively affected the QOL but BRP had no significant effect on the QOL in e models.

Table 4.5.1.9 Linear Mixed effect model of Psychosocial functioning and two socio demographics using maximum likelihood method of estimation and first-order autoregressive covariance structure

Variable	Model 89 β (95%CI)	P	Model 90 β (95%CI)	P	Model 91 β (95%CI)	P	Model 92 β (95%CI)	P
Fixed Parts								
OCS	-0.85(-1.37,-0.32)	0.002	-0.73(-1.27,-0.20)	0.007	-0.73(-1.26,-0.20)	0.007	-0.86(-1.38,-0.33)	0.001
GPD	-0.54(-0.71,-0.38)	<0.001	-0.53(-0.69,-0.36)	<0.001	-0.51(-0.67,-0.34)	<0.001	-0.52(-0.68,-0.36)	<0.001
BRP	0.21(-0.40,0.81)	0.510	0.24(-0.37,0.86)	0.440	0.29(-0.32,0.91)	0.351	0.25(-0.36,0.85)	0.424
Random Part								
Area of Residence	2		2		2		-	
Family Status	2		-		-		2	
Father's Education	-		2		-		2	
Mother's Education	-		-		2		-	
Levels	4		4		4		4	
Observations	1815		1791		1784		1855	
AIC	16162.653		15969.997		15909.205		16536.296	

Variable	Model 93 β	P	Model 94 β	P
Fixed Parts				
OCS	-0.80(-1.33,-0.28)	0.003	-0.81(-1.33,-0.29)	0.002
GPD	-0.51(-0.67,-0.34)	<0.001	-0.48(-0.65,-0.32)	<0.001
BRP	0.31(-0.30,0.91)	0.319	0.28(-0.32,0.89)	0.364
Random Part				
Area of Residence	-		-	
Family Status	2		-	
Father's Education	-		2	
Mother's Education	2		2	
Levels	4		4	
Observations	1847		1854	
AIC	16457.568		16527.547	

.2.0 Linear Mixed effect model of Psychosocial functioning and two socio demographics ing restricted maximum likelihood method of estimation and first-order autoregressive variance structure

ble 4.5.2.0 shows six models with each model taking two socio demographic variable as the ndom effects. Restricted Maximum likelihood method of estimation was used. The OCS (p= 001, 0.009, 0.008, 0.001, 0.003, 0.002) and GPD (p= <0.001, <0.001, <0.001, <0.001, <0.001, 0.001) for the six models respectively affected the QOL but BRP had no significant effect on e QOL in the models.

Table 4.5.2.0 Linear Mixed effect model of Psychosocial functioning and two socio demographics using restricted maximum likelihood method of estimation and first-order autoregressive covariance structure

Variable	Model 95 β (95%CI)	P	Model 96 β (95%CI)	P	Model 97 β (95%CI)	P	Model 98 β (95%CI)	P
Fixed Parts								
OCS	-0.86(-1.38,-0.33)	0.001	-0.71(-1.25,-0.18)	0.009	-0.73(-1.26,-0.19)	0.008	-0.87(-1.40,-0.35)	0.001
GPD	-0.54(-0.71,-0.38)	<0.001	-0.53(-0.69,-0.36)	<0.001	-0.51(-0.67,-0.34)	<0.001	-0.52(-0.68,-0.35)	<0.001
BRP	0.21(-0.40,0.82)	0.507	0.24(-0.37,0.86)	0.441	0.29(-0.32,0.91)	0.350	0.25(-0.36,0.85)	0.425
Random Part								
Area of Residence	2		2		2		-	
Family Status	2		-		-		2	
Father's Education	-		2		-		2	
Mother's Education	-		-		2		-	
Levels	4		4		4		4	
Observations	1815		1791		1784		1855	
AIC	16152.751		15965.818		15905.125		16531.924	

Variable	Model 99 β	P	Model 100 β	P
Fixed Parts				
OCS	-0.80(-1.32,-0.27)	0.003	-0.81(-1.33,-0.29)	0.002
GPD	-0.51(-0.67,-0.34)	<0.001	-0.48(-0.65,-0.32)	<0.001
BRP	0.30(-0.30,0.91)	0.327	0.364(-0.33,0.89)	0.364
Random Part				
Area of Residence	-			
Family Status	2			
Father's Education	-			
Mother's Education	2			
Levels	4			
Observations	1847			
AIC	16452.779			

2.1 Linear Mixed effect model of Psychosocial functioning and three socio nographics using maximum likelihood method of estimation and variance components ariance structure

ble 4.5.2.1 shows three models with each model taking three socio demographic variable as random effects. Maximum likelihood method of estimation was used. The OCS (p= 0.004, 004, 0.011) and GPD (p= <0.001, <0.001, <0.001) for the models respectively affected the OL but BRP had no significant effect on the QOL in the models.

4.5.2.1 Linear Mixed effect model of Psychosocial functioning and three socio demographics using
num likelihood method of estimation and variance components covariance structure

ble	Model 101 β (95%CI)	P	Model 102 β (95%CI)	P	Model 103 β (95%CI)	P
l Parts						
	-0.79(-1.32,-0.25)	0.004	-0.78(-1.32,-0.25)	0.004	-0.70(-1.24,-0.16)	
	-0.55(-0.71,-0.38)	<0.001	-0.53(-0.70,-0.36)	<0.001	-0.51(-0.68,-0.35)	
	0.21(-0.41,0.83)	0.509	0.27(-0.36,0.89)	0.402	0.23(-0.39,0.85)	
dom Part						
a of Residence	2		2		2	
ily Status	2		2		-	
ner's Education	2		-		2	
ther's Education	-		2		2	
vels	8		8		8	
servations	1760		1753		1755	
C	15688.708		15627.224		15654.499	

e 4.5.2.1 Linear Mixed effect model of Psychosocial functioning and three socio demographics using mum likelihood method of estimation and variance components covariance structure

able	Model 101 β (95%CI)	P	Model 102 β (95%CI)	P	Model 103 β (95%CI)	P
d Parts						
s	-0.79(-1.32,-0.25)	0.004	-0.78(-1.32,-0.25)	0.004	-0.70(-1.24,-0.16)	
D	-0.55(-0.71,-0.38)	<0.001	-0.53(-0.70,-0.36)	<0.001	-0.51(-0.68,-0.35)	
P	0.21(-0.41,0.83)	0.509	0.27(-0.36,0.89)	0.402	0.23(-0.39,0.85)	
ndom Part						
ea of Residence	2		2		2	
mily Status	2		2		-	
ther's Education	2		-		2	
other's Education	-		2		2	
evels	8		8		8	
bservations	1760		1753		1755	
IC	15688.708		15627.224		15654.499	

5.2.2 Linear Mixed effect model of Psychosocial functioning and three socio emographics using restricted maximum likelihood method of estimation and variance omponents covariance structure

able 4.5.2.2 shows three models with each model taking three socio demographic variable as e random effects. Restricted maximum likelihood method of estimation was used. The OCS p= 0.006, 0.006, 0.011) and GPD (p= <0.001, <0.001, <0.001) for the models respectively ffected the QOL but BRP had no significant effect on the QOL in the models.

4.5.2.2 Linear Mixed effect model of Psychosocial functioning and three socio demographics using cted maximum likelihood method of estimation and variance components covariance structure

Variable	Model 104 β (95%CI)	P	Model 105 β (95%CI)	P	Model 106 β (95%CI)	P
d Parts						
	-0.76(-1.30,-0.22)	0.006	-0.76(-1.30,-0.22)	0.006	-0.70(-1.24,-0.16)	
)	-0.55(-0.71,-0.38)	<0.001	-0.53(-0.70,-0.36)	<0.001	-0.51(-0.68,-0.35)	
,	0.21(-0.42,0.83)	0.518	0.26(-0.36,0.89)	0.406	0.23(-0.39,0.85)	
ndom Part						
a of Residence	2		2		2	
nily Status	2		2		-	
her's Education	2		-		2	
ther's Education	-		2		2	
vels	8		8		8	
bservations	1760		1753		1755	
IC	15680.419		15622.992		15650.341	

5.2.3 Linear Mixed effect model of Psychosocial functioning and three socio demographics using maximum likelihood method of estimation and compound symmetry covariance structure

Table 4.5.2.3 shows three models with each model taking three socio demographic variable as the random effects. Maximum likelihood method of estimation was used. The OCS (p= 0.012, 0.010, 0.024) and GPD (p= <0.001, <0.001, <0.001) for the models respectively affected the QOL but BRP had no significant effect on the QOL in the models.

2.3 Linear Mixed effect model of Psychosocial functioning and three socio ographics using maximum likelihood method of estimation and compound symmetry ariance structure

ble 4.5.2.3 shows three models with each model taking three socio demographic variable as random effects. Maximum likelihood method of estimation was used. The OCS (p= 0.012, 010, 0.024) and GPD (p= <0.001, <0.001, <0.001) for the models respectively affected the OL but BRP had no significant effect on the QOL in the models.

4.5.2.3 Linear Mixed effect model of Psychosocial functioning and three socio demographics using num likelihood method of estimation and compound symmetry covariance structure

ble	Model 107 β (95%CI)	P	Model 108 β (95%CI)	P	Model 109 β (95%CI)	P
d Parts						
	-0.70(-1.24,-0.16)	0.012	-0.71(-1.26,-0.17)	0.010	-0.63(-1.18,-0.08)	
	-0.54(-0.72,-0.38)	<0.001	-0.53(-0.70,-0.37)	<0.001	-0.52(-0.68,-0.35)	
	0.20(-0.42,0.82)	0.532	0.26(-0.36,0.89)	0.409	0.24(-0.38,0.87)	
dom Part						
a of Residence	2		2		2	
nily Status	2		2		-	
her's Education	2		-		2	
other's Education	-		2		2	
vels	8		8		8	
bservations	1760		1753		1755	
IC	15692.372		15630.524		15659.877	

.2.4 Linear Mixed effect model of Psychosocial functioning and three socio ographics using restricted maximum likelihood method of estimation and compound metry covariance structure

le 4.5.2.4 shows three models with each model taking three socio demographic variable as random effects. Restricted maximum likelihood method of estimation was used. The OCS 0.009, 0.004, 0.004) and GPD (p= <0.001, <0.001, <0.001) for the models respectively ected the QOL but BRP had no significant effect on the QOL in the models.

4.5.2.4 Linear Mixed effect model of Psychosocial functioning and three socio demographics using
...cted maximum likelihood method of estimation and compound symmetry covariance structure

...ble	Model 110 β (95%CI)	P	Model 111 β (95%CI)	P	Model 112 β (95%CI)	P
...d Parts						
	-0.73(-1.27,-0.18)	0.009	-0.67(-1.13,-0.21)	0.004	-0.60(-1.00,-0.19)	-0.60
	-0.55(-0.72,-0.38)	<0.001	-0.53(-0.67,-0.39)	<0.001	-0.52(-0.64,-0.40)	-0.52
	0.20(-0.42,0.82)	0.525	0.26(-0.26,0.79)	0.325	0.25(-0.21,0.71)	0.25
...dom Part						
...a of Residence	2		2		2	
...nily Status	2		2		-	
...her's Education	2		-		2	
...ther's Education	-		2		2	
...vels	8		8		8	
...servations	1760		1753		1755	
...IC	15686.646		15781.516		16110.029	

.2.5 Linear Mixed effect model of Psychosocial functioning and three socio mographics using maximum likelihood method of estimation and toeplitz covariance ucture

ble 4.5.2.5 shows three models with each model taking three socio demographic variable as e random effects. Maximum likelihood method of estimation was used. The OCS (p= 0.004, 004, 0.011) and GPD (p= <0.001, <0.001, <0.001) for the models respectively affected the OL but BRP had no significant effect on the QOL in the models.

Table 4.5.2.5 Linear Mixed effect model of Psychosocial functioning and three socio demographics using maximum likelihood method of estimation and toeplitz covariance structure

Variable	Model 113 β (95%CI)	P	Model 114 β (95%CI)	P	Model 115 β (95%CI)	P
Fixed Parts						
OCS	-0.79(-1.32,-0.25)	0.004	-0.78(-1.32,-0.25)	0.004	-0.70(-1.24,-0.16)	
GPD	-0.55(-0.71,-0.38)	<0.001	-0.53(-0.70,-0.36)	<0.001	-0.51(-0.68,-0.35)	
BRP	0.21(-0.41,0.83)	0.509	0.27(-0.36,0.89)	0.402	0.23(-0.39,0.85)	
Random Part						
Area of Residence	2		2		2	
Family Status	2		2		-	
Father's Education	2		-		2	
Mother's Education	-		2		2	
Levels	8		8		8	
Observations	1760		1753		1755	
AIC	15702.709		15641.225		15668.709	

4.5.2.6 Linear Mixed effect model of Psychosocial functioning and three socio demographics using restricted maximum likelihood method of estimation and toeplitz covariance structure

Table 4.5.2.6 shows three models with each model taking three socio demographic variable as the random effects. Restricted maximum likelihood method of estimation was used. The OCS (p= 0.004, 0.004, 0.011) and GPD (p= <0.001, <0.001, <0.001) for the models respectively affected the QOL but BRP had no significant effect on the QOL in the models.

Table 4.5.2.6 Linear Mixed effect model of Psychosocial functioning and three socio demographics using restricted maximum likelihood method of estimation and toeplitz covariance structure

Variable	Model 116 β (95%CI)	P	Model 117 β (95%CI)	P	Model 118 β (95%CI)	P
Fixed Parts						
OCS	-0.79(-1.32,-0.25)	0.004	-0.78(-1.32,-0.25)	0.004	-0.70(-1.24,-0.16)	
GPD	-0.55(-0.71,-0.38)	<0.001	-0.53(-0.70,-0.36)	<0.001	-0.51(-0.68,-0.35)	
BRP	0.21(-0.41,0.83)	0.509	0.27(-0.36,0.89)	0.403	0.23(-0.39,0.85)	
Random Part						
Area of Residence	2		2		2	
Family Status	2		2		-	
Father's Education	2		-		2	
Mother's Education	-		2		2	
Levels	8		8		8	
Observations	1760		1753		1755	
AIC	15698.573		15637.084		15664.341	

4.5.2.7 Linear Mixed effect model of Psychosocial functioning and three socio demographics using maximum likelihood method of estimation and unstructured covariance structure

Table 4.5.2.7 shows three models with each model taking three socio demographic variable as the random effects. Maximum likelihood method of estimation was used. The OCS (p= 0.017, 0.015, 0.031) and GPD (p= <0.001, <0.001, <0.001) for the models respectively affected the QOL but BRP had no significant effect on the QOL in the models.

Table 4.5.2.7 Linear Mixed effect model of Psychosocial functioning and three socio demographics using maximum likelihood method of estimation and unstructured covariance structure

Variable	Model 119 β (95%CI)	P	Model 120 β (95%CI)	P	Model 121 β (95%CI)	P
Fixed Parts						
OCS	-0.66(-1.21,-0.12)	0.017	-0.67(-1.22,-0.13)	0.015	-0.60(-1.15,-0.05)	0.031
GPD	-0.55(-0.72,-0.38)	<0.001	-0.53(-0.70,-0.37)	<0.001	-0.52(-0.69,-0.35)	<0.001
BRP	0.19(-0.42,0.81)	0.538	0.26(-0.36,0.88)	0.406	0.25(-0.37,0.87)	0.425
Random Part						
Area of Residence	2		2		2	
Family Status	2		2		-	
Father's Education	2		-		2	
Mother's Education	-		2		2	
Levels	8		8		8	
Observations	1760		1753		1755	
AIC	15762.909		15702.636		15729.676	

4.5.2.8 Linear Mixed effect model of Psychosocial functioning and three socio demographics using restricted maximum likelihood method of estimation and unstructured covariance structure

Table 4.5.2.8 shows three models with each model taking three socio demographic variable as the random effects. Restricted maximum likelihood method of estimation was used. The OCS ($p = 0.006, 0.005, 0.012$) and GPD ($p = <0.001, <0.001, <0.001$) for the models respectively affected the QOL but BRP had no significant effect on the QOL in the models.

Table 4.5.2.8 Linear Mixed effect model of Psychosocial functioning and three socio demographics using restricted maximum likelihood method of estimation and unstructured covariance structure

Variable	Model 122 β (95%CI)	P	Model 123 β (95%CI)	P	Model 124 β (95%CI)	P
Fixed Parts						
OCS	-0.66(-1.12,-0.19)	0.006	-0.67(-1.13,-0.21)	0.005	-0.60(-1.06,-0.13)	0.012
GPD	-0.55(-0.69,-0.41)	<0.001	-0.53(-0.68,-0.39)	<0.001	-0.52(-0.66,-0.38)	<0.001
BRP	0.19(-0.34,0.71)	0.483	0.26(-0.27,0.79)	0.330	0.25(-0.27,0.77)	0.350
Random Part						
Area of Residence	2		2		2	
Family Status	2		2		-	
Father's Education	2		-		2	
Mother's Education	-		2		2	
Levels	8		8		8	
Observations	1760		1753		1755	
AIC	15891.073		15831.525		15868.095	

4.5.2.9 Linear Mixed effect model of Psychosocial functioning and three socio demographics using maximum likelihood method of estimation and first-order autoregressive covariance structure

Table 4.5.2.9 shows three models with each model taking three socio demographic variable as the random effects. Maximum likelihood method of estimation was used. The OCS (p= 0.005, 0.004, 0.011) and GPD (p= <0.001, <0.001, <0.001) for the models respectively affected the QOL but BRP had no significant effect on the QOL in the models.

Table 4.5.2.9 Linear Mixed effect model of Psychosocial functioning and three socio demographics using maximum likelihood method of estimation and first-order autoregressive covariance structure

Variable	Model 125 β (95%CI)	P	Model 126 β (95%CI)	P	Model 127 β (95%CI)	P
Fixed Parts						
OCS	-0.77(-1.31,-0.23)	0.005	-0.78(-1.32,-0.25)	0.004	-0.70(-1.24,-0.16)	0.011
GPD	-0.55(-0.72,-0.38)	<0.001	-0.53(-0.70,-0.36)	<0.001	-0.51(-0.68,-0.35)	<0.001
BRP	0.21(-0.41,0.84)	0.500	0.27(-0.36,0.89)	0.402	0.23(-0.39,0.85)	0.470
Random Part						
Area of Residence	2		2		2	
Family Status	2		2		-	
Father's Education	2		-		2	
Mother's Education	-		2		2	
Levels	8		8		8	
Observations	1760		1753		1755	
AIC	15690.694		15629.224		15656.499	

4.5.3.0 Linear Mixed effect model of Psychosocial functioning and three socio demographics using restricted maximum likelihood method of estimation and first-order autoregressive covariance structure

Table 4.5.3.0 shows three models with each model taking three socio demographic variable as the random effects. Restricted maximum likelihood method of estimation was used. The OCS (p= 0.004, 0.004, 0.013) and GPD (p= <0.001, <0.001, <0.001) for the models respectively affected the QOL but BRP had no significant effect on the QOL in the models.

Table 4.5.3.0 Linear Mixed effect model of Psychosocial functioning and three socio demographics using restricted maximum likelihood method of estimation and first-order autoregressive covariance structure

Variable	Model 128 β (95%CI)	P	Model 129 β (95%CI)	P	Model 130 β (95%CI)	P
Fixed Parts						
OCS	-0.79(-1.32,-0.25)	0.004	-0.78(-1.32,-0.25)	0.004	-0.69(-1.23,-0.14)	0.013
GPD	-0.55(-0.71,-0.38)	<0.001	-0.53(-0.70,-0.36)	<0.001	-0.51(-0.68,-0.35)	<0.001
BRP	0.21(-0.41,0.83)	0.509	0.27(-0.36,0.89)	0.403	0.23(-0.39,0.86)	0.469
Random Part						
Area of Residence	2		2		2	
Family Status	2		2		-	
Father's Education	2		-		2	
Mother's Education	-		2		2	
Levels	8		8		8	
Observations	1760		1753		1755	
AIC	15686.573		15625.084		15652.325	

4.5.3.1 Linear Mixed effect model of Psychosocial functioning and four socio demographics using maximum likelihood method of estimation and variance components covariance structure

Table 4.5.3.1 shows a model in with four socio demographic variable were taken as the random effects. Maximum likelihood method of estimation was used. The OCS (p= 0.007) and GPD (p= <0.001) for the model affected the QOL but BRP had no significant effect on the QOL in the models.

Table 4.5.3.1 Linear Mixed effect model of Psychosocial functioning and four socio demographics using maximum likelihood method of estimation and variance components covariance structure

Variable	Model 131 β (95%CI)	P
Fixed Parts		
OCS	-0.75(-1.29,-0.20)	0.007
GPD	-0.53(-0.70,-0.36)	<0.001
BRP	0.20(-0.43,0.82)	0.542
Random Part		
Area of Residence	2	
Family Status	2	
Father's Education	2	
Mother's Education	2	
Levels	16	
Observations	1726	
AIC	15391.311	

4.5.3.2 Linear Mixed effect model of Psychosocial functioning and four socio demographics using restricted maximum likelihood method of estimation and variance components covariance structure

Table 4.5.3.2 shows a model in with four socio demographic variable were taken as the random effects. Restricted maximum likelihood method of estimation was used. The OCS ($p = 0.010$) and GPD ($p = <0.001$) for the model affected the QOL but BRP had no significant effect on the QOL in the models.

Table 4.5.3.2 Linear Mixed effect model of Psychosocial functioning and four socio demographics using restricted maximum likelihood method of estimation and variance components covariance structure

Variable	Model 132 β (95%CI)	P
Fixed Parts		
OCS	-0.72(-1.27,-0.17)	0.010
GPD	-0.53(-0.70,-0.37)	<0.001
BRP	0.19(-0.44,0.82)	0.549
Random Part		
Area of Residence	2	
Family Status	2	
Father's Education	2	
Mother's Education	2	
Levels	16	
Observations	1726	
AIC	15386.898	

4.5.3.3 Linear Mixed effect model of Psychosocial functioning and four socio demographics using maximum likelihood method of estimation and compound symmetry covariance structure

Table 4.5.3.3 shows a model in with four socio demographic variable were taken as the random effects. Maximum likelihood method of estimation was used. The OCS ($p = 0.021$) and GPD ($p < 0.001$) for the model affected the QOL but BRP had no significant effect on the QOL in the models.

Table 4.5.3.3 Linear Mixed effect model of Psychosocial functioning and four socio demographics using maximum likelihood method of estimation and compound symmetry covariance structure

Variable	Model 133 β (95%CI)	P
Fixed Parts		
OCS	-0.65(-1.20,-0.10)	0.021
GPD	-0.54(-0.70,-0.37)	<0.001
BRP	0.19(-0.44,0.81)	0.557
Random Part		
Area of Residence	2	
Family Status	2	
Father's Education	2	
Mother's Education	2	
Levels	16	
Observations	1726	
AIC	15398.828	

4.5.3.4 Linear Mixed effect model of Psychosocial functioning and four socio demographics using restricted maximum likelihood method of estimation and compound symmetry covariance structure

Table 4.5.3.4 shows a model in with four socio demographic variable were taken as the random effects. Restricted maximum likelihood method of estimation was used. The OCS (p= 0.022) and GPD (p= <0.001) for the model affected the QOL but BRP had no significant effect on the QOL in the models.

Table 4.5.3.4 Linear Mixed effect model of Psychosocial functioning and four socio demographics using restricted maximum likelihood method of estimation and compound symmetry covariance structure

Variable	Model 134 β (95%CI)	P
Fixed Parts		
OCS	-0.64(-1.19,-0.09)	0.022
GPD	-0.54(-0.70,-0.37)	<0.001
BRP	0.19(-0.44,0.81)	0.557
Random Part		
Area of Residence	2	
Family Status	2	
Father's Education	2	
Mother's Education	2	
Levels	16	
Observations	1726	
AIC	15395.083	

4.5.3.5 Linear Mixed effect model of Psychosocial functioning and four socio demographics using maximum likelihood method of estimation and toeplitz covariance structure

Table 4.5.3.5 shows a model in with four socio demographic variable were taken as the random effects. Restricted maximum likelihood method of estimation was used. The OCS (p= 0.006) and GPD (p= <0.001) for the model affected the QOL but BRP had no significant effect on the QOL in the models.

Table 4.5.3.5 Linear Mixed effect model of Psychosocial functioning and four socio demographics using maximum likelihood method of estimation and toeplitz covariance structure

Variable	Model 135 β (95%CI)	P
Fixed Parts		
OCS	-0.75(-1.29,-0.21)	0.006
GPD	-0.53(-0.70,-0.36)	<0.001
BRP	0.20(-0.43,0.82)	0.540
Random Part		
Area of Residence	2	
Family Status	2	
Father's Education	2	
Mother's Education	2	
Levels	16	
Observations	1726	
AIC	15421.318	

4.5.3.6 Linear Mixed effect model of Psychosocial functioning and four socio demographics using restricted maximum likelihood method of estimation and toeplitz covariance structure

Table 4.5.3.6 shows a model in with four socio demographic variable were taken as the random effects. Restricted maximum likelihood method of estimation was used. The OCS (p= 0.007) and GPD (p= <0.001) for the model affected the QOL but BRP had no significant effect on the QOL in the models.

Table 4.5.3.6 **Linear Mixed effect model of Psychosocial functioning and four socio demographics using restricted maximum likelihood method of estimation and toeplitz covariance structure**

Variable	Model 136 **β (95%CI)**	P
Fixed Parts		
OCS	-0.75(-1.29,-0.21)	0.007
GPD	-0.53(-0.70,-0.36)	<0.001
BRP	0.20(-0.43,0.83)	0.541
Random Part		
Area of Residence	2	
Family Status	2	
Father's Education	2	
Mother's Education	2	
Levels	16	
Observations	1726	
AIC	15417.096	

4.5.3.7 Linear Mixed effect model of Psychosocial functioning and four socio demographics using maximum likelihood method of estimation and unstructured covariance structure

Table 4.5.3.7 shows a model in with four socio demographic variable were taken as the random effects. Maximum likelihood method of estimation was used. The OCS (p= 0.023) and GPD (p= <0.001) for the model affected the QOL but BRP had no significant effect on the QOL in the models.

Table 4.5.3.7 Linear Mixed effect model of Psychosocial functioning and four socio demographics using maximum likelihood method of estimation and unstructured covariance structure

Variable	Model 137 β (95%CI)	P
Fixed Parts		
OCS	-0.61(-1.14,-0.09)	0.023
GPD	-0.54(-0.70,-0.38)	<0.001
BRP	0.18(-0.42,0.78)	0.564
Random Part		
Area of Residence	2	
Family Status	2	
Father's Education	2	
Mother's Education	2	
Levels	16	
Observations	1726	
AIC	15690.936	

4.5.3.8 Linear Mixed effect model of Psychosocial functioning and four socio demographics using restricted maximum likelihood method of estimation and unstructured covariance structure

Table 4.5.3.8 shows a model in with four socio demographic variable were taken as the random effects. Restricted maximum likelihood method of estimation was used. The OCS (p= 0.008) and GPD (p= <0.001) for the model affected the QOL but BRP had no significant effect on the Q●L in the models.

Table 4.5.3.8 Linear Mixed effect model of Psychosocial functioning and four socio demographics using restricted maximum likelihood method of estimation and unstructured covariance structure

Variable	Model 138 β (95%CI)	P
Fixed Parts		
OCS	-0.61(-1.07,-0.16)	0.008
GPD	-0.54(-0.68,-0.40)	<0.001
BRP	0.18(-0.34,0.69)	0.509
Random Part		
Area of Residence	2	
Family Status	2	
Father's Education	2	
Mother's Education	2	
Levels	16	
Observations	1726	
AIC	15849.468	

4.5.3.9 Linear Mixed effect model of Psychosocial functioning and four socio demographics using maximum likelihood method of estimation and first-order autoregressive covariance structure

Table 4.5.3.9 shows a model in with four socio demographic variable were taken as the random effects. Maximum likelihood method of estimation was used. The OCS (p= 0.009) and GPD (p= <0.001) for the model affected the QOL but BRP had no significant effect on the QOL in the models.

Table 4.5.3.9 Linear Mixed effect model of Psychosocial functioning and four socio demographics using maximum likelihood method of estimation and first-order autoregressive covariance structure

Variable	Model 139 β (95%CI)	P
Fixed Parts		
OCS	-0.73(-1.27,-0.18)	0.009
GPD	-0.53(-0.70,-0.37)	<0.001
BRP	0.20(-0.43,0.83)	0.542
Random Part		
Area of Residence	2	
Family Status	2	
Father's Education	2	
Mother's Education	2	
Levels	16	
Observations	1726	
AIC	15393.242	

4.5.4.0 Linear Mixed effect model of Psychosocial functioning and four socio demographics using restricted maximum likelihood method of estimation and first-order autoregressive covariance structure

Table 4.5.4.0 shows a model in with four socio demographic variable were taken as the random effects. Restricted maximum likelihood method of estimation was used. The OCS (p= 0.007) and GPD (p= <0.001) for the model affected the QOL but BRP had no significant effect on the QOL in the models.

Table 4.5.4.0 Linear Mixed effect model of Psychosocial functioning and four socio demographics using restricted maximum likelihood method of estimation and first-order autoregressive covariance structure

Variable	Model 140 β (95%CI)	P
Fixed Parts		
OCS	-0.75(-1.29,-0.21)	0.007
GPD	-0.53(-0.70,-0.36)	<0.001
BRP	0.20(-0.43,0.83)	0.541
Random Part		
Area of Residence	2	
Family Status	2	
Father's Education	2	
Mother's Education	2	
Levels	16	
Observations	1726	
AIC	15389.096	

4.6 Model fit assessment using Akaike's Information Criterion.

Table 4.6 shows all the fitted models with their Akaike's information criteria. Model 132 had the lowest Akaike's information criteria which indicates that it's the best model.

4.6 Model fit assessment using Akaike's Information Criterion.

Table 4.6 shows all the fitted models with their Akaike's information criteria. Model 132 had the lowest Akaike's information criteria which indicates that it's the best model.

Table 4.6 Akaike's Information Criteria of the Linear mixed effected models

Serial No.	AIC	Model	AIC	Model	AIC
1	16467.916	50	16529.572	99	16452.779
2	17067.394	51	16450.804	100	16523.631
3	16913.993	52	16521.539	101	15688.708
4	16794.886	53	16163.433	102	15627.224
5	16464.014	54	15971.200	103	15654.499
6	17062.518	55	15910.279	104	15680.419
7	16876.569	56	16536.341	105	15622.992
8	16790.81	57	16457.373	106	15650.341
9	16470.097	58	16528.544	107	15692.372
10	17068.525	59	16159.084	108	15630.524
11	16883.151	60	16030.052	109	15659.877
12	16797.217	61	15997.029	110	15686.646
13	16466.014	62	16623.686	111	15781.516
14	17064.517	63	16452.845	112	16110.029
15	16878.569	64	16523.549	113	15702.709
16	16792.807	65	16166.818	114	15641.225
17	16469.915	66	15973.997	115	15668.709
18	17068.480	67	15913.205	116	15698.573
19	16882.714	68	16540.071	117	15637.084
20	16796.886	69	16460.821	118	15664.341
21	16466.014	70	16531.547	119	15762.909
22	17064.518	71	16162.751	120	15702.636
23	16878.569	72	15969.930	121	15729.676
24	16792.808	73	15909.071	122	15891.073
25	16472.100	74	16537.323	123	15831.525
26	17070.639	75	16459.006	124	15868.095
27	16885.419	76	16527.274	125	15690.694
28	16799.348	77	16179.628	126	15629.224
29	16468.014	78	15988.575	127	15656.499
30	17068.804	79	15927.497	128	15686.573
•31	16880.569	80	16552.813	129	15625.084
32	16794.808	81	16473.269	130	15652.325
33	16469.915	82	16543.547	131	15391.311
34	17068.538	83	16219.582	132	15386.898*
35	16882.714	84	15981.930	133	15398.828
36	16796.886	85	15960.974	134	15395.083
37	16466.014	86	16590.82	135	15421.318
38	17064.518	87	16510.001	136	15417.096
39	16878.569	88	16578.476	137	15690.936
40	16792.810	89	16162.653	138	15849.468
41	16160.765	90	15969.997	139	15393.242
42	15967.997	91	15909.205	140	15389.096
43	15907.205	92	16536.296		
44	16573.661	93	16457.568		
45	16455.799	94	16527.547		
46	16525.547	95	16152.751		
47	16156.751	96	15965.818		
48	15963.882	97	15905.125		
49	15903.131	98	16531.924		

CHAPTER FIVE

DISCUSSION, CONCLUSIONS AND RECOMMENDATION

5.1 Discussion

This study assessed the effects of various psychosocial functions and socio demographics (background variables) on the quality of life of adolescents. An adapted World Health Organization Quality of Life-Bref (WHOQOL-BREF) was used to assess the Adolesents QOL and the Adolescents' psychosocial functioning Inventory (APFI) was used to assess the Adolescents psychosocial functioning. These were done among non-diseased population of Adolesents.

We found that family status of adolescents affected their quality of life through bivariate analysis which agrees with previous studies (Gonçalves et al., 2010; Fuh et al., 2005 and Cecen- Erogul et al., 2012). Although some studies depicted that the Area of Residence and parents level of education had significant effects on Quality of life (Singh et al., 2014 and Masrour et al., 2011), the area of residence, father's highest level of education and mother's highest level of education had no significant effect on the quality of life of adolescents in our study, this may be due to the fact that the participants were from a low income setting (Deaton, 2008).

In our result, family status had no significant effect on the QOL of adolescents through multivariate analysis. This was in contrast to Musick and Meier 2010 in which their study suggested that parental conflict had an effect on young adults and those adolescents who live with single mothers and stepfather families were more associated with the predictors of well-being which might be due to the differences in the way the information was obtained from participants. In Musick and Meier's study, questions on parental conflict were asked.

Furthermore, in our study, adolescents whose mothers have no kind of education were less likely to have a poor QOL compared to those whose mothers have some formal education. The father's highest level of education did not have a significant effect on adolescents QOL. These results were in line with Crede et al., 2015 findings which showed that just mother's education presides over the relationship between adolescents' life satisfaction and academic achievement. Adolescents whose mother's had achieved the same or higher education as their children had an association between their life satisfaction and academic achievements but the father's educational attainment was not a significant predictor of this relationship.

As stated by Akpa et al., 2015 the reliability estimate for the internal consistency of the APFI subscales were moderate for OCS and BRP and good for GDP. Our results showed that OCS, GPD and Age significantly predicted the adolescents QOL but BRP had no significant effect on the QOL. This follows an existing literature of Wu YP and Steele RG in 2013 which identified three psychosocial subgroups. It was stated that subgroups having higher levels of psychosocial problems had poorer outcomes of QOL.

Also, Lee et al., 2006 reported that worse psychosocial functioning was recorded among adolescents between the ages of five and eleven and that adolescents below eleven years reported lower mean QOL scores.

Our model consisted of different method of estimation and different covariance structures. The random effects were added to the APFIs (fixed effects) in a sequential order. After adding the random effects sequential to the models the OCS and GPD were significant in most cases but the BRP was not significant for all the models which supports the regression analysis of the APFI on the QOL done earlier in the study.

The REML provided better estimates overall compared to the ML which correlates with Diggle et al., 2002 who stated that the REML provides less bias estimate compared to the ML. Different covariance structures were used in the process of finding the best fit model. There is no general rule in the selection of covariance structures but feasibility and the fit indices are ways of selecting appropriate ones (Maldonado, 2012).

The AIC was used as a method of model selection in our study. Although there are other different information criteria used in the selection of a best fit model, a recent work (Gurka, 2006) suggested that at the moment there is no criterion that stands alone as 'best' criterion when selecting Linear mixed Models and that in general understanding the role played by information criteria, more work needs to be done.

5.2 Conclusion

Our study analyzed the effect of socio demographics and psychosocial functions on the quality of life of adolescents. Our findings showed that age, gender, family status, mother's highest level of education and two of the three Adolescents psychosocial functioning inventory scales (OCS and GPD) had significant effects on the quality of life of adolescents. Furthermore, the restricted maximum likelihood method of estimation with the variance components covariance structure provided the best fit model.

5.3 Limitations

In our study, there is a limitation in the ability of the instruments to measure outcome of interests particularly in the measurement of psychosocial functioning (Burchinal, Nelson and Poe, 2006). Another limitation to our study are the covariates not collected that may be essential to the results. In addition, pertaining to the modeling approach used, limitations are partly in the instruments and knowledge and also partly in the hands of the researcher (Maldonado, 2012). The method used for analysis (LME) is with his own disadvantages as with other statistical methods and the approach was chosen because of the nature of our data. LME is the most appropriate model for the data. Although, assumption verification is stressed in statistical methods, LME could be an exception. For instance, there are limited methods used in verifying the normality assumption for the normality of the error term and the random-effects (Jiang, 2007). The impact caused by ignoring these assumptions is unclear (Verbeke and lasaffre, 1996). Although Jiang(2007) proposed methods of goodness of fit tests and diagnostic plots to know the distribution of the error term and the random effects, however, the process is comfortably ignored and will continue to be the norm until guidelines which are generally accepted are suggested.

Furthermore, the selection of a bias free model is rare. In LME researchers are not only concerned with the indicators for the model but also ascribing the best covariance structure for the random effects (Maldonado, 2012). Choosing a covariance structure is more difficult than expected. Estimating the covariance matrix involves an optimization problem for which the often used newton-raphson and estimated mean algorithm may be unsuccessful (Peng and Lu, 2012). We tried balancing the indicator relevance and the suitability of the covariance structure with the number of estimated parameter to solve this. Also, in our analysis there were covariance structures that were not considered but given the nature of the analysis, it is highly unlikely that a more disciplined structure would have provided the best fit.

Regardless of these limitations in our model approach, we are self-assured of the models presented and that our results have significantly contributed to adolescents' health and provided a good background in the formation of future interventions.

5.4 Recommendation

More intense research (both cross sectional and cohort studies) should be centered into the QOL and psychosocial functioning of adolescents in order to better describe and gain more knowledge of their way of life and thinking. Also, more studies using linear mixed effect models should be encouraged.

REFERENCES

Adil, A. Ghayas, S. (2008). Impact of parent death on adolescents' psychosocial functioning. *Journal of Psychiatric Reasearch*. Vol. 3(1) P. 1-11

Ainsworth, M. and Filmer D (2006). Inequalities in children's schooling: AIDS, orphanhood, poeverty, and gender. *World Development 34: 1099-1128.*

Akpa, OM. Bamgboye, EA. Baiyewu, O (2015). The Adolescents' Psychosocial Functioning Inventory (APFI): scale development and initial validation using Exploratory and Confirmatory Factor Analysis. *Afr J Psychol Study Soc Issues. 2015; 18(1): 1-21*

Atwine, B. Cantor, E. Banjunirwe, F. (2005). Psychological distress among AIDS orphans in rural Uganda. *Social Science & Medicine 61: 555 - 564.*

Awasthi, S. Agnihotri, K. Chandra, H. Singh, U. Thakur, S (2010). Validation of WHO QOL-BREF instrument in Indian adolescents. *The Indian Journal of Pediatrics* 77(4), pp 381-386

Baca, CB. Vickrey, BG. Hays, RD. Vassar,SD. Berg, AT. (2010). Differences in child versus parent reports of the child's health-related quality of life in children with epilepsy and healthy siblings. *Value in Health, Vol.13, No.6, pp.778-786, ISSN: 1524-4733*

Balkrishnan, R. Kulkarni, AS. Cayce, K. Feldman, SR. (2006).Predictors of healthcare outcomes and costs related to medication use in patients with acne in the United States. *Cutis 2006 Apr;77(4):251-5.*

Behrendt, A. and Serigne, MM. (2008). The psychosocial impact of parents loss and orphanhood of children the the areas of high prevalence: a cross section study in the North West region ofCameroon. http://www.sx.ac.uk/armedcon/story_id/Study_report_Cameroon.pdf

Brant. (2007) Multiple Linear Regression. https://www.stat.ubc.ca/~rollin/teach/BiostatW07/reading/MLR.pdf

Bronfenbrenner, U. (2001). Human development. *Bioecological Theory of. In N. J. Smelser & P. B. Baltes (Eds.). International encyclopedia of the social and behavioral sciences (pp. 6963-6970). Oxford, England: Elsevier.* http://dx.doi.org/10.1016/B0-08-043076-7/00359-4

Bronfenbrenner, U. (2005). Making human beings human: Bioecological perspectives on human development.*Thousand Oaks,CA:SAGE Publications, Inc; 1 edition*

Brown RT. Antonuccio, DO. DuPaul, GJ. (2008). Childhood Mental Health Disorders Evidence Base and Contextual Factors for Psychosocial, Psychopharmacological, and Combined Interventions. Washington,DC: American Psychological Association;2008

Burchinal, MR. Nelson, L. Poe, M. (2006).Growth Curve Analysis: An Introduction to Various Methods for Analyzing Longitudinal Data. *Monographs of the Society for Research in Child Development, 71(3), 65-87.*

Calarge, CA. Ginger, N. Diqiong, X. Zimmerman, B. (2012).Correlates of weight gain during long-term risperidone treatment in children and adolescents. *Child and Adolescent Psychiatry and Mental Health*20126:21 http://www.capmh.com/content/6/1/21

Caldera, Y. Hart, S.(2004). Exposure to Child Care, Parenting Style and Attachment Security. Infant and Child Development, 13, 21-33.

Case, A. Ardington, C.(2006). The impact of parental death on school outcomes: longitudinal evidence from South Africa. *Demography, 43: 483-508.* https://www.princeton.edu/rpds/papers/Case_Ardington_The_Impact_of_Parental_Death_on_School_Enrollment_Demography.pdf

Castro, MG. Oliveira, MS. Miguel, AC. Araujo, RB (2007). WHOQOL-BREF psychometric properties in a sample of smokers. Revista Brasileira de Psiquiatria Vol 29 no 3 http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1516-44462007000300012

Cecen-Erogul. Ayse, R. Dingiltepe. Tmur (2012). The comparison of Adolescents form single parent families and intact families in terms of life satisfaction and Quality of life. Ilkogretim Online, *Vol. 11 Issue 4, p1077-1086. 10p.*

Central Intelligence Agency. (2014). The World Fact Book. Country Comparison to the World. Population. Available from: https://www.cia.gov/library/publications/the-world-factbook/fields/2119.html.

Chatterji, M., Dougherty, L. Ventimiglia, T. Mulenga, Y. Jones, A. Mukaneza, A. Murray, N. Buek, K. William, W. Amon, J (2005). The well-being of children affected by HIV/AIDS in Lusake, Zambia. and Gitarama Province, Rwanda. from http://www.synergaid.org/documents/Lusaka_Gatimara_BaselineReport.pdf

Choudhury, S. Blakemore, S. Charman (2006). Social cognitive development during adolescence (2006) *Soc Cogn Affect Neurosci, 1(3):165-174*

Crede, J. Wirthwein, L. McElvany, N. Steinmayr, R. (2015).Adolescents' academic achievement and life satisfaction: the role of parents' education. *Frontiers in Psychology.2015;6: 52* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4315030/

David, A. and Brazier. C. (2011). The state of the world's children (2011). Adolescence an age of opportunity. http://www.unicef.org/publications/index_57469.html

Davis, CS. (2002). Statistical Methods for the Analysis of Repeated Measurements. New York, NY: Springer. http://www.springer.com/us/book/9780387953700

Deaton. Angus. (2008). Income, Health, and Well-Being around the World: Evidence from the Gallup World Poll. *Journal of Economic Perspectives,22(2):53-72.*

Diggle, P. Heagerty, P. Liang, KY. Zeger, S. (2002). Analysis of Longitudinal Data. New York, NY: Oxford University Press.

Dunn LK, O'Neill JL, Feldman SR (2011) Acne in Adolescents: Quality of life, self-esteem, mood, and psychological disorders. *Dermatol Online J. 2011 Jan 15;17(1):1.*

Eiser, C. Morse, R. (2001). A review of measure of quality of life in children with chronic illness. *Archives of Disease Childhood, 84, 205–211.* http://dx.doi.org/10.1136/adc.84.3.205

Fikret Isik. (2011). Generalized Linear Mixed Models An Introduction for Tree Breeders and Pathologists. Statistic Session class notes, Fourth International Workshop on the Genetics of Host-Parasite Interactions in Forestry. http://www4.ncsu.edu/~fisik/Fikret%20Isik%20-%20Lecture%20notes%20for%20statistics%20session%20-%20IUFRO%20Genetics%20of%20Host-Parasite%20Interactions%20in%20Forestry%20-%202011.pdf

Finucane Jeffrey. H Samet and Nicholas J Horton (2007). Translational methods in biostatistics: linear mixed effect regression models of alcohol consumption and HIV disease progression over time. *Epidemiologic Perspectives & Innovations 2007, 4:8 doi:10.1186/1742-5573-4-8.* http://www.epi-perspectives.com/content/4/1/8.

Folayan, MO. Haire, B. Harrison, A. Odetoyingbo, M. Fatusi, O. Brown, B. (2015). Ethical Issues in Adolescents Sexual and Reproductive Health Research in Nigeria. *Developing World Bioethics.* 15(3): 191–198. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4600029/

Foster, G. (2002). "The capacity of the extended family safety net for orphans in Africa. *Psychology, Health and Medicine 5: 55 - 62.*

Fuh JL, Wang SJ, Lu SR and Juang KD, (2005). Assessing quality of life of adolescents in Taiwan. *Psychiatry and clinical Neurosciences. 2005 feb;59(1):11-8.*

Gaspar, T. Matos, G. (2009). Adolescent's lifestyles, ethnicity and socioeconomic status in Portugal. *Journal of Cognition, Brain and Behavior 13, 49–57.*

Gaspar, T. Matos, M. Ribeiro, JL. Leal, I. Erhart, M. Ravens-Sieberer, U. (2010). Kidscreen-52: Quality of life in children and adolescents. *Journal of Children and Adolescents Psychology, 1, 49–64.*

Gaspar, T. Matos, M. Ribeiro, J. Leal, I. Ferreira, A. (2009). Health-related quality of life in children and adolescents and associated factors. *Journal of Cognitive and Behavioral Psychotherapies, 9, 33–48.*

Gbiri, CA. Akingbohungbe, AD. (2011). Determinants of Quality of Life in Nigerian Children and Adolescents with Epilepsy: A Hospital-based Study. *Disability, CBR and Inclusive Development (DCID) formerly Asia Pacific Disability Rehabilitation Journal. Vol22, No3 (2011).* http://dcidj.org/article/view/99

Giannakopoulos, G. Dimitrakaki, C. Pedeli, X. Kolaitis, G. Rotsika, V. Ravens-Sieberer, U. Tountas Y. (2009). Adolescents' wellbeing and functioning: relationships with parents' subjective general physical and mental health. *Health and Quality outcomes* 7:100.

Gingrich, P. (2004). Introductory Statistics for the social sciences. 735-74 http://uregina.ca/~gingrich/ch10.pdf

Girma Minalu, Aerts, M. Coenen, S. Versporten A, Muller, A. Adriaenssens, N. Beutels P. Molenberghs, G. Goossens, H. Hens, N. (2011). Application of mixed-effects models to study the country-specific outpatient antibiotic use in Europe: a tutorial on longitudinal data analysis. *Journal of Antimicrobial Chemotherapy Volume 66, Issue suppl 6 Pp. vi79-vi87.*
http://jac.oxfordjournals.org/content/66/suppl_6/vi79.full

Gonçalves, H. González, DA. Araújo, CL. Anselmi, L. Menezes, AM. (2010). The impact of Sociodemographic conditions on the Quality of life among adolescents in a Brazilian Birth cohort: a longitudinal study. *Rev Panam Salud Publica 28(2), 2010.* http://www.scielosp.org/pdf/rpsp/v28n2/a01v28n2.pdf

Goodburn, EA. Ross, DA. (1995). A picture of health? A review and annotated bibliography of the health of young people in developing countries. Geneva, Switzerland: World Health Organization, World Health Organization, Adolescent Health Programme. Available from: https://extranet.who.int/iris/restricted/handle/10665/62500.

Gurka, M.J. (2006). Selecting the Best Linear mixed model under REML, *The American Statistician, 60(1),19,2006.*

Haneef, Z., Grant, ML. Valencia, I. Hobdell, EF. Kothare, SV. Legido, A. Khurana, D. (2010). Correlation between child and parental perceptions of health-related quality of life in epilepsy using the PedsQL V 4.0 measurement model. *Epileptic disorders, Vol.12, No.4, pp.275-282*

Hariharan, S. Rogers, JH. (2008). Estimation Procedures for Hierarchical Linear Models. Multilevel Modeling of Educational Data (A. A. Connell and D. B. McCoach, eds.).*Charlotte, NC: Information Age Publishing, Inc.* http://www.infoagepub.com/products/Multilevel-Modeling-of-Educational-Data

Hasnain, M. Vieweg, WV. Hollet, B. (2012).Weight gain and glucose dyregulation with second-generation antipsychotics and antidepressants: a review for primary care physicians. *Postgraduate Medicine 124(4): 154-67. Doi:10.3810/pgm.2012.07.2577. PMID 22913904*

IBM SPSS Advanced Statistics 22. (2013). Page 99-101. http://www.sussex.ac.uk/its/pdfs/SPSS_Advanced_Statistics_22.pdf

Issa BA, Baiyewu O. (2006). Quality of life of patuients with Diabetes mellitus in a Nigerian Teaching Hospital. *Hong Kong Journal of Psychiatry. 2006; 16:27–33.*

Szyndler, JE. Towns, SJ. Van Asperen, PP. Mckay, KO. (2005). Psychological and family functioning and quality of life in adolescents with cystic fibrosis. Journal of Cystic Fibrosis 4 135– 144

Jiming Jiang (2007). Linear and Generalized Linear Mixed Models and their applications. *New York: Springer Science + Business media, LLC.* http://www.springer.com/us/book/9780387479415

Karen Grace-Martin, (2016). Logistic Regression Models for Multinomial and ordinal variables. The Analysis Factor. http://www.theanalysisfactor.com/logistic-regression-models-for-multinomial-and-ordinal-variables/

Kiirya, S. (2005). Sometimes I wish I would also die: AIDS-related parental death and its effect on orphaned children's self-esteem and sociability at school. Kampala, Uganda, Department of Educational Psychology, Makerere University.

Koot, H. (2002). Challenges in child and adolescent quality of life research. Acta Paediatrics, 91, 265-266.

Landgraf, JM. Maunsell, E. Speechley, KN. Bullinger, M. Campbell, S. Abetz, L. Ware, JE. (1998). Canadian-French, German and UK versions of the Child Health Questionnaire: methodology and preliminary item scaling results. *Quality of Life Research.*7:433-445.

Lee, GM. Steven L. Gortmaker, McIntosh, K Hughes, MD. Oleske, JM. (2006). Quality of life for children and Adolescents: Impact of HIV Infection and Antiretroviral Treatment.February2006,volume117 /issue2. http://pediatrics.aappublications.org/content/117/2/273

Lindblade, Odhiambo, KF. Rosen, DH. DeCock, KM. (2003). Health and nutritional status of orphans < 6 years old cared for by relatives in Western Kenya.*Tropical Medicine and International Health* 8: 67-72. http://onlinelibrary.wiley.com/doi/10.1046/j.1365-3156.2003.00987.x/full

Makama, V. Ani, C. Grantham-McGregor (2002). Psychological well-being of orphans in Dar El Salaam, Tanzania. *Acta Paediatrica 91(4): 459 – 479*

Hasnain, M. Vieweg, WV. Hollet, B. (2012).Weight gain and glucose dyregulation with second-generation antipsychotics and antidepressants: a review for primary care physicians. *Postgraduate Medicine 124(4): 154-67. Doi:10.3810/pgm.2012.07.2577. PMID 22913904*

IBM SPSS Advanced Statistics 22. (2013). Page 99-101. http://www.sussex.ac.uk/its/pdfs/SPSS_Advanced_Statistics_22.pdf

Issa BA, Baiyewu O. (2006). Quality of life of patuients with Diabetes mellitus in a Nigerian Teaching Hospital. *Hong Kong Journal of Psychiatry. 2006; 16:27–33.*

Szyndler, JE. Towns, SJ. Van Asperen, PP. Mckay, KO. (2005). Psychological and family functioning and quality of life in adolescents with cystic fibrosis. Journal of Cystic Fibrosis 4 135– 144

Jiming Jiang (2007). Linear and Generalized Linear Mixed Models and their applications. *New York: Springer Science + Business media, LLC.* http://www.springer.com/us/book/9780387479415

Karen Grace-Martin, (2016). Logistic Regression Models for Multinomial and ordinal variables. The Analysis Factor. http://www.theanalysisfactor.com/logistic-regression-models-for-multinomial-and-ordinal-variables/

Kiirya, S. (2005). Sometimes I wish I would also die: AIDS-related parental death and its effect on orphaned children's self-esteem and sociability at school. Kampala, Uganda, Department of Educational Psychology, Makerere University.

Koot, H. (2002). Challenges in child and adolescent quality of life research. Acta Paediatrics, 91, 265-266.

Landgraf, JM. Maunsell, E. Speechley, KN. Bullinger, M. Campbell, S. Abetz, L. Ware, JE. (1998). Canadian-French, German and UK versions of the Child Health Questionnaire: methodology and preliminary item scaling results. *Quality of Life Research.* 7:433-445.

Lee, GM. Steven L. Gortmaker, McIntosh, K Hughes, MD. Oleske, JM. (2006). Quality of life for children and Adolescents: Impact of HIV Infection and Antiretroviral Treatment.February2006,volume117 /issue2. http://pediatrics.aappublications.org/content/117/2/273

Lindblade, Odhiambo, KF. Rosen, DH. DeCock, KM. (2003). Health and nutritional status of orphans < 6 years old cared for by relatives in Western Kenya.*Tropical Medicine and International Health* 8: 67-72. http://onlinelibrary.wiley.com/doi/10.1046/j.1365-3156.2003.00987.x/full

Makama, V. Ani, C. Grantham-McGregor (2002). Psychological well-being of orphans in Dar El Salaam, Tanzania. *Acta Paediatrica 91(4): 459 – 479*

Maldonado, LG. (2012). Linear Mixed-Effects Models: Applications to the Behavioral Sciences and Adolescent Community Health. http://scholarcommons.usf.edu/etd/4363

Mallmann,(2003). Building resilience in children affected by HIV and AIDS. *Maskew MillerLongman.* https://www.k4health.org/sites/default/files/BuildingResilienceManual.pdf

Masrour, RD. Chehrehgosha, M. Seyyedolshohadayee, M. Hosseini, AF. (2011).Quality of life and its related factors in adolescents with epilepsy. *Iran journal of Nursing* volume 24,(73); 47-54 http://ijn.iums.ac.ir/browse.php?a_id=1044&sid=1&slc_lang=en

Methúsalemsdóttir,HF. Egilson, SP. Guðmundsdóttir, R. Valdimarsdóttir, UA. Georgsdóttir, I. (2013). Quality of life of adolescents born with extreme low birth weight. Acta Paediatrica 102(6): 597-601.

Miller,V. Palermo,TM. Grewe, SD. (2003). Quality of life in pediatric epilepsy: Demographic and disease-related predictors and comparison with healthy controls. *Epilepsy & behavior*, Vol.4, No.1, pp.36-42, ISSN: 1525-5069.

Min, SK. Kim, KI. Lee, CI. Gung, YC. Suh, SY.and Kim. DK (2002). Development of the Korean version of the WHO Quality of Life scale and WHOQOL-BREF. *Quality of Life Reasearch*, 11, 593-600

Modi, AC. King, AS. Monahan, SR. Koumoutsos, JE. Morita, DA. Glauser, TA. (2009). Even a single seizure negatively impacts pediatric health-related quality of life. *Epilepsia*, Vol.50, No.9, pp.2110-2116

Montanaro, M. Battistella, PA. Boniver,C. Galeone, D. (2004). Quality of life in young Italian patients with epilepsy. *Neurological sciences*, Vol.25, No.5, pp.264-73

Musick, K. Meier, A. (2010). Are both parents always better than one? Parental conflict and Young adult well-being. *Social Science Research. 2010 Sep 1; 39(5): 814–830* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2930824/

NBS (2012). National Baseline Youth Survey. NBS Final Report in collaboration with Federal Ministry of Youth Development. http://www.nigerianstat.gov.ng/pdfuploads/2102%20National%20Baseline%20Youth%20Survey%20Report_1.pdf

Vikram, P. Flisher, AJ. Hetrick, S, McGorry, P. (2007). Mental Health of Young People: A global public-health challenge. *The Lancet, vol. 369, no. 9569*,pp. 1302–1313 https://www.ncbi.nlm.nih.gov/pubmed/17434406

Peng, H. Lu, Y. (2012). Model selection in linear mixed effect models. *Journal of Multivariate Analysis,* 109, 109-129.

Peng, CJ. Nichols, RN. (2003). Using Multinomial logistics models to predict adolescents behavioral risk. *Journal of Modern Applied Statistical Methods* Volume2(1),177-188.

Post Marcel. (2014). Definitions of the Quality of Life: What has happened and how to move on. *Topics in Spinal cord injury rehabilitation* 20(3):167-180

Quinn,G. Gonçalves, V. Sehovic, I. Bowman, ML. Reed, DR. (2015).Quality of life in adolescent and young adult cancer patients: a systematic review of the literature. *Journal of patient related outcome measures.* 6: 19–51. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4337625/

Ravens-Sieberer, Karow, A. Barthel, D. Klasen, F. (2014). How to assess quality of life in child and adolescent psychiatry. *Dialogues Clinical Neurosciences. 16(2): 147–158*

Sengendo, J. Nambi, J. (1997). "The psychological effect of orphanhood: a study of orphans in Rakai district." *Health Transition Review7:* 105-124

Sil. S, Lynch-Jordan, A. Ting, TV. Peugh, J. Noll, J. Kashikar-Zuck. S, (2013). Influence of family environment on long-term psychosocial functioning of adolescents with juvenile fibromyalgia. *Arthritis Care (Hoboken).* 2013 Jun; 65(6): 903-9.

Singh, K. Bassi, M. Junnarkar, M. Negri, L. (2015). Metal health and psychosocial functioning in adolescence: An investigation among Indian students from Delhi. *Journal of Adolescence* 39 pp 59-69.

Singh, K. Junnarkar, M. (2014). Validation and effect of demographic variables on perceived quality of life by adolescnets. *Asian journal of psychiatry Volume 12, Pages 88-94.* http://www.asianjournalofpsychiatry.com/article/S1876-2018(14)00177-4/abstract

Skevington,SM. Lotly, M. O'Connell, KA. (2004). The World Health Organization's WHOQOL-BREF quality of life assessment: Psychometric properties and results of the international field trial a Report from WHOQOL Group. *Quality of Life Research,*13.2:299-310

Spence, SH. Shortt, AL. (2007) Research review: can we justify the widespread dissemination of universal, school-based interventions for the prevention of depression among children and adolescents? *Journal of Child Psycholology and Psychiatry.* 48(6):526–542

Ueyama.(2007). Mortality, Mobility and Schooling Outcomes among Orphans Evidence from Malawi. *International food policy research institute* http://paa2007.princeton.edu/papers/70612

UNAIDS.(2006).Annual Report: Making the money work. Geneva, UNAIDS. http://www.unaids.org/sites/default/files/media_asset/jc1306_annual_report_en_0.pdf

UNAIDS, UNICEF, USAID (2004). Children on the brink: a joint report of new orphan estimates and a framework for action. Available from http://www.unicef.org/publications/index_22212.html

UNICEF (2004). Children on the brink 2004: a joint report of new orphan estimates and a framework for action. New York, UNICEF, UNAIDS & USAID. http://www.unicef.org/publications/cob_layout6-013.pdf

UNICEF(2003)."Africa's Orphaned Generations. From http://www.unicef.org/publications/index16271.html.

United Nations Children's Fund (2010). Progress for Children: Achieving the MDGs with equity, No 9, UNICEF, New York2010. pp. 88–129. http://www.unicef.org/protection/Progress_for_Children-No.9_EN_081710.pdf

United Nations Children's Fund (2006). Caring for Chidren affected by HIV and AIDs. https://www.unicef-irc.org/publications/pdf/insight-hiv-eng.pdf

United Nations Children's Fund. Statistics (2011). At a glance: Nigeria. Available from: http://www.unicef.org/infobycountry/nigeria_statistics.html

United Nations, Department of Economic and Social Affairs (2009). Population Division, World Population Prospects: The 2008 revision. http://www.un.org/esa/population/publications/wpp2008/wpp2008_highlights.pdf

USAID (2013). Voices from the communities: the impact of HIV/AIDS on the life of orphaned children an their guardians. Family Health International & USAID. https://rmportal.net/library/content/HIVAids-VociesOfTheCommunity-Impact-Orphans_PNACY062.pdf

Usefy, AR. Ghassemi, GR. Sarrafzadegan, N. Mallik, S. Baghaei, AM and Rabiei K (2008). Psychometric Properties of the WHOQOL-BREF in an Iranian Adult Sample. *Community Mental Health Journal*. 46: 136-147

Uslu, G. Sendur, N. Uslu, M. Savk, E. Karaman, G. Eskin, M. (2008). Acne: prevalence, perceptions and effects on psychological health among adolescents in Aydin, Turkey.*Journal of the European Academy of Dematol Venereol.* 22(4):462-9

Verbeke, G. Lesaffre, E. (1996). A linear mixed-effects model with heterogeneity in the random-effects population. *Journal of the American Statistical Association*, 91(433), 217-221.

Verbeke, G. Molenberghs, G. (2009). Linear Mixed Models for Longitudinal Data. New York, NY: Springer. http://www.springer.com/gp/book/9781441902993

Vilar, GN. Santos, LA. Filho, JF. (2015). Quality of life, self-esteem and psychosocial factors in adolescents with acne vulgaris. *Anais Brasileiros demartologia* 90(5): 622-629.

Walker N, Lewis-Jones MS. (2006). Quality of life and acne in Scottish adolescent schoolchildren: use of the Children's Dermatology Life Quality Index (CDLQI) and the Cardiff Acne Disability Index (CADI). *Journal of the European Academy of Dematol Venereol.* 20 (1):45-50

WHO (1994). Development of the WHOQOL: Rationale and current status. *International Journal of Mental Health.* 23: 24–56.

WHO.(1997). WHOQOL Measuring quality of life. Available at http://www.who.int/mental_health/media/68.pdf

WHO,(1998). The World Health Organization quality of life assessment (WHOQOL): development and general psychometric properties. *Social Science in Medicine.* 46(12):1569–1585. https://www.ncbi.nlm.nih.gov/pubmed/9672396

WHO, (2014). Maternal, new born, child and adolescent health 2014. Adolescents and mental health. Retrieved from http://www.who.int/maternal_child_adolescent/topics/maternal/en/

Wikipedia(2015). Benuestate. https://en.wikipedia.org/wiki/Benue_State

Wikipedia,(2016).Multinomial logistic regression. https://en.wikipedia.org/wiki/Multinomial_logistic_regression

Williamson Foster. (2005). The role of the health sector in strengthening systems to support children's healthy development. *WHO Library Cataloguing in publication data* http://www.who.int/maternal_child_adolescent/documents/pdfs/9241594624.pdf

World Bank (2002). Education and HIV/AIDS, a window of hope. Washington, D.C., World Bank.http://siteresources.worldbank.org/EDUCATION/Resources/278200-1099079877269/547664-1099080042112/Edu_HIVAIDS_window_hope.pdf

World Health Organization and World Organization of Family Doctors (2008). Integrating Mental Health into Primary Care: A global perspective, WHO and Wonca, Geneva and London. http://www.who.int/mental_health/resources/mentalhealth_PHC_2008.pdf

World Health Organization mhGAP (2008). Mental Health Gap Action Programme – Scaling up care for mental, neurological and substance use disorders, WHO, Geneva, 2008. http://www.who.int/mental_health/mhgap_final_english.pdf

World Health Organization. (2001). The World Health Report: Mental health – New understanding, new hope, WHO, Geneva http://www.who.int/whr/2001/en/

APPENDIX I

The Adolescents Psychosocial Functioning Inventory (APFI):

i) Optimism and Coping Strategies (OCS)

a) I feel though my parents/guardians are poor, I will be rich

b) I feel life will not continue to be difficult for me

c) I feel I may be nobody now but I will be a great person someday

d) I hope a miracle will happen

ii) General Psychosocial Dysfunctions (GPD)

a) I feel I am a disgrace to my family

b) I feel like running from everything around me

c) I find it difficult to sleep

d) I feel like few years from now, I will be a total failure

e) I feel guilty for all the difficulties in my family

f) I cannot see any light of hope in my future life

g) I feel like everything around me is falling apart

h) Everywhere I turn, I see that my life is hopeless

i) Judging from the situations in my family, I am hopeless

j) I feel my family is a shame to the community

k) I have too many problems; I cannot be free from them

l) I feel my presence causes distraction to people

m) It is as if I am a burden to my family/community

n) I feel like things just wouldn't work for me

o) I think of killing myself

iii) Behaviour and Relationship Problems (BRP)

a) People of my age hate me

b) I break rules

c) I feel people of my age will take me for granted

d) I shout at people; even adults

Adapted WHO Quality of Life-BREF. (WHOQOL-BREF):

i) Physical Health Domain (PHD)

a. You feel that physical pain prevents you from doing what you need to do
b. You need some medical treatments to function in your daily life
c. You have enough energy for everyday life
d. You are satisfied with your sleep
e. You are able to get around well
f. You are satisfied with your capacity to work
g. You are satisfied with your ability to perform your daily living activities

ii) Psychological Domain (PSD)

a. You do enjoy life
b. You feel your life is meaningless
c. You are able to concentrate
d. You have negative feelings such as blue mood, despair, anxiety, depression.
e. You are able to accept your bodily appearance
f. You are satisfied with yourself

iii) Social Relationship Domain (SRD)

a. You are satisfied with your personal relationships
b. You are satisfied with the support you get from your friends
c. You are satisfied with your relationship with people of the opposite sex

iv) Environment Domain (END)

a. You feel safe in your daily life
b. You live in a healthy physical environment
c. You are satisfied with your access to health services
d. You have enough money to meet your needs
e. You have available information that you need in your day-to-day life
f. You have enough opportunity for leisure activities
g. You are satisfied with the condition of your living place
h. You are satisfied with your transport

APPENDIX II

The syntax command for the linear mixed effect model

```
MIXED QOL_TRAN BY A04 WITH APFI_OCS APFI_GPD APFI_BRP
 /CRITERIA=CIN(95) MXITER(150)MXSTEP(30)
SCORING(1)SINGULAR(0.000000000001) HCONVERGE(0,
  ABSOLUTE) LCONVERGE(0, ABSOLUTE) PCONVERGE(0.000001, ABSOLUTE)
 /FIXED=APFI_OCS APFI_GPD APFI_BRP | SSTYPE(3)
 /METHOD=ML
 /PRINT=CPS CORB COVB DESCRIPTIVES G  LMATRIX R SOLUTION TESTCOV
 /RANDOM=A04 | COVTYPE(VC)
 /SAVE=FIXPRED PRED
 /EMMEANS=TABLES(OVERALL).

MIXED QOL_TRAN BY A04 A07 A08 A10 WITH APFI_OCS APFI_GPD APFI_BRP
 /CRITERIA=CIN(95) MXITER(150) MXSTEP(30) SCORING(1)
SINGULAR(0.000000000001) HCONVERGE(0,
  ABSOLUTE) LCONVERGE(0, ABSOLUTE) PCONVERGE(0.000001, ABSOLUTE)
 /FIXED=APFI_OCS APFI_GPD APFI_BRP | SSTYPE(3)
 /METHOD=ML
 /PRINT=CPS CORB COVB DESCRIPTIVES G  LMATRIX R SOLUTION TESTCOV
 /RANDOM=A04*A07*A08*A10 | COVTYPE(VC)
 /SAVE=FIXPRED PRED
 /EMMEANS=TABLES(OVERALL).
```

```
MIXED QOL_TRAN BY A04 A08 A10 WITH APFI_OCS APFI_GPD APFI_BRP
 /CRITERIA=CIN(95) MXITER(150) MXSTEP(10) SCORING(1)
SINGULAR(0.000000000001) HCONVERGE(0,
  ABSOLUTE) LCONVERGE(0, ABSOLUTE) PCONVERGE(0.000001, ABSOLUTE)
 /FIXED=APFI_OCS APFI_GPD APFI_BRP | SSTYPE(3)
 /METHOD=REML
 /PRINT=CPS CORB COVB DESCRIPTIVES G  LMATRIX R SOLUTION TESTCOV
 /RANDOM=A04*A08*A10 | COVTYPE(VC)
 /SAVE=FIXPRED PRED
 /EMMEANS=TABLES(OVERALL).

MIXED QOL_TRAN BY A04 A07 A08 A10 WITH APFI_OCS APFI_GPD APFI_BRP
 /CRITERIA=CIN(95) MXITER(150) MXSTEP(10) SCORING(1)
SINGULAR(0.000000000001) HCONVERGE(0,
  ABSOLUTE) LCONVERGE(0, ABSOLUTE) PCONVERGE(0.000001, ABSOLUTE)
 /FIXED=APFI_OCS APFI_GPD APFI_BRP | SSTYPE(3)
 /METHOD=REML
 /PRINT=CPS CORB COVB DESCRIPTIVES G  LMATRIX R SOLUTION TESTCOV
 /RANDOM=A04*A07*A08*A10 | COVTYPE(VC)
 /SAVE=FIXPRED PRED
 /EMMEANS=TABLES(OVERALL).
```