A STATISTICAL STUDY OF FACTORS ASSOCIATED WITH PSYCHOSIS AT MATHARI HOSPITAL, NAIROBI

WILFRED MUSANDA OLWENDE (B. SC.)
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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University, or for any other award.

Signature ..... Date: 26/11/2015

Wilfred Musanda Olwende (B. Sc.) (I56/CTY/PT/21415/2010)

Department of Statistics and Actuarial Sciences

SUPERVISORS

We confirm that the work reported in this thesis was carried out by the student under our supervision.

Signature ..... Date: 26/11/15

Dr. Edward Gachangi Njenga

Department of Statistics and Actuarial Sciences,

Kenyatta University

Signature ..... Date: 26.11.2015

Prof. Caleb Joseph Othieno

Department of Psychiatry,

University of Nairobi

DEDICATION

I dedicate this work to my family and friends who have been supportive.

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I wish to thank:

The Almighty God for granting me good health, understanding, and speed in this academic adventure.

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ACRONYMS AND ABBREVIATIONS

AIC	-	Akaike information criterion
ANCOVA	-	Analysis of covariance
ANOVA	-	Analysis of Variance
DSM V	-	Diagnostic and Statistical Manual of Mental Disorders
DUP	-	Duration of Untreated Psychosis
EI	-	Early Intervention
EOS	-	Early-Onset Schizophrenia
H_a	-	Alternative Hypothesis
H_0	-	Null Hypothesis
KNH/ UON-ERC	-	Kenyatta National Hospital/ University of Nairobi Ethics and Research Committee
MLE	-	Maximum Likelihood Estimator
PTSD	-	Post Traumatic Stress Disorder
SSE	-	Error Sum of Squares
SSR	-	Regression Sum of Squares
SST	-	Total Sum of Squares
VEOS	-	Very Early-Onset Schizophrenia

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ABSTRACT

Although there are known factors associated with increased risk of developing psychosis, the exact etiology remains elusive. Psychosocial and biological factors are known to interact in their development. Factors such as obstetric complications, season of birth, drug abuse, migration and ethnicity, urbanicity, social adversity, and trauma in childhood have been found to be related to psychosis. Unfortunately, studies done in Kenya only look at these factors as secondary to other inquiries. This study sought to identify the determinants of psychosis as presented by patients admitted at Mathari Hospital. Mathari Hospital is Kenya's sole National Referral and Teaching psychiatric Hospital with a capacity of 700 beds. This was a cross-sectional study of patients being discharged from Mathari Hospital at the time. A questionnaire was designed to help in collecting information from the patients, after obtaining permission from the Kenyatta National Hospital/ University of Nairobi Ethics and Research Committee. First patient was randomly selected, from a list of patients admitted at the time, after which every odd number patient being discharged was approached for interview. The patient included was to be able to respond to questionnaire items. Agitated patients were excluded. Clinical notes at admission were incorporated for clinical history, as well as primary caregiver accounts. Data analysis was performed in R 3.0.2 Software. Data obtained was analysed in terms of descriptive statistics, and later logistic regression was used to determine the important factors that affect psychosis and establish any associations that are unique to the Kenyan scenario. Multiple linear regression was used to establish factors that determine length of DUP. One-way ANOVA was used to test the effect of social and biological factors on DUP and age at onset of psychosis. Simple linear regression was done to model the relationship between age at onset of psychosis and duration, in years, of drug abuse. A total of 145 patients completed the interviews. Majority of the respondents were male patients (55.17%, n=80, N=145). 53.79% (n=78, N=145) of the respondents had a working diagnosis of psychosis. The mean age at onset of psychosis was 26.03±7.67 SD (n=67, N=145), the mean Duration of Untreated Psychosis (DUP), in weeks, was 10.19±8.47 SD (n=67, N=145). It was established that family history of psychosis and residence were significant in predicting the probability of a patient having psychosis. Drug abuse and residence were significant in determining the length of DUP.

CHAPTER ONE

INTRODUCTION

1.1 Background

Psychosis is classified according to the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-IV), as a component of certain serious mental disorders in which a person loses touch with reality; principal signs include hallucinations, delusions and impaired insight (American Psychiatric Association, 2000). The psychotic states include: Schizophrenia, Schizophreniform disorder, Schizo-affective disorder, Delusional disorder, Brief psychotic disorder, Shared psychotic disorder, Psychotic disorder due to a general medical condition, Substance-induced psychotic disorder, and Psychotic disorder not otherwise specified. There are a number of known factors that increase the risk of developing psychotic states such as schizophrenia. As in many other diseases, genetic and environmental factors interact in their development. Psychosocial and environmental factors shown to be related to psychosis and schizophrenia are: obstetric complications, season of birth, drug abuse, migration and ethnicity, urbanicity, social adversity and trauma in childhood (Mattson *et al.*, 2008).

Although family history is the strongest risk factor for schizophrenia; environmental factors related to urbanicity may contribute to a substantial proportion of the population (Casten and Preben, 2001). The lifetime prevalence of bipolar disease is approximately 1%. Adoption studies have demonstrated that biological relatives of bipolar patients are more likely to have the disorder than are adoptive relatives (Taylor *et al.*, 2002). Heavy

use of cannabis increases the risk of psychosis; genetics seems to predispose more (Luzi *et al.*, 2008).

Similar findings by Cecile *et al.* (2005).Symptoms indicative of psychosis are strongly related to childhood abuse (Read *et al.*, 2005). Studies report that exposures to infection, and nutrition deprivation during early development, elevate the risk of developing schizophrenia, specifically at prenatal period. Exposure to lead is given as an example of a chemical agent for which some effects have been described throughout the life course (Mark and Ezra, 2005).

Several studies, but not all, have found a higher prevalence of psychosis in patients with epilepsy, compared with the general population (Ping *et al.*, 2005). Psychotic symptoms affect most patients with Parkinson disease with increased risk in those with higher age at onset (Forsaa *et al.*, 2010). Ndetei *et al.* (2009) found that patients of mental illness were generally younger than their relatives, and advanced that the onset of mental illness occurs at a relatively younger age. Morrisson *et al.* (2003) suggested that there are many different factors that could be responsible for symptoms that occur in response to a traumatic event and that it was likely that cognitive, behavioral, physiological, affective, and environmental factors all contribute to the development of PTSD and psychotic disorders.

Most of studies done in Kenya do not give due precedence to factors associated with psychosis. These factors are only looked at as secondary to broader inquiries. Limited data available from more developed countries is not representative as presentation of

schizophrenia and psychosis differs across cultures (Sartorious *et al.*, 1996). This study sought to describe factors associated with psychosis and determine the significant contributors to psychosis in Kenya. This study sought to assess the association and extent of psychosocial and biological factors to psychosis, as relevant to the Kenyan situation, basing on patients admitted at Mathari Hospital.

1.2 Problem Statement

There are a number of known factors that increase the risk of developing psychotic states such as schizophrenia. As in many other diseases, psychosocial and biological factors interact in their development. Environmental and psychosocial factors shown to be related to psychosis and schizophrenia are: obstetric complications, season of birth, drug abuse, migration and ethnicity, urbanicity, social adversity and trauma in childhood (Mattson *et al.*, 2008). Most of studies done in Kenya do not give due precedence to factors associated with psychosis. Studies done in Kenya only look at these exposure factors as secondary measures to other inquiries. Limited data available from more developed countries is not representative as presentation of schizophrenia and psychosis differs across cultures and environments (Sartorius *et al.*, 1996). Hence little is known on what significantly contributes to psychosis in Kenya.

1.3 Objectives

1.3.1 General objective

The main aim of this research was to determine factors that significantly contribute to psychosis in Kenya.

1.3.2 Specific objectives

i. To identify the significant contributors to psychosis among patients at Mathari Hospital using logistic regression analyses.

ii. To determine association of psychosocial and biological factors to DUP among patients at Mathari Hospital using multiple linear regression.

iii. To determine whether there is association between psychosocial and biological factors among patients at Mathari Hospital.

iv. To identify determinants of age at onset of psychosis among patients at Mathari Hospital.

1.4 Significance of the Study

The study sought to identify the determinants of psychosis among patients at Mathari Hospital and use this information to draw conclusions on what exposure factors are important in Kenya.

This study sought to identify what factors will be important to address in order to lessen the burden of psychosis in Kenya.

1.5 Hypotheses

H_{1o}: Psychosocial and biological factors are not associated with psychosis

H_{1a}: Psychosocial and biological factors are associated with psychosis

H_{2o}: Psychosocial and biological factors are not associated with DUP

H_{2a}: Psychosocial and biological factors are associated with DUP

H_{3o}: Psychosocial and biological factors are independent of each other

H_{3a}: Psychosocial and biological factors are not independent of each other

H_{4o}: Psychosocial and biological factors are not associated with age at onset of psychosis

H_{4a}: Psychosocial and biological factors are associated with age at onset of psychosis

1.6 Limitations of the study

Selection bias arose as a result of exclusion of violent, extremely agitated and acutely psychotic patients. This was in accordance with the provisions in the ethical approval for this study as psychiatric patients are considered vulnerable. The data was obtained from only one Hospital; Kenya has only one referral psychiatric Hospital.

1.7 Definition of terms

Psychosis - a loss of contact with reality; usually including false beliefs about what is taking place or who one is (delusions) and seeing or hearing things that aren't there (hallucinations).

Post Traumatic Stress Disorder - a disorder in which a person experiences disabling anxiety after a traumatic event such as: war, rape, physical abuse, bad accident or disaster.

Diagnostic and Statistical Manual of Mental Disorders, 5th Edition - a categorization of psychiatric diagnoses; the manual is published by the American Psychiatric Association, and covers all mental health disorders for both children and adults.

It also lists: known causes of these disorders, statistics in terms of gender, age at onset, and prognosis as well as some research concerning the optimal treatment approaches.

Schizophrenia - a severe lifelong mental disorder characterized by hallucinations and delusions.

Schizophreniform disorder - has all criterion A symptoms for schizophrenia, but full criterion is attained over a rapid period i.e. 1-6 months as opposed to several years in schizophrenia.

Schizoaffective disorder - a mental condition that causes both a loss of contact with reality (psychosis) and mood problems.

Brief psychotic disorder - the DSM-V defines brief psychotic disorder as an illness lasting from 1 day to 1 month, with an eventual return to the premorbid level of functioning.

Duration of Untreated Psychosis - period between first positive symptoms of psychosis and start of treatment.

Prodromal phase - the time which a disease process has begun but is not yet clinically manifest.

Working diagnosis - provisional diagnosis, of the most likely nature of a disease.

Etiology - the cause of a specific disease.

Positive symptoms - symptoms of mental illness characterized by delusions, hallucinations and disorganized speech

Negative symptoms - symptoms of mental illness characterized by poor drive, low energy, poor self-care and emotional withdrawal

CHAPTER TWO

LITERATURE REVIEW

Perala *et al.* (2007) found that the lifetime prevalence of all psychotic disorders was 3.06% and rose to 3.48%; when register diagnoses of non-responders group were included. Lifetime prevalences were as follows: 0.87% for schizophrenia, 0.32% for schizoaffective disorder, 0.07% for schizophreni form disorder, 0.18% for delusional disorder, 0.24% for bipolar 1 disorder, 0.35% for major depressive disorder with psychotic features, 0.42% for substance-induced psychotic disorder, and 0.21% for psychotic disorder due to a general medical condition. Schizophrenia typically begins in young adulthood, and may lead to disability that lasts a lifetime (Marshall and Rathbone, 2011). Similar findings were arrived at by Ndetei *et al.* (2009). People suffering from epilepsy, have an increased risk of suffering from psychotic symptoms (Farooq and Sherin, 2008). Similar observation was made by Ping *et al.* (2005).

Psychosis has been associated with substance abuse in various studies (Verdoux *et al.*, 2005; Arsenault *et al.*, 2002). However, in their study, Shiers and Lester (2004) observed that reducing level of exposure to cannabis in the general population should be considered a public health priority by national health agencies, not only as an intervention to reduce psychosis, but also to prevent other adverse outcomes associated with exposure to cannabis. They observe that; the view that, the incidence of cannabis induced psychosis as too low to justify specific prevention campaigns, has no basis, in light of other outcomes attributable to cannabis. Psychosis has been found to run within families, in many studies.

Margari *et al.* (2011) confirmed that familial liability, plays a significant role in VEOS/EOS. Socio-demographics among psychotic patients, have been explored in various studies, and tend to reach similar conclusions.

Ndetei *et al.* (2007) in their study found that nearly three quarters (72.5%) of psychotic patients admitted at Mathari Hospital were male, 68.5% were aged between 20 and 34 years, and 63.7% reported to be single. Nearly half (49.2%), had attained up to 12 years of formal education, and 90% were dependants of a member of the family. Co-morbidity was recorded with an average of three DSM-IV disorders.

Paruk *et al.* (2009), observed that in the seventy adolescents, with psychosis, admitted to adult psychiatric wards over a 2-year period, the age range was 13-18 years, 80% were male, 37.1% reported a positive family history of mental illness, 50% smoked nicotine and 61.4% reported cannabis use.

Heins *et al.* (2011) observed that childhood trauma, was associated with psychotic disorder, in a dose-response fashion, in comparison of patients and healthy subjects (adjusted odds ratio=4.53, 95% CI=2.79-7.35). The comparison of siblings and healthy subjects, suggested that siblings shared a degree of trauma with the patients (adjusted odds ratio=1.61, 95% CI=0.95-2.61), but the patient-sibling comparison indicated much greater exposure in patients, than in siblings (adjusted odds ratio=2.60, 95% CI=1.78-3.78). They also found out that childhood abuse, but not neglect, was associated with positive, but not negative symptoms, in dose-response fashion, in all three groups.

In a meta-analysis, Varesė *et al.* (2002) found that childhood adversity and trauma substantially increased the risk of psychosis with an OR of 2.8. Schizophrenia has also been linked with intrauterine exposure to maternal stress, due to bereavement, famine and major disasters. Recent evidence suggests that human vulnerability, may be greatest in the first trimester of gestation, and rodent experiments suggest sex specificity. Malaspina and Kleinhaus (2008) described the consequence of acute maternal stress, through a follow-up of offspring, whose mothers were pregnant during the Arab-Israel war of 1967. They focused on gestational month, and offspring's sex. They found out that, there was a raised incidence of schizophrenia, for those who were in the second month of fetal life during war (Relative Risk=2.3, CI= 1.1-4.7), seen more in females (RR=4.3, CI=1.7-10.7) than in males (RR=1.2, CI=0.4-3.4). This meant that maternal exposure, during second month of fetal life, to war predisposes the child to Schizophrenia especially for females. Their study, lent a new angle to the contribution of trauma in psychosis.

Murphy and Brewer (2011) observed that early intervention services, were established on the basis of a number of fundamental principles, including the notions that intervening in the early stages of psychosis, alters illness trajectory and prognosis. Chiliza *et al.* (2008) concluded that studies of first-episode psychosis, conducted over the last two decades, have increased our knowledge of the pathophysiology of schizophrenia. It is now clear, that early intervention in schizophrenia increases the likelihood of a more positive outcome, in this disorder. The role of the clinician has been extended, and clinicians can now offer holistic interventions, with renewed hope

for a better outcome for their patients. McGorry *et al.* (2000) observed that most patients with schizophrenia, experience a period of disturbance, before the onset of florid psychotic symptoms, which has come to be called the prodromal phase.

Typically, the prodrome, is chacterised by nonspecific mood and anxiety symptoms; negative symptoms (such as poor drive, low energy and poor interpersonal skills) and attenuated positive symptoms (hallucinations and odd thinking). Accurate identification of patients, during the prodromal phase, may allow opportunities for intervention, before the onset of psychosis. Which emphasizes, the importance of early intervention, as a means of minimizing further deterioration in function, and optimizing outcome. (Birchwood *et al.*, 1998). In a meta-analysis, Marshall *et al.* (2005) reported that longer DUP was associated with worse outcome at 6 and 12 months. Since psychosis is believed to vary in presentation from one region to another, it is important to gain knowledge on what factors significantly contributes to psychosis in Kenya.

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CHAPTER THREE

METHODOLOGY

3.1 Study Design

This was a cross-sectional study of psychiatric patients, being discharged at Mathari Hospital, at the time of the study. An analytical cross-sectional design was ideal given measures of exposure factors and disease was done simultaneously. The study was both descriptive and analytical. The differences in outcome (a diagnosis of psychosis or otherwise) was compared in patients across various exposure factors. Determinants of DUP were investigated given previous studies show that long DUP was associated with poor treatment outcome for patients diagnosed with psychosis. This study also sought to find out what leads to differences in age at onset of psychosis for individuals. A questionnaire was used to collect information from patients. Clinical notes at admission, and caregiver accounts, were also incorporated. This was carried out with a view of eliciting adequate baseline data that can act as basis for policy-oriented awareness and action; including further research. Tools administered on the patient were limited to one questionnaire, to prevent excessive burden to participants. The questionnaire was simplified and brief, in order not to be cumbersome to the patients.

3.2 Study Area and Target Population

The study was based at Mathari Hospital. Mathari Hospital is Kenya's sole national referral and teaching psychiatric hospital. This, therefore, had the potential to capture patients from all over Kenya. Mathari Hospital has a capacity of 700 beds.

Mathari Hospital has 5 male-only wards and 2 female-only wards; the main amenity ward is mixed. Patients were sampled in all the 8 wards. The in-patient population at

Mathari Hospital includes those suffering from a wide range of psychiatric disorders. These patients are usually admitted when they exhibit disturbed behavior which relatives or community members deem uncontrollable. Mathari Hospital largely serves patients who cannot afford private in-patient psychiatric facilities. This is a sizeable proportion, and likely representative of the Kenyan population, as the country is a low income economy. All patients admitted to the hospital at the time of the study were eligible for the study. Sex and age did not form basis for inclusion or exclusion. Patients had to be capable of attending, understanding and responding to questionnaire items to be included in the study. Extremely agitated, violent and acutely psychotic patients were excluded from study. Patients were approached at the point of discharge; in order to increase response rate, and quality of response, since patients being discharged are deemed to have improved.

3.3 Sample size determination

The formula for determining sample size for a single population proportion, was used as proposed by Fosgate (2009);

$$n = \frac{p(1-p)(z_{1-\alpha/2})^2}{e^2}$$

(3.1) where:

$Z_{1-\alpha/2}$ – Area under the normal curve usually set at 1.96, which corresponds to 95% confidence interval.

p – Expected proportion, for this study set at 3.48%, the lifetime prevalence of all psychotic disorders as found by Perala *et al.* (2007);

e – Is one half the desired width of confidence interval; degree of precision set at 0.05.

α – level of significance: 0.05.

$$n = \frac{0.0348(1-0.0348)(1.96)^2}{0.05^2} = 51.614$$

n=52 patients

3.4 Sampling procedure

A list of all patients, admitted at the beginning of the study, at ward level, was obtained. For the five months of study, new patients being admitted along the course of the study were included into the study. Re-admitted patients were excluded. This was aimed at avoiding double participant recruitment. A systematic sampling technique was used to sample patients being discharged at ward level for interview. Specifically, from the list provided, the first patient was randomly selected after which every odd number patient was approached for interview at discharge by a senior psychiatry nurse. This rationale was to ensure a representative number of patients were interviewed by the end of this study.

3.5 Data collection

A questionnaire was used to elicit socio-demographic and clinical data: probable age of onset of psychosis, duration of untreated psychosis, gender distribution, substance abuse, social adversity, traumatic experiences before diagnosis, social status before diagnosis in relation to level of education, occupation and economics, family history of psychosis, and concomitant ailments.

Clinical notes at admission were also incorporated, alongside primary caregiver accounts. The questionnaire was administered in form of interview, by senior psychiatry nurses, at ward level.

3.6 Training procedures

Senior psychiatry nurses, enlisted as research assistants, were trained on how to administer questionnaire by interview, with an aim of observing: ethical tenets of participant confidentiality, informed consent, right to termination and protection of vulnerable subjects. The correct verbal and body language, was emphasized, so as to make participant at ease, and ensure quality of information gathered. Training was also done on how to record interview output and clinical notes from patient records.

3.7 Study Instrument

We designed a quasi-structured questionnaire, which was administered on patients, to determine their interaction with predetermined factors associated with psychosis, as observed in previous studies. This was corroborated with clinical notes at admission. Clinical notes at admission were consulted for information that lends to this study and clinical history. Primary caregivers accounts were recorded for information about onset of symptoms and DUP. Due to nature of patients being studied, study tools administered directly to patient were limited to one questionnaire. The questionnaire was pre-tested on five patients, to gauge its suitability to address the research questions.

3.8 Ethical considerations

Approval to conduct the study was sought and obtained from KNH/ UON-ERC.

Informed consent was obtained from selected patients. Patients were assured that their willingness or lack thereof to participate, was not to influence the care they received at the institution. Participants were accorded adequate time to decide whether to give consent or decline participation. Patients who showed impaired decision-making

capacity were guided to give or decline consent with the involvement of guardians. Participants were informed that the study was purely academic, and participation was voluntary: without any monetary benefit. The importance of this study, as a contribution to knowledge in psychiatric care, was explained to the study subjects. Confidentiality was maintained at all levels; numbers were used for identification in place of names. Language used was at the level of the participant.

3.9 Data Management and Statistical Analysis

Questionnaires were assigned number codes. These codes represented a patient in the data. Clinical notes were coded, after collection, and incorporated to data elicited from interviews. Data was double entered into a password protected Microsoft Excel Worksheet, and thereafter, data cleaning and validation was done; to ensure quality of data collected. Data was backed-up by uploading on a protected internet resource.

3.9.1 Descriptive Statistics

Data analysis was done in R 3.0.2 statistical package (R Core Team, 2013).

Categorical variables were summarized, and presented as: tables of frequencies, pie charts and percentages. Further, continuous variables were summarized, using: measures of central tendency, distribution and dispersion. The need for early intervention was assessed by obtaining the average duration of untreated psychosis.

3.9.2 Pearson's chi-squared tests

The chi-square test, is used to test how likely an observed distribution of categorical data is due to chance. Data to be analyzed by chi-square is in most cases presented in the form of a contingency table. A contingency table is designed to record and examine

the relationship between two categorical variables; it displays the multivariate frequency distribution of the variable, in a matrix format. The chi-square statistic can also be considered as a 'goodness of fit' statistic, given it is useful in testing whether an observed group of counts, matches a theoretical pattern.

The chi-square statistic is of the form:

$$\chi^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i}$$

(3.2)

where:

χ^2 - the chi-square statistic

O_i - Observed frequency for category i

E_i - Expected frequency for category i

Expected frequency= (row total*column total)/grand total

For a 2*2 table, as in the case of this study, data is to be presented as in Table 3.1 below:

Table 3.1: Format for a 2*2 contingency table

		Chacteristic A		
Chacteristic B		Yes	No	Total
	Yes	A	b	a+b
	No	C	d	c+d
	Total	a+c	b+d	n

Thus, the expected frequency for an individual in cell a, can be obtained as:

$$E = \frac{(a+b)(a+c)}{n}$$

(3.3)

The validity of the chi-square, is dependent on both the sample size and the number of cells, on the contingency table. The sample size should be large: at least 100. Cochran (1954), postulated that the chi-square is valid if no cell frequencies are less than one, and no more than 20% less than five. Degrees of freedom (d.f), tell how many numbers in the table, are actually independent. This points to the actual variation permitted by the data set. The degrees of freedom for a chi-square table, are equal to the number of rows minus one times the number of columns minus one; (r-1)(c-1). The chi-square value and degrees of freedom determine the probability, or p-value, of independence.

In our situation, the Pearson's chi-square tests were used to measure associations, between psychosocial and biological factors among patients sampled:

H_0: There is no association between psychosocial and biological factors

H_a: There is association between psychosocial and biological factors

The psychosocial and biological factors tested were family history of psychosis, gender, childhood trauma, diagnosis of psychosis, residence and marital status.

3.9.3 One-way anova

The One-way ANOVA are general linear models, where the response variable is continuous, while the explanatory is categorical and is known as a factor. This method is used to compare means of two or more samples using the F distribution.

A factor is a single discrete classification scheme for data, such that each individual classification belongs to exactly one class, known as a level for that classification scheme. If we consider sex as a factor, it has two levels: male and female.

This model can be expressed as:

$$y_{ij} = \mu + \alpha_i + \varepsilon_{ij}$$

(3.6)

where:

μ - is referred to as the grand or overall mean

$\alpha_i = \mu_i - \mu$ is a factor (treatment) effect. It is the average effect, that factor in level i, has on the overall mean; the effect of the ith treatment.

Hypothesis to test is:

$H_0: \mu_1 = \mu_2 = \ldots\ldots \mu_k = \mu$ or

$H_0: \alpha_1 = \alpha_2 = \ldots = \alpha_k = 0$

The test statistic is:

$$F = \frac{SS_{tr}/k-1}{SS_{res}/n-k} = \frac{MS_{tr}}{MS_{res}} \sim F(k-1, n-k)$$

(3.9)

Here, we reject H_0 if the computed value of F ratio is greater than F (k-1, n-k, α). The residuals are assumed to be normally and independently distributed random variables with mean zero and constant variance δ^2.

In our case, One-way ANOVA tests were used to test for treatment effect of psychosocial and biological factors on DUP and age at onset of psychosis. The QQ plot and Shapiro-Wilk normality tests were used to check for normality assumption. Lavene's test was used to check for assumption of equal variances. The non-parametric,

Kruskal- Wallis test, was used to test and confirm factor effect, where assumptions for ANOVA were violated.

3.9.4 Simple linear regression

Simple linear regression, is a statistical tool that fits a straight line, to a set (x,y) data pairs. Where x is thein dependent variable and y is the dependent variable. The slope and intercept of the fitted line, are chosen so as to minimize the sum of squared differences between observed response values and fitted values. That is a method of ordinary least squares is used to fit a straight line model to the data.

Simple linear regression was used to model relationship between age at onset of psychosis and duration, in years, of drug abuse. Here, age at onset of psychosis was the dependent variable while duration of drug abuse was the independent variable. Both were continuous variables.

The model was of the form: $y_i = \beta_0 + \beta_1 x_i + \varepsilon_i$, i=1,...., n (3.10)

where:

y_i - age at onset of psychosis for patient i

x_i - Duration, in years, of drug abuse for patient i

β_o - Intercept

β_1 - Slope

ε_i - error term

For each unit increase in the explanatory variable x, the expected response y_i is increased by β_1.

Ordinary least squares method was used to determine β_0 and β_1, by minimising the error sum of squares criterion.

$$\sum_{i=1}^{n}\{y_i - (\beta_0 + \beta_1 x_i)\}^2$$

(3.11)

And this results to:

$$\hat{\beta}_0 = \bar{y} - \bar{\beta}_1 \bar{x}$$

(3.11)

and:

$$\hat{\beta}_1 = \frac{\sum_i (y_i - \bar{y})(x_i - \bar{x})}{\sum_i (x_i - \bar{x})^2} \text{ as estimates.}$$

(3.12)

3.9.5 Multiple logistic regression

Logistic regression is used to model dichotomous outcome variables. In the logit model, the log of odds of the outcome is modelled, as a linear combination of the predictor variables. The logit function is bounded between zero and one: and in essence models a probability.

Let y be a binary outcome: y is coded y=1 if event of interest occurs and y=0 if it does not occur. If y=1 indicates, for instance, an individual developed a disease of interest. Then the mean of y is a measure of the probability for developing the disease. Hence

the model is based on probabilities associated with the binary outcome, as opposed to the actual outcome. The probabilities are functions of explanatory variables. The function of the mean it takes, is the logit function, or the logarithm of the odds. The estimated coefficients forming a logistic regression fit are interpreted in terms of odds and odds ratios.

If p is the probability of an event occurring, the probability of the event not occurring is 1-p. The odds are thus defined as:

$$Odds = \frac{p}{1-p}$$

The odds ratio compares the odds of events of two groups; say group z and x:

$$odds\ ratio = \frac{\frac{p_z}{1-p_z}}{\frac{p_x}{1-p_x}}$$

When only one explanatory variable is included, the model is of the form:

$$\left[\frac{p}{1-p}\right] = e^{\beta_0+\beta_1 x}$$

When you introduce logs on both sides:

$$\ln\left[\frac{p}{1-p}\right] = \beta_0 + \beta_1 x$$

(3.15)

Solving for p, this yields:

$$p = \frac{e^{\beta_0+\beta_1 x}}{1+e^{\beta_0+\beta_1 x}}$$

(3.16)

Interpretation of $\hat{\beta}_1$ is rendered as: a one unit increase in the predictor x is estimated to be associated with multiplying the odds of success by $e^{\hat{\beta}_1}$; holding all else in the model constant. In essence, where $\hat{\beta}_1 > 0$ then there is an increase in the log of odds of the event for every unit increase in the explanatory variable. Where $\beta_1 < 0$, then there is a decrease in the log of odds of the event for every unit increase in the explanatory variable. Where $\hat{\beta}_1 = 0$, then there is no relationship. If the explanatory variable is continuous, then e^{β_1} is the change in the risk for every additional measure of the explanatory variable.

If the predictor is a categorical variable, then e^{β_1} is the odds ratio of one group to the other; with one group taken to be the reference group. The estimated odds of success, when all predictors equal zero, is obtained from the constant term as $e^{\hat{\beta}_0}$.

The intercept and slope coefficients, in the logistic model, are estimated using maximum likelihood. The resultant estimated probabilities of success, are the maximum likelihood estimates of the conditional probabilities of success; given the observed values of the predictors. For instance, for each data point we can have a vector of features: x_{ij} and an observed class; y_i. The probability of that class is either p, if $y_i = 1$, or 1-p, if $y_i = 0$. The likelihood is then:

$$l(\beta_0, \beta) = \prod_{i=1}^{n} p(x_i)^{y_i} (1 - p(x_i))^{1-y_i}$$

(3.17)

The log-likelihood thus:

$$l(\beta_0, \beta) = \sum_{i=1}^{n} y_i \log p(x_i) + (1 - y_i) \log(1 - p(x_i))$$

(3.18)

$$= \sum_{i=1}^{n} - \log(1 + e^{\beta_0 + \beta_{xi}}) + \sum_{i=1}^{n} y_i (\beta_0 + \beta_1 x_i)$$

(3.19)

The log likelihood is differentiated, with respect to the parameters and the derivatives, set equal to zero and then solved; to yield the MLE:

$$\frac{\partial l}{\partial \beta_1} = \sum_{i=1}^{n} (y_i - p(x_i; \beta_0, \beta)) x_{ij}$$

(3.20)

Inference for logistic regression is often based on deviance. The deviance is twice the log-likelihood ratio statistic. Deviance for logistic model can be likened to the residual sum of squares in ordinary least squares regression for the linear model. The smaller the deviance, the better the fit of the logistic model.

A large value for deviance, is an indication that there is a significant lack of fit for the logistic model. The null deviance summarizes the fit of a logistic model that just includes an intercept. In this study, multiple logistic regression analysis, was performed to identify predictors of psychosis. This is known to extend the techniques of multiple regression analysis, to research situations, in which the outcome variable is a binary. In

R software, the ***glm*** function, with ***logit*** and ***binomial*** specified as the link function and family respectively, was used to perform the logistic regression.

In our situation, patients who had psychosis were coded as 1 or 0 otherwise. Predictors were also coded as dummy variables: Gender (female=0, male=1), Family history of psychosis (No=0, Yes=1), Drug abuse (No=0, Yes=1), Residence (Rural=0, City=1), Childhood trauma (No=0, Yes=1).

The model was of the form:

$$\ln\left[\frac{p}{1-p}\right] = \beta_0 x_0 + \beta_1 x_1 + ... + \beta_k x_k$$

(3.21)

where $x_1, x_2, \ldots, x_k$ are social and biological factors explaining psychosis.

3.9.6 Multiple linear regression

Multiple regression model, is a generalized linear model, in which the conditional mean, is a linear function of the regression parameters. The multiple regression model, can be written as:

$$E\left(y_i / x_1, x_2, \ldots, x_p \right) = \beta_0 + \sum_{j=1}^{p} \beta_j x_{ij}$$

(3.22)

where $x_1, x_2, \ldots, x_p$ are the predictor variables, and $\beta_0, \beta_1, \ldots, \beta_p$ are the regression coefficients; x_{ij} is the value of predictor x_j, for observation i, and y_i is the outcome for observation i.

For a sample of size n, the model can be expressed in matrix form as: $\underline{y} = x\underline{\beta} + \underline{\varepsilon}$

$$\begin{bmatrix} y_1 \\ y_2 \\ ' \\ ' \\ y_n \end{bmatrix} = \begin{bmatrix} x_{11}x_{12}\ldots x_{1p} \\ x_{21}x_{22}\ldots x_{2p} \\ '\ldots\ldots\ldots\ldots \\ '\ldots\ldots\ldots\ldots \\ x_{n1}x_{n3}\ldots x_{np} \end{bmatrix} \begin{bmatrix} \beta_0 \\ \beta_1 \\ ' \\ ' \\ \beta_p \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ ' \\ ' \\ \varepsilon_n \end{bmatrix}$$

Multiple linear regression, allows us to investigate the joint effect of these p predictors on the response y_i. Here, a single outcome variable, is related to two or more predictors, simultaneously.

The common assumption of multiple regression analysis, is that the dependent variable, is a continuous variable, that is normally distributed. However, the model is robust against departure from the normality assumption, as long as there is a relatively large number of values for the dependent variable, and the distribution is relatively symmetrical. The responses on the dependent variable across the observations are assumed to be independent of one another. This model is used to identify predictors that are associated with the response variable in order to promote understanding of the underlying process, determine the extent to which one or more of the predictors is/ are linearly related to the dependent variable after adjusting for other variables that may be related to it, and predict the value of the dependent variable from the predictor values.

Regression coefficients, are estimated using the least squares principle, where we find and then select the values of the estimates that minimize the error sum of squares:

$$SSE = (\underline{y} - x\underline{\beta})'(\underline{y} - x\underline{\beta})$$

(3.23)

Differentiating the SSE, with respect to each unknown regression coefficient, yields p+1 simultaneous equations, known as the normal equations. The matrix form of the normal equations is:

$$x'\underline{y} = (x'x)\underline{\beta}.$$

This solves to:

$$\hat{\underline{\beta}} = (x'x)^{-1}x'\underline{y}.$$

The coefficient $\hat{\beta}_j$; j=1, 2, … , p gives the change in the average value of the response variable, for an increase of one unit in the corresponding predictor x_j, holding the other factors in the model constant. Each of the estimates is adjusted for the effects of all other predictors.

Where the predictors variables are indicator variables:

$$x = \begin{cases} 0, absent \\ 1, present \end{cases}$$

Here, the regression coefficient β_1 is interpreted as the increase or decrease in average outcome levels in the group assigned the value 1 with respect to the reference group (assigned the value 0).

To test for the overall significance of the regression model, we use the ANOVA approach, where the total sum of squares is decomposed into two components:

explained variance, due to regression, and the unexplained variance or residual variance, which is due to error:

SST=SSR+SSE

$$\underline{y}'\underline{y} - n\overline{y^2} = \left(\hat{\beta}'x'\underline{y} - n\overline{y^2}\right) + \left(\underline{y}'\underline{y} - \hat{\beta}'x'\underline{y}\right)$$

(3.24)

The model adequacy is determined by the coefficient of multiple determination (R^2), which is the proportion of variability in the response variable, that is accounted for by the regression model. It is given by:

$$R^2 = \frac{SSR}{SST} = 1 - \frac{SSE}{SST}$$

$0 < R^2 < 1$; a good fit of the model will give value of R^2 close to one, while a poor fit will give value of R^2 close to zero. R^2 indicates the amount of variation explained by the predictors, and hence is a useful indicator of the fitted model. R^2 is inflated by increasing the number of parameters in the model, and for this reason, adjusted R^2 is used:

$$R^2{}_{adj} = 1 - \frac{SSE/(n-p-1)}{SST/(n-1)}$$

(3.25)

where:

n - number of observations

p - number of parameters in the model

The adjusted R^2 is R^2 adjusted for the number of predictors in the model. The adjusted R-squared increases only if the new term improves the model more than would be expected by chance.

A multiple linear regression model was fitted to identify predictors of DUP.

$$y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + ... + \beta_p x_p \tag{3.26}$$

where y_i, the response variable, is DUP (in weeks) for patient i, and is quantitative.

$X_1, X_2, \ldots, X_p$ are the psychosocial and biological predictors of DUP, and are dummy variables as above.

$\beta_0, \beta_1, \ldots, \beta_p$ are the regression coefficients.

Model selection was done by stepwise method, with forward-backward direction and AIC as criterion.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Results

This section contains results for demographic information, descriptive and inferential analyses.

4.1.1 Demographic and descriptive analysis results

Table 4.1 contains descriptive and demographic analyses of data as obtained from the respondents.

Table 4.1: Descriptive analyses o results

Variable	Characteristic	Count (N=145)	Percentages
Gender	Male	80	55.17%
	Female	65	44.83%
Diagnosis	Alcohol use disorder	21	14.48%
	Anxiety disorder	4	2.76%
	Bipolar disorder	28	19.31%
	Major depressive disorder	8	5.52%
	Poly-substance use disorder	6	4.14%
	Psychosis	78	53.79%
District	Central	52	35.86%
	Coast	4	2.76%
	Eastern	26	17.93%
	Nairobi	22	15.17%
	North Eastern	9	6.21%
	Nyanza	9	6.21%
	Rift-valley	13	8.97%
	Western	10	6.90%

Marital status	Divorced	5	3.45%
	Married	55	37.93%
	Separated	15	10.34%
	Single	67	46.21%
	Widowed	3	2.07%
Education	No formal education	4	2.76%
	Primary	47	32.41%
	Secondary	55	37.93%
	Tertiary	39	26.90%
Worked prior to admission	Yes	83	58.45%
	No	59	41.55%
Occupation	Business	33	22.76%
	Formal employment	32	22.07%
	Informal employment	27	18.62%
	Student	8	5.52%
	Unemployed	45	31.03%
Income	<Kshs.5000/ month	70	48.28%
	≥Kshs.5000/month	75	51.72%
Housing status	Homeless	4	2.76%
	Live with relative	60	41.38%
	Owner	53	36.55%
	Rent	28	19.31%
Drug abuse	No	67	46.53%
	Yes	77	53.47%
Frequency of drug abuse	Most times	8	10.39%
	Often	28	36.36%
	Some times	15	19.48%
	Very often	26	33.77%
Dependency	No	13	17.11%

	Yes	63	82.89%
Drug abused	Alcohol	41	63.08%
	Bhang	8	12.31%
	Heroin	4	6.15%
	Miraa	1	1.54%
	Polysubstance	11	16.92%
Family history of psychosis	No	78	53.79%
	Yes	67	46.21%
Member with psychosis	Blood relative	38	56.72%
	Brother	10	14.93%
	Father	3	4.48%
	More than one	3	4.48%
	Mother	3	4.48%
	Non-blood	1	1.49%
	Sister	9	13.43%
Place of birth	Rural	112	77.24%
	Urban	33	22.76%
Residence	City	84	57.93%
	Rural	61	42.07%
Co-morbidity	No	104	72.22%
	Yes	40	27.78%
Other diagnosis	Alcohol dependency	1	2.86%
	Anemia	1	2.86%
	Cannabis dependency	1	2.86%
	Diabetes	3	8.57%
	Epilepsy	2	5.71%
	Heroin dependency	1	2.86%
	HIV	8	22.86%
	Hypertension	7	20.00%

	Liver cirrhosis	1	2.86%
	MDD	3	8.57%
	Multiple diagnoses	2	5.71%
	OCD	1	2.86%
	Peptic ulcer	1	2.86%
	Periodontitis	1	2.86%
	PTSD	1	2.86%
Childhood trauma	No	30	20.69%
	Yes	115	79.31%
Anxiety following trauma	Yes	115	100%
Length of trauma/ anxiety	Long time (≥6 months)	67	60.36%
	Short time (<6 months)	44	39.34%
Discomfort in memory	No	61	53.04%
	Yes	54	46.96%
Early treatment	No	29	20.42%
	Yes	113	79.58%

A total of 145 patients participated by attending to interview items and completing the questionnaire. As shown in Table 4.1, above, out of a total of 145 participants that completed the study: 55.17% were male and 44.83% were female, 14.48% had been diagnosed with alcohol use disorder, 2.76% with Anxiety disorder, 19.31% with Bipolar disorder, 5.52% with Major depressive disorder, 4.14% with poly-substance use disorder and 53.79% with Psychosis. 35.86% of patients reported their home district to be Central, 2.76% as Coast, 17.93% as Eastern, 15.17% as Nairobi, 6.21% as North Eastern, 6.21% as Nyanza, 8.97% as Rift-valley and 6.90% as Western. 3.45% of

respondents were divorced, 37.93% married, 10.34% separated, 46.21% single and 2.07% widowed.

2.76% had no formal education, 32.41% had primary education as highest attained, 37.93% had secondary education as highest attained and 26.90% attained college education.

41.55% of the patients had worked prior to hospitalization while 58.45% had not been working prior to hospitalization. 22.76% were in business, 22.07% in formal employment, 18.62% in informal employment, 5.52% were students and 31.03% unemployed. 48.28% had no income, while 51.72% earned above Kshs.5000 in a month, none of the respondents earned above Kshs. 40000. 2.76% of respondents were homeless, 41.38% lived with a relative, 36.55% owned or lived in what was considered family property, 19.31% rented houses. 46.53% abused drugs and substances, 53.47% did not abuse any drugs. Among those abusing drugs, 19. 48% reported to use drugs sometimes, 10.39% most times, 36.36% often and 33.77% very often, 83.89% of those abusing drugs reported dependency on these drugs and 17.11% were not dependent. 63.08% of those abusing drugs took alcohol, 12.31% took Bhang, 6.15% took Heroin, 1.54% Miraa and 16.92% took more than one type of drug: poly-substance abuse.

A positive family history of psychosis was reported by 46.21% of the respondents; among those who reported a family history of psychosis, 56.72% had a blood relative as member of family affected, 14.93% had a brother as affected member, 4.48% had father as affected, 4.48% had mother as affected member, 4.48% had more than one member

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of family affected, 13.43% had sister as affected and 1.49% had a non-blood relative as family member affected.

Most of the respondents, 77.24%, reported rural as their place of birth while 22.76% reported urban as place of birth. 57.93% currently resided in a city while 42.07% resided in a rural area.

72.22% of respondents had some form of co-morbidity; the co-morbid condition with highest frequency was HIV at 22.86% (n=8) of the respondents with co-morbidities. 20.69% of respondents had childhood trauma, of these, 100% (n=115) were experiencing anxiety in relation to a traumatic event. 60.36% of those experiencing anxiety had this feeling for a long time: period over six months. 46.96% had discomfort in relation to memories of a childhood traumatic event. The primary caregivers reported that 79.58% of these patients had received early treatment.

Table 4.2: Numerical summaries

Variable	Mean	SD	IQR	0%	25%	50%	75%	100%	N	N/A
Age	34.7931	10.55797	15	17	26	33	41	57	145	0
DUP (weeks)	10.19231	8.470051	13.75	1	2.25	8	16	35	78	67
Duration of	9.707692	8.311744	8	2	4	7	12	39	65	80
Age of onset	27.44138	8.343224	11	16	21	25	32	55	145	0
Age at onset of	26.02564	7.663329	9.75	16	21	24	30.75	48	78	67

As shown in Table 4.2, the mean age was 34.79±10.56 SD, the mean DUP (weeks) was 10.19±8.47 SD, the mean duration of drug abuse, in years, was 9.71±8.31SD, while the

mean age at onset was 27.44±8.34 SD for all diagnoses. The mean age at onset of psychosis was 26.02±7.66 SD.

4.1.2 Measures of association between psychosocial and biological factors

Table 4.3 below shows results for the measures of association between psychosocial and biological factors.

Table 4.3: Measures of categorical associations between psychosocial and biological factors

Variable 1	Variable 2	Chi-square	D.f	P- value
Family history of Childhood trauma	Gender	0.9866	1	0.3206
	Gender	3.3625	1	0.0667
Diagnosis of Psychosis	Residence	2.6382	1	0.1043
Family History of Diagnosis of Psychosis	Drug abuse	3.8085	1	0.05099
	Marital Status	10.1707	4	0.03765

Table 4.4 below shows distribution of diagnosis across various marriage statuses.

Table 4.4: Contingency table for diagnosis of psychosis and marital status

Diagnosis of psychosis	Divorced	Married	Separated	Single	Widowed
No	4	31	3	27	2
Yes	1	24	12	40	1

The results in Table 4.3, show that all other variables are independent at 5% level of significance, except for a diagnosis of psychosis and marital status (p-value=0.03765, α=0.05). The results for the association between a diagnosis of psychosis and marital status, were not valid, given more than 20% of cell frequencies (as shown in table 4.4), were below 5, as suggested by Cochran (1954).

4.1.3 Parametric tests of factor effects on DUP and age at onset of psychosis

Table 4.5 below shows results for the parametric tests of factor effect on DUP.

Table 4.5: Parametric test of effect of factors on DUP

Factor	Df	Sum Sq	Mean Sq	F value	P. value
Education	3	103	34.22	0.467	0.706
Drug abuse	1	1298	1298.0	23.34	6.88e-06*
Type of drug abused	3	144.9	48.29	0.631	0.601
Family history of	1	0.38	0.38	0.005	0.942
Residence	1	87.44	87.44	1.222	0.272
Gender	1	476	476.0	7.166	0.0091*
Childhood trauma	1	29.65	29.65	0.41	0.524

Results in Table 4.5, show that drug abuse (p-value=6.88e-06, α=0.05) and gender (p-value=0.0091, α=0.05), had a significant effect on DUP.

Checking for assumptions of the ANOVA test above was done using a qq plot as show in Figure 4.1 below:

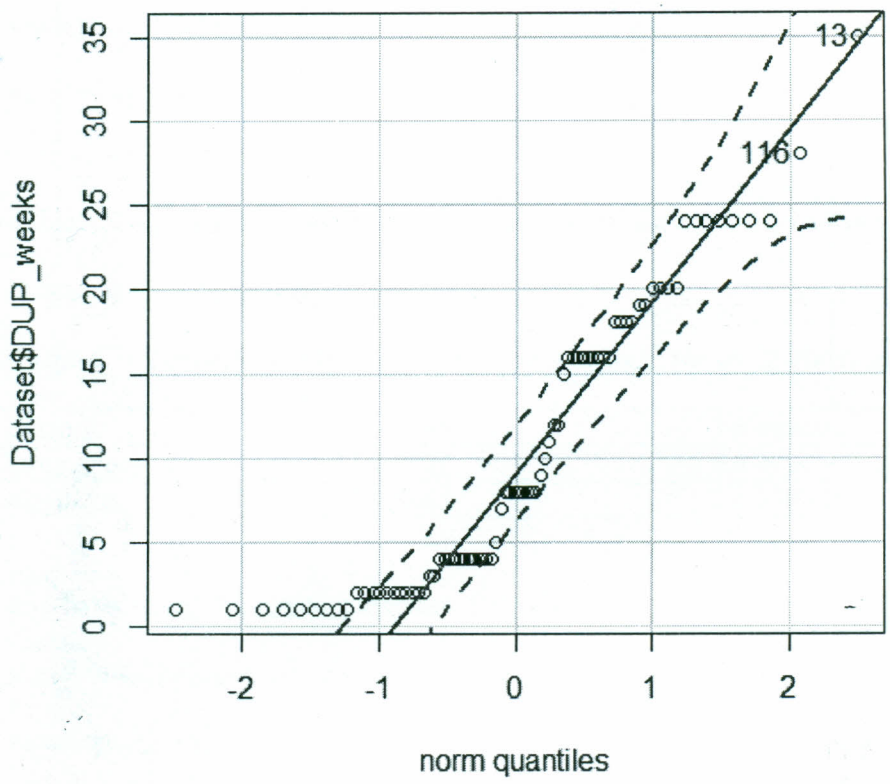

Figure 4.1: QQ plot for normality assumption of DUP

As shown in Figure 4.1, above, the assumption of normality was not met by the variable DUP. To confirm this, a mathematical non-parametric approach, Shapiro-Wilk normality test was done.

Table 4.6 below shows results for the non-parametric Shapiro-Wilk test for normality of DUP.

Table 4.6: Non-parametric Shapiro-Wilk normality test for DUP

W	P value
0.8837	3.416e-06

Results in Table 4.6, above, confirm DUP was not normally distributed (p-value=3.416e-06, α=0.05).

Table 4.7 below shows results for the Levene's test for equal variances of DUP at levels of drug abuse and gender.

Table 4.7: Levene's test for equal variances of DUP for drug abuse and gender

Factor	F value	P value
Drug abuse	9.9572	0.002296*
Gender	4.8863	0.03008*

The assumption for equal variances for DUP, was not met, for both drug abuse (p-value=0.002296, α=0.05) and gender (p-value=0.03008, α=0.05), as shown in Table 4.7. Assumption of independence of samples was attained at sampling stage.

The results for the nonparametric Kruskal-Wallis test for factor effect of drug abuse and gender on DUP are shown in Table 4.8 below.

Table 4.8: Non-parametric Kruskal-Wallis test for factor effect of drug abuse and gender on DUP

Factor	Kruskal-Wallis chi-squared	Df	P-value
Drug abuse	16.3697	1	5.211e-05
Gender	5.7024	1	0.01694

From the Kruskal-wallis test, Table 4.8, the same conclusion was obtained as in one-way ANOVA; that drug abuse (p-value=5.211e-05, α=0.05) and gender (p-value=0.01694, α=0.05), have significant treatment effect on DUP. DUP is influenced by drug abuse and gender.

The results for the parametric test of treatment effect of various factors on age at onset of psychosis are shown in Table 4.9 below.

Table 4.9: Parametric test of traetment effect of factors on age at onset of psychosis

Factor	Df	Sum Sq	Mean Sq	F value	P. value
Gender	1	74	74.00	1.264	0.264
Drug abuse	1	0.05	0.05	0.001	0.978
Family history of	1	10.48	10.48	0.177	0.675
Residence	1	47.77	47.77	0.811	0.371
Childhood trauma	1	88.29	88.29	1.513	0.222

Results from Table 4.9, show there was no significant effect of the variables: gender, drug abuse, family history of psychosis, residence and childhood trauma, on age at onset of psychosis. Age at onset of psychosis is not influenced by these factors.

4.1.4 Test of association of duration of drug abuse on age at onset of psychosis

Results for the test of association of between drug abuse and age at onset of psychosis are shown in Table 4.10 below.

Table 4.10: Test of association of duration of drug abuse and age at onset of psychosis

	Estimate	Std.Error	T value	P-value
(Intercept)	23.3685	1.3912	16.797	<2e-16*
Duration of drug abuse	0.3963	0.1092	3.628	0.000573*
Multiple R-squared: 0.1728, Adjusted R-squared: 0.1597				

Results in Table 4.10, show that the relationship between duration of drug abuse and age at onset of psychosis was significant (p-value=0.000573, α=0.05).

The above results mean that, for each increase by one year of the duration of drug abuse, the age at onset of psychosis increases by 0.3963 years. There is poor correlation since the adjusted R^2 is closer to zero (Adjusted R-squared 0.1597).

4.1.5 Test of significance of exposure factors in determining psychosis

Results for the test of significance of exposure factors in determining whether a patient is diagnosed with psychosis are shown in Table 4.11 below.

Table 4.11 Test of significance of exposure factors in determining whether a patient is diagnosed with psychosis or otherwise

	Estimate	Std. Error	Z Value	P. value
(Intercept)	-1.3527	0.5824	-2.323	0.0202*
Drug abuse	-0.3446	0.4299	-0.802	0.4228
Family history of psychosis	1.5844	0.3885	4.079	4.53e-05*
Gender	-0.0175	0.4221	-0.041	0.9669
Residence	0.8296	0.3891	2.132	0.0330*
Childhood Trauma	0.6719	0.4785	1.404	0.1603

Table 4.12 Odds ratios and 95% confidence intervals following logistic regression

	Odds Ratio	2.5%	97.5%
(Intercept)	0.2585347	0.08256432	0.809553
Drug abuse	0.7085236	0.30508561	1.645458
Family history of psychosis	4.8765739	2.27741516	10.442089
Gender	0.9826478	0.42964646	2.247421
Residence	2.2922816	1.06929650	4.914030
Childhood trauma	1.9578856	0.76639239	5.001767

Results in Table 4.11, show that Family history of psychosis ($p=4.53e-05$, $\alpha=0.05$) and residence ($p=0.0330$, $\alpha=0.05$), were significant in predicting the probability of a patient having psychosis.

With group that does not abuse drugs as reference, the log of odds of a patient being diagnosed as having psychosis, decreases by 0.3446 (OR=0.71, 95% CI: 0.31-1.65) for those abusing drugs. With those having no family history of psychosis as reference (family history of psychosis=0), the log of odds of a patient being diagnosed as having psychosis increases by 1.5844 (OR=4.88, 95% CI: 2.28-10.44), for patients having a family history of psychosis. With female gender as reference (female=0), the log of odds of a male patient being diagnosed as having psychosis decreases by 0.0175 (OR=0.98, 95% CI: 0.43-2.25).

With rural residence as the reference (rural=0), the log of odds of a person residing in a city having psychosis increases by 0.8296 (OR=2.29, 95% CI: 1.07-4.91). With negative childhood trauma as reference (childhood trauma=0), the log of odds of a person who experienced trauma in childhood being diagnosed as having psychosis increases by 0.6719 (OR=1.96, 95% CI: 0.77-5).

4.1.6 Test of association of exposure factors to DUP

Results for the test of association of various factors on DUP are shown in Table 4.13 below.

Table 4.13 Test of association of various factors on DUP

	Estimate	Std. Error	T value	P. value
Intercept	8.61663	3.26576	2.638	0.0102 *
Drug abuse	8.48669	1.85825	4.567	2e-05 *
Family History of psychosis	0.08263	1.76650	0.047	0.9628
Gender	1.51059	1.81908	0.830	0.4091
Residence	-4.10405	1.83450	-2.237	0.0284 *
Childhood trauma	-0.74201	2.49828	-0.297	0.7673
Multiple R-squared: 0.302, Adjusted R-squared: 0.2535				

Results from table 4.13, show that holding other factors constant, patients with a history of drug abuse, have a longer DUP by 8.48669 weeks, patients with a family history of psychosis have a longer DUP by 0.08263 weeks, male patients have a longer DUP by 1.51059 weeks.

Patients residing in the city had a shorter DUP by 4.10405 weeks, while those with childhood trauma had a shorter DUP by 0.74201 weeks. The model showed poor, positive, correlation (Adjusted R^2: 0.2535). Overall only drug abuse (p-value=2e-05, α=0.05) and residence (p-value=0.0284, α=0.05) were significant in predicting length of DUP. This was also illustrated by model selection below:

```
Start:  AIC=334.29
DUP_weeks ~ 1

                                Df Sum of Sq    RSS    AIC
+ Drug_abuse                     1   1297.99 4226.1 315.40
+ Gender                         1    475.96 5048.2 329.27
<none>                                       5524.1 334.29
+ Residence                      1     87.44 5436.7 335.05
+ Childhood_trauma               1     29.65 5494.5 335.87
+ Family_history_of_psychosis    1      0.38 5523.7 336.29

Step:  AIC=315.4
DUP_weeks ~ Drug_abuse

                                Df Sum of Sq    RSS    AIC
+ Residence                      1    327.22 3898.9 311.12
<none>                                       4226.1 315.40
+ Gender                         1     89.34 4136.8 315.74
+ Family_history_of_psychosis    1      7.33 4218.8 317.27
+ Childhood_trauma               1      3.91 4222.2 317.33
- Drug_abuse                     1   1297.99 5524.1 334.29

Step:  AIC=311.12
DUP_weeks ~ Drug_abuse + Residence

                                Df Sum of Sq    RSS    AIC
<none>                                       3898.9 311.12
+ Gender                         1     38.00 3860.9 312.35
+ Childhood_trauma               1      5.98 3892.9 313.00
+ Family_history_of_psychosis    1      0.01 3898.9 313.12
- Residence                      1    327.22 4226.1 315.40
- Drug_abuse                     1   1537.78 5436.7 335.05

Call:
lm(formula = DUP_weeks ~ Drug_abuse + Residence, data = Dataset)

Coefficients:
(Intercept)    Drug_abuse     Residence
      8.671        9.135        -4.387
```

Figure 4.2: Stepwise model selection

The results for model selection, with forward-backward stepwise regression and AIC as criterion, is shown Table 4.12 below.

Table 4.14: Stepwise model selection using AIC

(Intercept)	Drug abuse	Residence
8.671	9.135	-4.387

Results in Table 4.14 above show that the stepwise model selection identified the model which included the variables residence and drug abuse as the one which produced the lowest Akaike Information Criteria as shown in Figure 4.2 above.

4.2 Discussion

In a study done in South Africa (Burns *et al.*, 2012), it was concluded that aspects of social capital pertaining to greater community involvement led to delays in pathways to appropriate care and that it was possible community members opted to care for individuals with early psychosis longer before sending them to formal health services. This was especially likely in the contexts where mental health services were scarce and inaccessible. In addition, individual factors including greater age at onset and police involvement in the care pathway were significantly associated with shorter DUP in their study.

Male patients were the majority (55.17%, n=80); This was likely as a result of mental illness manifestation, and societal perception of the male psychiatric patient, as being aggressive and uncontrollable. This necessitates hospitalisation. Majority of participants, indicated Central as their home district (35.86%), while Coast had the least (2.76%). This is likely as a result of the former being proximal to Mathari Hospital and the latter being furthest. Consequently no inferences were done on this variable. Majority (60%) of the respondents, were not in any marital relationship: 3.45% divorced, 10.34% separated and 46.21% single. This point's out the negative social implication mental illness carries. Most of the patients were educated with 64.83% having attained, at least, secondary level education. Most of the respondents (58.45%) were not working at the period leading to hospitalisation. And 31.03% considered themselves unemployed. 48.28% had no income and none of the respondents earned

more than Kshs. 40,000/month. This underscores the fact that mental illness diminishes a patient's productivity and employability.

Among patients who reported a family history of psychosis (n=67), only 1.49% (n=1), had a non-blood member of family, as the member having psychosis. This corroborates with other studies that have shown that adoptive members of the family did not alter a relative's chances of developing psychosis. Taylor *et al.* (2002) showed that biological relatives of patient are more likely to have the disorder than are adoptive relatives.

Majority of respondents (77.24%) had been born in rural places; however, 57.93% currently resided in a city. This demonstrates possibility of migration, social disruption and social adversity related to living in an urban setting as a contributor to mental illness. The highest co-morbid condition was HIV (22.86%). This was an unexpected revelation and could be as a result of poor judgement and inability to practise safe-sex by psychiatry patients. Following Pearson's chi-squared test, no association was observed among the categorical variables; family history of psychosis, gender, childhood trauma, diagnosis of psychosis, residence and marital status. One-way ANOVA tests revealed that drug abuse and gender had a significant treatment effect on DUP. None of the factors tested, gender, drug abuse, family history of psychosis, residence and childhood trauma, had a treatment effect on age at onset of psychosis.

Age at onset of psychosis, and duration, in years, of drug abuse had a linear relationship. This model showed that for each additional year of drug abuse, the age at onset of psychosis increased or delayed by almost half a year (0.4817 years). DUP had

no association with age at onset of psychosis. Family history of psychosis and residence were significant in predicting the probability of a patient having psychosis.

Drug abuse, gender and childhood trauma were not significant in this aspect. This is unlike other studies done globally, and we can relate this to the peculiarities of the Kenyan patient vis-à-vis conditions elsewhere.

Drug abuse was significant in predicting DUP. Drug abuse served to increase DUP by several weeks. This can be explained in a number of ways: Community misinterpreting signs of psychosis as simple effects of drug abuse and therefore not seeking psychiatric treatment, drug addicts have a tendency of denial and would evade any rehabilitation efforts; this can delay treatment.

Residence was significant in predicting DUP. Residing in a city had the effect of shortening DUP. This can be explained in several ways: City residents have a better awareness of mental illness compared to their rural counterparts and would therefore seek early treatment for their relatives, City residents have better access to psychiatric treatment facilities and would be treated earlier than their counterparts in rural areas. It is also possible to conclude that social adversity related to life within urban areas hastens a patient's progression from prodromal phase of psychosis to full blown psychosis. This makes living in a city a risk factor for psychosis

Casten *et al.* (2001) concluded that environmental factors related to urbanicity may contribute to a substantial proportion of the population developing schizophrenia. Whether the migration from rural to urban residence leads to psychosis is not answered

at this level. Cantor *et al.* (2005) concluded that a personal or family recent migration increases risk of developing schizophrenia.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

Male gender, as in other studies (Ndetei *et al.*, 2007; Paruk *et al.*, 2009), accounted for a higher number of patients with psychosis. In a previous study, done at Mathari Hospital, the researchers concluded that it was possible that the gender distribution of mental illness was as a result of real difference in experience of mental illness according to gender (Ndetei *et al.*, 2009). Family history of psychosis and residence were significant in predicting psychosis. 98.51% of respondents with a family history of psychosis had a blood relative as member of family with psychosis. Drug abuse served to lengthen DUP. Mean DUP (10.19±8.47 SD weeks) pointed to a situation where patients develop positive symptoms of psychosis but treatment is delayed.

Urban residence carried a higher burden for psychosis than rural residence. Though most of the patients reported having been born in a rural setting, they were currently residing in a city. This study supports male gender leaning strategies in addressing psychosis. Persons with a family history of psychosis are most vulnerable and should be screened and early intervention or preventive measures taken. The urban and city environment should be looked at exhaustively to understand factors that make this environment risky for good mental health. Drug abuse is a modifiable risk factor. It is acceptable, at this stage, to say persons with a positive family history of psychosis should stay away from drugs.

5.2 Recommendations

More resources should be devoted to study psychosis at preclinical level in the Kenyan context to help address the unique challenges encountered by patients and lessen the burden. Given the high proportion of patients with a working diagnosis of psychosis, screening should be done on the general population for better treatment outcome. Early intervention should be made core in management of psychosis. This requires more specialists to be trained in psychiatry. More psychiatric care facilities should be established closer to the communities. Public awareness of psychosis and other mental illnesses promoted, so that cases can be brought early enough for specialized care. Most psychiatric patients, as seen in this study, don't earn enough due to their diminished earning power, probably as a consequence of their illness. It shall be a bold and helpful approach if the Kenyan government provided mental health services at no cost; this will definitely encourage timely seeking of treatment and therefore possible early intervention. It is important to investigate further why HIV was found to be the most common co-morbid condition among these patients, bearing in mind, HIV status was neither a primary nor a secondary measure in this study.

The urban and city environment should be looked at exhaustively to establish and understand factors that make this environment detrimental to good mental health in Kenya.

Further inquiry should attempt to clarify the exact causal path for rural-urban migration as a risk factor for psychosis in Kenya, and its contribution quantified, given more urbanization is expected as Kenya moves to attain vision 2030.

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APPENDICES

APPENDIX I: INFORMED CONSENT EXPLANATION

NB: Was read/ translated in/into a language in which participant was conversant (English or Swahili)

My name is Wilfred Musanda Olwende, pursuing a Masters of Science in Biostatics at Kenyatta University. I am doing a study entitled; Factors associated with psychosis in Kenya; a case study of Mathari Hospital, Nairobi as part of my degree award fulfillment. My supervisors are Dr. Edward Njenga of Kenyatta University and Dr. Caleb Othieno of the University of Nairobi.

The aim of this study is to assess factors associated with psychosis in Kenya and their extent as presented by patients admitted at Mathari Hospital. This study will be conducted by me under supervision of my supervisors. This is a medical research and you are required to understand the following which apply to all in medical research.

Your participation is completely voluntary and you may withdraw consent at any time in the course of the interview.

Declining to participate will not in any way affect the care/ entitlements you receive at this facility.

Please don't hesitate to ask any questions should you require clarification after reading this explanation.

I will engage you in an interview of not more than 30 minutes, which shall help me obtain information for my study.

Your caregiver will also be asked a few questions touching on your condition.

Other than the emotional discomfort some questions might cause you, no invasive procedure will be used.

All information will be treated as confidential as the analysis will be generalized without any specific reference to an individual (you). Serial numbers instead of your name will be used for identification. Your name will only appear on the consent form which will be kept separately from the study documents for legal purposes.

There will be no material gain from this study. Information gathered will help form a better understanding of mental illness in Kenya and probably inform policy towards better mitigation.

For any questions related to this study you may reach me on +254729563286 or my supervisors and/or KNH/ UON Ethics and Research committee on 7263009 or P.O BOX 20723, Nairobi.

APPENDIX II: CONSENT FORM

I, the undersigned volunteer to participate in this study, of which purpose has been fully explained to me by the interviewer.

I understand that all information obtained will be used for this study only and I am entitled to confidentiality and also reserve the right to withdraw from the study as I may deem necessary without losing any benefit to which I am otherwise entitled to.

Participant's Name……..

Signature……Date……

Witness Name……

…….Signature……...Date…….....

APPENDIX III: QUASI-STRUCTURED QUESTIONNAIRE

Date……..

Serial Number…… Patient number……

1. D.O.B……(dd/mm/yy)

2. Sex

a) Male

b) Female

3. Home district

Nairobi

Western

Eastern

North Eastern

Coast

Rift-valley

Nyanza

Central

4. What is your marital status? (show card and clarify any ambiguity)

a) Single

b) Married

c) Separated

d) Divorced

e) Widowed

f) Cohabiting

5. Have you attended any formal schooling? If yes, to what level? (circle as per response don't offer options to participant)

a) No formal education

b) Primary

c) Secondary

d) Tertiary

e) Other (specify).....

6. Were you working before being brought to hospital?

a) Yes

b) No

7. What do you do for a living? (circle as per response don't offer options to participant, clarify)

a) Student

b) Formal employment

c) Informal employment

d) Business Person

e) Unemployed

f) Any other (specify).....

8. Approximate amount of income per month (Kshs) _____(circle as per response don't offer options to participant)

a) Less than 5000

b) 5000 – 10000

c) 10001 – 20000

d) 20001 – 30000

e) 30001 – 40000

f) Above 40000

9. What is your housing status?

a) Owner

b) Rent

c) Live with relative

d) Homeless

e) Others (specify)……

10. Do you take alcohol or other drugs?

a) Yes

b) No

11. If yes above, how often?

a) Sometimes

b) Most times

c) Often

d) Very often

12. Do you find it difficult to go without drugs?

a) Yes

b) No

13. Which drugs do you find difficult to go without? (if yes above)

a) Alcohol

b) Bhang (cannabis)

c) Miraa (khat)

d) Others, specify

14. How long have you had to use these drugs? (ask or skip depending on answers above)

15. Do you know of a family member suffering from psychosis?

a) Yes

b) No

16. If Yes above, whom? (circle as per response don't offer options to participant)

a) Mother

b) Father

c) Brother

d) Sister

e) Blood relative

f) Non blood relative/ adopted/ spouse

17. Where were you born?

a) Urban

b) Rural

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18. Where have you stayed most of your life? (circle as per response, probe for exact place and fit)

City (Nairobi or Mombasa)

Town

Rural (village)

19. Apart from your current treatment do you have any other diagnosis?

a) Yes

b) No

20. If yes above, do you suffer from epilepsy or Parkinson disease? (check record)

a) Epilepsy

b) Parkinson disease

c) Others, specify.....

21. Are you receiving treatment for this other condition?

Yes

No

22. Have you had a saddening experience in childhood?

a) Yes

b) No

23. Did that make you anxious as well?

Yes

No

24. How long did that feeling last?

25. Do you feel uncomfortable with situations that bring back memories of that event?

a) Yes

b) No

Qns 26 & 27 require caregiver involvement, Qns 28& 29 to be directed exclusively to caregiver

26. At what age did you start having experiences that necessitated your current treatment?.....

(also check records, primary caregiver information to be recorded too)

27. At what age did you start receiving psychiatric care?.....

(check records for first episode and indicator for duration of untreated psychosis)

28. Did patient receive psychiatric care when initial signs of disturbance showed?

Yes

No

29. How many weeks/ months elapsed between first appearance of these signs and treatment?

You have successfully completed the interview, thank you for your participation!

APPENDIX IV: SHOW CARD

Question number 4

Single

Married

Separated

Divorced

Widowed

Cohabiting

Question numbers: 6, 10,12,15,21,22,23,25

Yes

No

Question number 9

Live in own house

Rent

Live with relative

Homeless

Any other (specify)

Question 11

Sometimes

Most times

Often

Very often

Question 17

Urban

Rural

Question 19

Yes

No

Question 25

Yes

No