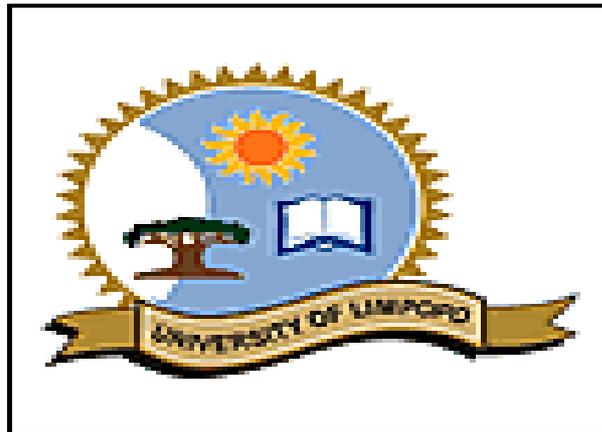


**THE DIAGNOSTIC OUTCOMES OF ELECTROENCEPHALOGRAM PERFORMED  
ON ADULT PSYCHIATRIC PATIENTS AT DR GEORGE MUKHARI HOSPITAL,  
GARANKUWA” OVER A PERIOD OF JANUARY 2006 TO DECEMBER 2008**



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## DECLARATION

I ,the undersigned hereby declare that the work contained in this dissertation and hereby submitted to the University of Limpopo, for the degree of MMED(psychiatry) is my original work and that I have not previously in it's entirety or in part, submitted it at this ,or any university, and all material contained herein has been duly acknowledged

Initial and Surname (Title).....

Student Number .....

Signature .....

Date .....

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## **ABBREVIATIONS**

**CNS** – Central nervous system

**DGMH** – Dr George Mukhari Hospital

**DSMIV** – Diagnostic statistical Manual for Diagnosis of Mental Disorders

**EEG** - Electroencephalogram

**GMC** – General medical condition

**IED** – Inter -Ictal Epileptogenic Discharge

**OPD** – Outpatient department

**QEEG** – quantitative Electroencephalogram

## ABSTRACT

### INTRODUCTION

The yield of EEG amongst psychiatric patients has been reported to be low and the value of EEG in the practice of psychiatry is questionable. EEG is used as part of a diagnostic work up for patients with psychiatric disorders. Often the reason given for its use is to exclude epilepsy as a cause of psychiatric symptoms. Epilepsy is primarily a clinical diagnosis, but the EEG may provide strong support by the findings of inter – ictal Epileptogenic discharge

### METHOD:

All the adult EEGs requested at Dr George Mukhari psychiatric hospital, over a 36 month period ,were reviewed to describe the outcome of the requested EEG reports .The study is a simple retrospective analysis of 111 consecutive EEG requested to the department of Neurology at DGMH from psychiatric unit at DGMH. Subjects were both inpatients and outpatients .All the EEG was reported by a qualified Neurologist. Data were extracted from the EEG request form and the patients' clinical files, which reported on the clinical reason for the EEG test, nature of psychiatric diagnosis of patients, the psychiatric treatment received prior to the EEG test and the nature of the EEG results

### RESULTS

There were 111 EEG reports analysed, and 69 EEG reports for males and 42 EEG reports for females. The reason for EEG request was dominated mainly by exclusion of epilepsy. Majority of the patients were diagnosed with a psychotic disorder , followed second by a mood disorder , all of which was attributed to GMC (epilepsy).About 62.73% of patients were on a combination of treatment of antipsychotic drug and anticonvulsants, whilst 34.55% were on antipsychotic monotherapy prior to the EEG test.

Further analysis of the requested EEG form was carried out in whom the test was to determine whether or not the patients were suffering from epilepsy. EEG abnormalities were identified amongst 24% of the patients. About 11,7% of patients presented with non specific EEG results

.Out of a total number of 111 patients whom an EEG test was requested and epilepsy was highly suspected from clinical presentation, only 14 patients (12.6%), presented with epileptiform discharge on their EEG results. However majority of the patients (76%) demonstrated normal EEG pattern, which doesn't exclude a diagnosis of epilepsy.

## CONCLUSION

The yield of EEG in psychiatry is low. To diagnose epilepsy as a cause of psychiatric presentation, clinicians should continue to rely on the clinical history of attacks and not the EEG .In the practice of psychiatry it is not recommended to routinely order an EEG to exclude a diagnosis of epilepsy, more so to confirm a psychiatric diagnosis.The presence of a psychiatric symptoms in patients who presents with epilepsy, is rarely associated with meaningful EEG changes

# CHAPTER 1

## Introduction & Background

Patients with epilepsy have a high prevalence of psychiatric co morbid conditions. Both neurology and psychiatry, deal with disease of the same origin – the brain. Predicting the interaction between neurologic and psychiatric disease is not, therefore, unreasonable.

Epilepsy is a chronic disorder characterised by seizures, or a paroxysmal brain dysfunction due to excessive neuronal discharge.<sup>21, 22</sup> Psychiatric and cognitive disturbances are relatively common in epilepsy, especially refractory epilepsy. Some authors reported greater incidence of behavioural disorders in patients with epilepsy than in general population. The most common psychiatric condition in epilepsy is depression, anxiety and psychosis.<sup>15, 11</sup>

Many clinicians in the field of psychiatry and neurology are faced with the dilemma of differentiating between primary psychiatry disorder and psychiatric manifestations due to epilepsy and organic brain syndrome<sup>7,13,21</sup> Between Neurology, internal medicine and psychiatry departments at DGMH, diagnosis of epilepsy still remain a clinical diagnosis. In certain cases it becomes very challenging in determining what came first between seizure and mental illness.

EEG is a useful tool for the diagnosis of epilepsy, where the report of eye witness is not either completely available, or is not available at all, but its use should be handled with caution<sup>6</sup>. The EEG must be read very carefully, so that non epileptic person may not be labelled as a case of epilepsy, which will be indeed very unfortunate for the patient.

EEG has long been discovered and readily available to clinicians throughout the world.<sup>6,8</sup> It gained its reputation as a diagnostic tool for a range of indications, since it can record a variety of pathological conditions. Its primary role is mainly to diagnose epilepsy and provide supporting evidence of a seizure disorder, and also help with classification of epileptic syndrome. Emerging evidence suggest that EEG may also provide useful prognostic information regarding seizure recurrence after a single unprovoked attack and following antiepileptic drug withdrawal.

Despite its reputation, the clinical use of EEG amongst psychiatric patients remains unappreciated and highly criticised. The validity of EEG in modern psychiatry is highly questioned, whether it is still a useful tool or not,

due to higher prevalence of non specific EEG findings amongst psychiatric patients. EEG can be used for a variety of indications in psychiatric practice.

The commonly used reason for requesting EEG amongst psychiatric patients at DGMH is to rule out epilepsy amongst patients presenting with psychiatric conditions. The diagnosis is primarily made from a careful history taking and examination, because robust amounts of literature have indicated the limited value and yield of EEG amongst psychiatric patients.

There is little South African data examining the prevalence or usefulness of EEG abnormalities among adult psychiatric patients. Some work has been done in adolescents by Prof Szabo who reviewed all admissions to the adolescent inpatient unit at Tara hospital between 1990 and 1995. Of the thirty six patients who underwent EEG during the study period, 44% had epilepsy from EEG findings, 34% non specific abnormal EEG and 22% were normal.<sup>8</sup>

Overall the findings of his study demonstrated that significant majority of patients referred for EEG had abnormal results. Therefore the yield of EEG in his study was high but how significant did the EEG results influence the final diagnosis and management for the patients is not clear. The only other published study from South Africa, was a retrospective study performed by Stein et al at Hillbrow Hospital (Johannesburg).<sup>8,20</sup>

All departmental referrals for EEG during a one year period (1986 -1987) were analysed in an attempt to establish the value and benefit to patient care. The study group consisted of 145 patients. Nearly half of the study population were shown to have clearly demonstrable abnormalities on EEG. Szabo and Stein's EEG results outcomes were influenced by different selection criteria, which influenced the prevalence of abnormal EEG found, and the usefulness of EEG.

This study is a retrospective study conducted with the purpose of establishing the outcome of the requested EEG amongst psychiatric patients suspected of having epilepsy and other organic brain syndrome, at DGMH over a 36 month period.

## 1.1 Problem Statement & Significance of the Study

EEG is a frequently used investigative tool by psychiatrists at DGMH as part of a diagnostic workup for patients who presents with psychiatric symptoms suspected to be due to epilepsy.

Robust literature on the use of EEG in psychiatric practice, demonstrated that the diagnostic yield of EEG in psychiatry is low.<sup>11, 19</sup> Other studies reported that none of the abnormal EEG's found amongst psychiatric patients helped in identifying an organic factor that was not already diagnosed. Based on this data, it is hypothesized that routine use of EEG amongst psychiatric patients, to rule out epilepsy provides low diagnostic yield.

This study is aimed at describing the diagnostic outcome of EEG requested among adult psychiatric patients from DGMH psychiatry clinic over a specified period of 36 months (Jan 2006 – December 2008). The significance of this study is to determine whether an EEG is a justified investigative tool amongst psychiatric patients and how often does it produce results that the psychiatrist was not expecting.

## 1.2 Research Goal

To determine the yield of EEG performed amongst psychiatric patients who were referred for EEG test during the study period.

## 1.3 Research Questions

- 1) What is the diagnostic yield of EEG performed amongst adult psychiatric patients over a specified period of the study?
- 2) What is the value of EEG in psychiatric practice, as a tool for diagnosis of epilepsy and seizure disorders?
- 3) When is an EEG justified?
- 4) What are the frequent reasons for requesting EEG amongs adult psychiatric patients at DGMH psychiatric clinic?

## 1.4 Objectives of the Study

The Objective of the study is;

1. To determine the indications for requested EEG by the general Adult psychiatry unit at DGMH
2. To determine the frequency of EEG abnormalities among adult psychiatric patients referred for EEG evaluation.
3. To establish the psychiatric diagnostic profile of adult psychiatric patients, who were sent for EEG during the study period?
4. To describe the pharmacological interventions implemented prior to performance of EEG on Adult psychiatric patients
5. To determine the frequency of epileptogenic EEG abnormalities amongs the identified abnormal EEG reported.

## CHAPTER 2

### LITERATURE REVIEW

Electroencephalography (EEG) is a non invasive neurodiagnostic technique of recording from the scalp the spontaneous electrical activity of the brain and correlating it to the underlying brain functional. Ever since the introduction of the EEG by the psychiatrist Hans Berger in 1929 improvement in electronics and technology has made EEG one of the most widely used laboratory test for clinical evaluation of neurologic disorders.<sup>3,11</sup>

However in the past three decades with continuing advances in neuroimaging, particularly magnetic resonance imaging (MRI), the role of clinical EEG has become more restricted and progressively more focused. Its major utility at present is in the evaluation of epileptic disorders. It is primarily used to confirm the diagnosis of seizure disorders, localisation, classification and monitoring of epileptogenic zone.<sup>2,14</sup>

EEG can be recorded in various forms. This involves using either conventional (routine) EEG method or quantitative EEG (qEEG). Quantitative EEG involves computer assisted imaging and statistical, analysis of the EEG, for detecting abnormalities assisting the physician in making a diagnosis, and purposes relating to patient care. Among the techniques of functional brain imaging, qEEG offers many advantages.<sup>1,16,17</sup>

The conventional EEG technique is the commonly used practical method in evaluating psychiatric patients. The conventional EEG involves visual inspection of abnormal EEG by a trained qualified neurologist. There has been robust literature which is controversial on the use of qEEG amongst psychiatric patients.<sup>1,5</sup>

Epilepsy is a chronic disorder characterised by recurrent seizures, which may vary from muscle jerks to severe convulsions. Estimated life time prevalence of 1% of the world's population suffers from epilepsy. Until the early 20<sup>th</sup> century, seizures were often considered a form of psychopathology and persons with epilepsy were routinely confined to asylums.<sup>10</sup>

From the current literature, there is more than enough evidence to support a balanced position, concluding that patients with epilepsy are at higher risk for certain types of psychiatric and behavioural symptoms. Epilepsy and psychiatric disorders, both are an expression of altered cerebral functioning and their history is often connected.<sup>12</sup> Epidemiological data demonstrated that more than 50% epileptic patients have greater incidence of psychiatric manifestations (especially with temporal lobe epilepsy) than general population

Psychiatric conditions with increased prevalence among epileptic patients includes, depression , anxiety disorders, schizophrenia like psychosis,, temper related disorders and personality changes. Epilepsy in these cases precedes psychiatric presentation, beginning at early ages and continues throughout puberty. Research reports the time it lapses between psychiatric presentation and beginning of epilepsy to be 10 to 14 years.<sup>20, 21</sup>

Despite extensive literature on this relationship that exists between epilepsy and psychiatric presentation, it is still challenging to psychiatrists, to differentiate between primary psychiatric disorder and psychiatric presentation due to epilepsy. Under DSM IV – TR criteria, establishing the diagnosis of most major psychiatric disorders requires ruling out evidence of organic factors that might have initiated or maintained the disturbance (such as epilepsy).

To rule out organic factor requires evidence from history, physical examination and supportive laboratory tests. Such criteria of the DSM IV – TR, increase the use of neurodiagnostic technique in the practice of psychiatry.

## **2.1. The Clinical Use of EEG in Psychiatric practice**

For more than 40 years, the EEG has been widely used by psychiatrists for both research and clinical purposes. Considerable research on EEG correlates of certain psychiatric disorders has been carried out, but these studies are largely irrelevant for the purpose of clinical diagnosis and management of psychiatric patients. EEG has been routinely used in the past by many psychiatrists as a non invasive, relatively inexpensive test for both cerebral function and structure. Diagnostically the EEG has been useful in psychiatry primarily to help differentiate between patients with and without underlying organic neurological disorders.<sup>9, 12</sup>

Despite poor sensitivity and specificity for identifying particular psychiatric conditions, for decades it was the only tool of surgery and direct visualisation of the brain that reliably delivered information on the cerebral parenchyma. As the result, a large body of literature exists attempting to make pathognomonic sense of the electrical tracings gathered from many clinical conditions. EEG failed as a diagnostic tool for brain functional alterations on many grounds; however, multiple studies of general psychiatric and healthy populations debunked its value as a screening tool. Not only do most psychiatric conditions lack specific electrical pattern associated with them on the EEG tracings, but also non specific abnormalities do appear on tracing of normal general populationl.<sup>5,11</sup>

Robust literature reported the use of EEG in psychiatric conditions such as affective disorders, eating disorders, psychosis, personality disorders, dementia delirium and behavioural disorders amongst children. None of these studies reported consistent, specific EEG results. The value of EEG in the practice of psychiatry has been a debated issue and the routine use of EEG amongst psychiatric patients is highly discouraged. The value of EEG amongst psychiatric patients depends heavily among the diagnosis considered and the role it adds in managements of patients.

The American Psychiatric association's task force on quantitative electrophysiological assessment has concluded that qEEG can help in detection of excess slow activity in organic disorders such as dementia and delirium. <sup>6</sup> However they also concluded that qEEG is not yet able to help in the diagnosis of many other psychiatric disorders such as schizophrenia and depression. They further emphasised that the ability of a qEEG to make psychiatric diagnosis or discriminate between various group of psychiatric patients and normal subjects is not established.

The most common reason for ordering EEG amongst psychiatric patients is to rule out epilepsy. However this practice is based on the mistaken assumption that a normal EEG implies the absence of epilepsy. The EEG is the most sensitive in detecting site of seizure foci and may provide strong support, by the finding of interictal epileptogenic discharge. However a normal interictal EEG can never exclude a clinical diagnosis of epilepsy. In one study of patients with a known seizure disorder who had received a single interictal EEG, the EEG of 10% – 15% was normal. In another study of psychiatric patients without a history of epilepsy, only 2.6% were found to have epileptiform abnormalities on EEG.<sup>16, 18</sup>

When evaluating psychiatric patients for epilepsy, a single normal EEG is not sufficient for ruling out a seizure disorder. It has been shown that serial EEG's particularly if spaced over a year or longer yields more accurate

results. If the first EEG is normal, it sometimes helps to obtain second one after 12hours of sleep deprivation.<sup>19</sup> Considering this robust debates about routine use of EEG amongst psychiatric patients, it is clear that EEG use amongst psychiatric patients should be used with caution, and be limited to patients who present with epilepsy and also considering its limited value, it adds in the management of patient more so with patients who are already on psychotropic medication.

## **2.2. The prevalence of EEG abnormalities amongst patients with psychiatric Disorders in the absence of Epilepsy**

Turning to psychiatric disorders, it is clear that is not uncommon to find typically minor EEG abnormalities in some syndromes and this is not surprising. Despite the existing robust EEG literature reporting abnormalities amongst psychiatric patients, only a few generalisations can be made between a particular EEG pattern and neuropsychiatric disorder. Perhaps the best recognised EEG abnormalities are the non specific EEG slowing often found in the temporal and central brain areas.<sup>2, 7, 11</sup>

The strong and relatively straightforward correlation that has been established between EEG abnormalities and epilepsy has overshadowed the more complex relationship between EEG abnormalities and psychiatric disorders. Numerous studies documented conventional EEG abnormalities in 20 %- 60% of patients with schizophrenia. Abrahams and Taylor showed that schizophrenia patients had twice as many left sided temporal lobe abnormalities than patients with affective disorders who have more right sided EEG findings.<sup>2</sup>

Definite EEG abnormalities have been documented in a high proportion of schizophrenic patients, but perhaps were minor, quite non specific diffuse type, the most predominant observed EEG abnormalities being low amplitude alpha waves. EEG abnormalities were more frequent found in the cohort of schizophrenic patients who had a positive family history, suggesting that genetic factor may be contributing to EEG traits. The EEG aberrations possibly reflected abnormalities in cortical neuronal architecture, cellular neuropathology and neurochemical transmitter abnormalities that underpin the schizophrenia pathophysiology, in addition to possible effect of using neuroleptic medication <sup>2, 8</sup>

Furthermore specific differences have also been reported among subgroups of schizophrenia. Catatonic schizophrenia has been reported to display more incidences of EEG abnormalities and least common amongst paranoid type. The catatonic type predominantly displays paroxysmal EEG activity. This reported data are insufficient to permit valid generalisation.<sup>20</sup>

## 2.3 The Role of EEG in Epilepsy

EEG is the most specific method to define epileptogenic cortex. Since Gibbs and colleagues discovered spike and wave discharges in epilepsy in 1935, the EEG has been used to diagnose and manage epilepsy. While advances in neurological knowledge and neurodiagnostic testing have vastly improved the diagnostic process, EEG continues to play a pivotal role.<sup>16, 21</sup> EEG reveals characteristic findings in several epilepsy syndromes, as well as assisting with classification of seizure (either focal or generalised).

Emerging evidence suggests that EEG may also provide useful prognostic information regarding seizure recurrence after a single unprovoked attack and following antiepileptic drug withdrawal. EEG video telemetry monitoring has an established role in the diagnosis of non epileptic pseudoseizure and localising the seizure focus for surgical purposes. EEG is reported to add value in the diagnosis of non-convulsive status epilepticus which may exhibit a wide range of clinical presentation ranging from minimal confusion to bizarre behavioural manifestations to psychosis and coma.

EEG has been reported to be useful in excluding forced normalisation, a phenomenon where a serial of EEG's were found to be normal and yet the patient known with epilepsy are well controlled on treatment and they still reports psychiatric symptoms.<sup>21</sup>

Many of the epilepsy syndromes are associated with specific EEG features, present in early life or childhood. The common EEG characteristic of many epileptic syndromes involves a pattern of epileptiform activity. Rarely epileptiform discharges are recorded in healthy, particularly young individuals. The epileptiform discharges are specific for seizure disorders but not sensitive for the diagnosis of epilepsy.

EEG has relatively low sensitivity in the diagnosis of epilepsy, ranging between 25% - 56%. Specificity is better but again variable at 78% -98%. Its sensitivity and specificity depends on several factors such as age and recording procedures, for example, sleep recordings and stimulation procedure (hyperventilation, photic stimulation).<sup>19</sup>

Interictal video/EEG recording is considered to be critical in localising the epileptogenic zone. A careful analysis of the first clinical signs and symptoms of a seizure and of the evolution of the seizure and of the evolution of the seizure symptomatology can provide important localising clues. However the interictal spike remains the hallmark of epilepsy, vividly demonstrating cortical hyper excitability and hypersynchrony, and is present in normal interictal state. The presence of interictal spike helps to confirm a clinical diagnosis of epilepsy, aids in defining the epilepsy syndrome.

It is crucial to recognise that an abnormal EEG demonstrating interictal epileptiform discharge does not in itself indicate that an individual has a seizure disorder, as interictal epileptiform discharge are seen in a small percentage of normal subjects who never develop epilepsy and interictal epileptiform discharge can be found amongst patients with psychiatric disorders which are not complicated by epilepsy. In some cases, where the EEG is normal it doesn't exclude epilepsy as around 10% of patients with epilepsy never show epileptiform discharges.<sup>3, 19</sup>

EEG is still a valuable test in the assessment of patients with epilepsy or seizure syndromes, especially where there is a strong suspicion of organic brain disorders or epilepsy. When evaluating patients for epilepsy, a single normal EEG is not sufficient evidence for ruling out a seizure disorder. It has been shown that serial EEG's, particularly if spaced over a year or longer yield more accurate results.

If the first EEG is normal it sometimes helps to obtain a second one after 12 hours of sleep deprivation, or EEG recording can be done with photic stimulation or hyperventilation techniques. One must remember that the EEG is merely a tool, and its usefulness depends largely upon the skill of individual who wields it. Like all diagnostic tests, it has significant limitations and cannot substitute for a careful history and exercise of a good judgement. Nonetheless in skilled hands, it provides unique and vital information in many patients and enhances our understanding of their condition.

EEG video telemetry monitoring has an established role in the diagnosis of non epileptic pseudo seizure and localising the seizure focus for epilepsy surgery. EEG is reported to add value in the diagnostic of non convulsive status epileptics, which may exhibit a wide range of clinical presentation ranging minimal confusion to bizarre behavioural manifestation to psychosis and coma. This condition can be easily missed clinically; the diagnosis can only be picked through EEG investigation. EEG has been reported to be useful in excluding forced normalisation a phenomenon where a serial of EEG's done and found to be normal and no clinical activity is reported and epileptic patient is reporting psychiatric symptoms.<sup>8, 19</sup>

## 2.4 The Timing of an EEG

Due to the random and often unpredictable nature of epileptic seizure, the EEG is typically recorded between seizures and conclusions are based on the EEG findings in between seizures. The finding of epileptiform activity spikes, spike-waves, sharp waves in the EEG must reinforce the diagnosis of a seizure though the extent remains uncertain as some patients with this epileptiform discharges never have seizures, there is

insufficient high quality evidence that interictal EEG within this period increase likelihood of epileptiform discharge.<sup>20,21</sup>

## 2.5 Limitations of EEG in psychiatric practice

Despite the known limitations of EEG, there are multiple factors which will interfere with the outcome of EEG among psychiatric patients. EEG abnormalities seem to occur more frequently in patients on psychotropic drugs, more significantly with haloperidol, clozapine and olanzepine.<sup>11</sup> Anxiety or hyperventilation attacks can be mistaken for seizures. Many of the so called pseudo seizures are actually hyperventilation attacks. It has been reported in literature, that relatives of individual who have epilepsy may have inherited genetic EEG pattern and not have any epileptic seizures.

This information raises the question of clinical importance of interictal epileptiform discharge. It has been reported that the prevalence of interictal changes is increased in patients with psychogenic non epileptic seizures, but the diagnostic significance of those changes has never been described. How often and in which circumstances do non epileptic subjects show interictal epileptiform discharge in EEG.<sup>15,18,21</sup>

Among healthy adults without seizures history, the frequency of epileptiform discharge is approximately 0.5%. Practically none of these healthy subjects subsequently develop seizures. Interictal epileptiform discharge occur slightly more often (10% - 30%) in subjects with a head injury, stroke, tumours craniotomy, infection, cerebral palsy or during migraine. In children without prior history of seizures, epileptiform discharge may occur in up to 5%, and this may be as high as 8% if adequate sleep EEG is recorded.<sup>8</sup>

Epileptiform activity found in the EEG is specific of epilepsy, but not sensitive for diagnosis of epilepsy as the cause of transient loss of consciousness or other paroxysmal event that is clinically likely to be epilepsy. EEG has relatively low sensitivity in epilepsy ranging between 25% - 56%. Misinterpretation of epileptiform discharge among non epileptogenic phenomenon or over interpretation of non specific EEG abnormalities are common reasons for over diagnosis of epilepsy.<sup>19</sup>

# CHAPTER 3

## METHODOLOGY

### 3.1 Aims and Objectives

#### Aims

To determine the diagnostic outcome of EEG performed on adult psychiatric patients at Dr George Mukhari Hospital between a period of January 2006 and December 2008

#### Objectives

This study took place at Dr George Mukhari, Garankuwa hospital. The main objectives of the study are:-

1. To determine the frequency of EEG abnormalities among adult psychiatric patients referred for Electroencephalography evaluation.
2. To determine the indications of requested EEG by the general adult psychiatry unit at Dr George Mukhari hospital.
3. To establish the psychiatric diagnostic profile of adult patients, who were sent for EEG test during a period of January 2006 and December 2008
4. To describe the pharmacological interventions implemented prior to performance of EEG on patients
5. To determine the frequency of epilepsy amongst abnormal EEG reported

### 3.2 Study Design

This is a retrospective study conducted based on EEG reports of all adult psychiatric patients (both male and female) diagnosed with a mental disorder according to the Diagnostic and statistical manual of mental disorders (DSM IV- TR) on which an EEG was performed at neurology clinic at Dr George Mukhari hospital, in the 36 month period of January 2006 to December 2008

### **3.3 Study Population**

The study population includes all adults (>18 years) psychiatric patients, both male and female, both inpatients and outpatients seen at Dr George Mukhari, Garankuwa hospital psychiatric unit and diagnosed with a mental disorder according to DSM IV –TR. The sample size of 111 psychiatric patients, were send for an EEG test at Dr George Mukhari, Garankuwa hospital neurology clinic, in a 36 months period of January 2006 to December 2008, only 111 adult EEG reports were retrieved, with exclusion of children from the study.

### **3.4 Sample**

The sample size comprised of 111 adult psychiatric patients seen at Dr George Mukhari hospital, psychiatric unit, diagnosed with a mental disorder according to Diagnostic and Statistical Manual of mental disorders (DSM IV-TR) and EEG was performed at neurology clinic, between a period of January 2006 and December 2008

### **3.5 Data Collection**

EEG request form, in duplicate, was the tool used by referring psychiatrist to request for an EEG for each patient. The EEG request forms were sent to the neurology clinic at DGMH, where the patients were assigned an appointment date, and EEG were performed on individual patients on the assigned date by a trained EEG personnel. The EEG reports ,were interpreted by a qualified neurologist, and the results were documented on the same EEG request form and the copy of all results were filed at neurology clinic, and the other copies were filed in the patients psychiatric hospital file.

The researcher will attempt to analyse information using a duplicate of EEG request form, to obtain information which will then be transferred to a data collection sheet. See the attached copy of data collection sheet at the back of the dissertation.

The data collection sheet” comprise of the following sections as outlined below:

- Demographic data: which includes parameters of age and gender
- Reason of referral: To establish why the patient was referred
- Past psychiatric history: To ascertain whether the patient was known to have psychiatric problem before coming to hospital
- Current psychiatric diagnosis: This is a diagnosis made according to the DSM IV-TR (diagnostic and statistical manual of mental disorders-4<sup>th</sup> edition text revision).
- The present medication history: To ascertain the type of medication the patient received prior to EEG test.
- Outcome of the EEG test: To establish the results of the EEG test, whether the EEG was normal or abnormal.
- Clinical diagnosis of EEG test: To ascertain whether an abnormal EEG supported the diagnosis of epilepsy.

### 3.6 Data Analysis

All data collected in this study was captured in an electronic database. Data capturing was verified and validity checks were be performed. Demographic and clinical data were summarised by descriptive statistics. Categorical variables was summarised by frequency counts and percentages.

Using the EEG request form, EEG outcome of each patient was categorized as abnormal, normal or unspecified .Simultaneously the clinical diagnosis of epilepsy amongst each patient was recorded as yes or no.

The statistical analysis comprised of the construction of a 2x2 table which summarises the outcome of EEG and clinical diagnosis of the sample.

The type of analysis that was performed is illustrated by way of example in the following table.

Clinical diagnosis of Epilepsy			Total
EEG outcome	Yes	No	
Abnormal	80	10	90
Normal or Unspecified	70	40	110
<b>Total</b>	150	50	200

From the example in the table it appears that from the 90 patients with EEG, 80 patients were clinically diagnosed with epilepsy. This percentage can be qualified by a 95% Confidence Interval.

Out of the 110 patients with normal/ unspecified EEG outcomes, 70 (63.6%) were also clinically diagnosed with epilepsy. This percentage can also be qualified by a 95% Confidence Interval.

The association between EEG outcome and clinical diagnosis was tested for significance by the Fisher Exact test. All statistical procedures were performed on SAS release 9.1.3, running under Microsoft Vista business for a personal computer statistical tests is two-sided and values  $\leq 0.05$  was considered significant.

### **3.7 Reliability**

The study is reliable because it can be re-conducted after the period of the study, using the same subject's EEG report under the same conditions in the same institution and the results will be similar. Information on the EEG request form is assumed to be accurate as possible as these are legal documents.

### **3.8 Validity**

The study is valid because all the EEG's requested were interpreted by qualified registered neurologist at Dr George Mukhari hospital. The records of the original EEG tracing performed, are filed at the neurology clinic which could be used currently and in the future to validate information on the EEG results. Psychiatric

diagnoses are further standardised by the DSM-IV-TR criteria for psychiatric diagnosis which is internationally recognized. The above measure ensured that validity of the study is maintained.

### **3.9 Bias**

Selection bias were avoided, because all patients referred from psychiatry unit for EEG test during the study period were included in the study, except patients below the age of 18 years.

### **3.10 Ethical Consideration**

- Permission to conduct the study was obtained from the Medical Research Ethics and Publications Committee of faculty of health sciences (University of Limpopo).The permission was obtained before the commencement of the study.
- The information obtained from the patients EEG report was treated with highest level of confidentiality and were used solely for the purpose of the study.
- Patient confidentiality was maintained because information were recorded on the data collection sheet were patient names were omitted.
- Each data collection sheet was given an identification number that corresponds with the patient's name. Patient's name and hospital number did not appear on the data collection sheet so as to maintain anonymity.

### **3.11 Budget**

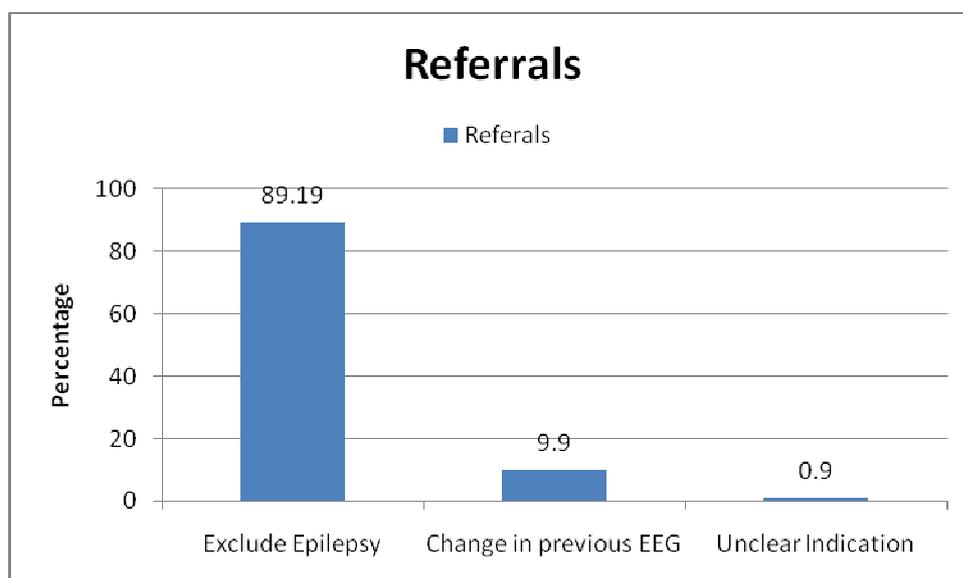
The study is self sponsored .The time frame of the study is 9 months. This involved, data collection (01<sup>st</sup> -28<sup>th</sup> February 2010), data analysis (01<sup>st</sup> -30<sup>t</sup>April 2010) and write up of a dissertation (01<sup>st</sup> June – 31<sup>st</sup> October 2010).

## CHAPTER 4

### 4.0 RESULTS

#### 4.1 REASON OF REFFERAL

This study was conducted using data from the patient's EEG request form, from neurology clinic at DGMH and also from the patient's medical files at psychiatric outpatient clinic at DGMH. There were a total number of 111 adult EEG request forms, analysed during the study period. Out of a total number of 111 patients were referred for EEG test, 99 patients (89.19%) were referred to exclude a diagnosis of epilepsy; only 11 patients (9.9%) were referred to exclude any change from previous EEG done in the past. Only 1 patient (0.9%) the indication for EEG request was not clear. Figure 1 and Table 1 below list the advanced reasons for EEG request in 111 patients.



Reason for EEG request (percent of subjects)

Figure 1. Reason for the EEG request amongst 111 adult Psychiatric patients

REASON FOR EEG REFERRAL	FREQUENCY	PERCENTAGE
Exclude Epilepsy	99	89.9%
Change in Previous EEG Results	11	9.9%
Unknown Reason	1	0.9%

**TABLE 1 Reasons for EEG Referral amongst 111 adult Psychiatric patients**

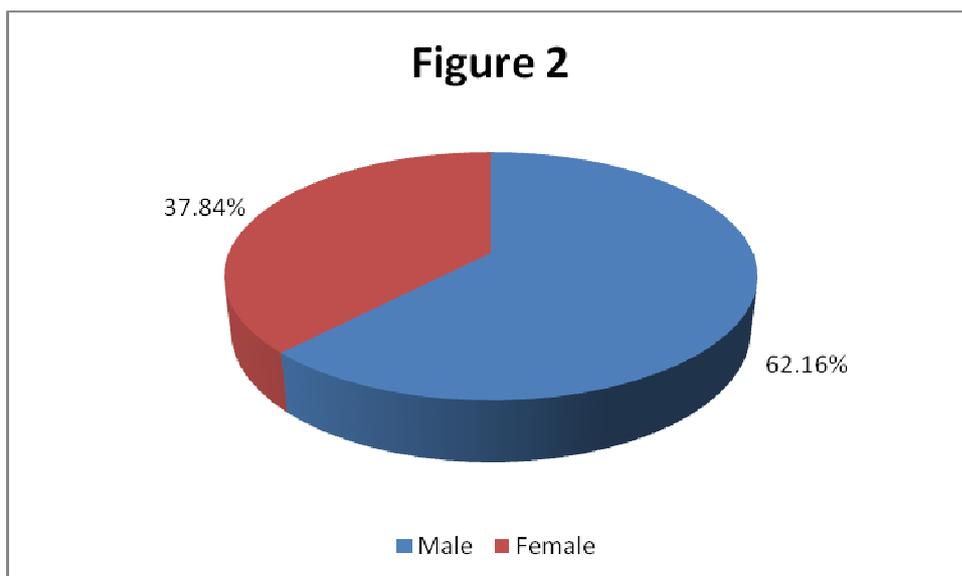
## **4.2 Demographic Profile of Study Population**

Further analysis of the EEG request form was carried out to determine distribution of patient according to the gender, age, diagnostic profile and treatment profile.

Table 2 presents the gender distribution of all 111 adult psychiatric patients. A total number of 69 patients (62.1%) were males and 42 patients (37.84%) were females.

GENDER	FREQUENCY	PERCENTAGE
MALE	69	62.16%
FEMALE	42	37.84%

**TABLE 2: DISTRIBUTION OF PATIENTS BY GENDER**



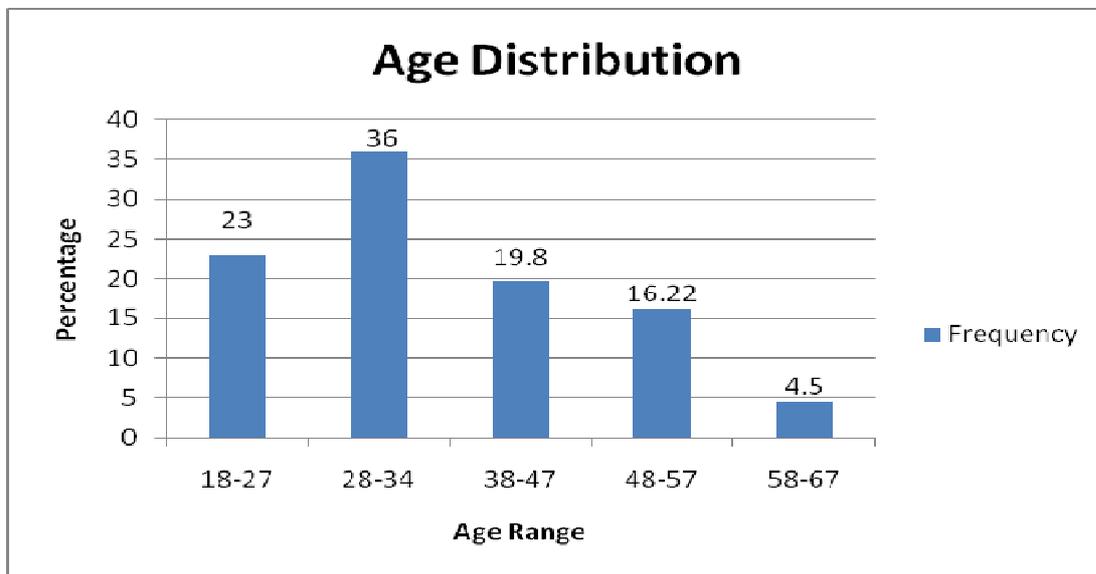
**Figure 2. Distribution of patients by gender**

### 4.3 Age Characteristics

This table presents the age distribution of both adult male and female patients, with age ranging from 18 years to 67 years. **Majority of the sample population were found amongst the 28 – 37 year age category accounting for 36 % of the sample population**

AGE RANGE	FREQUENCY	PERCENTAGE
18 -27	26	23%
28 – 37	40	36%
38 – 47	22	19.8%
48 – 57	18	16.22%
58 – 67	5	4.5%

**TABLE 3: AGE CHARACTERISTICS OF 111 ADULT PSYCHIATRIC PATIENTS**



**Figure 3 .Distribution of patients by age Categories**

#### **4.4 Distribution of Patients by the Diagnosis made prior to the EEG test**

Further analysis of the patient medical records from psychiatric clinic was carried out to determine the psychiatric diagnosis made prior to EEG request.

PSYCHIATRIC DIAGNOSIS	FREQUENCY	PERCENTAGE	NORMAL EEG	ABNORMAL EEG
Psychotic disorder due to GMC (epilepsy)	73	65.77%	52.25%	12.6%
Schizophrenia	18	16.22%	10.82%	5.4%
Mood Disorder due to GMC(epilepsy)	14	12.61%	9.01%	3.6%
Major depressive disorder	5	4.5%	2.7%	1.8%
Bipolar Mood disorder	1	0.9%	0%	0.9%

**TABLE 4: Distribution of patients according to the diagnosis made prior to the requested EEG test**

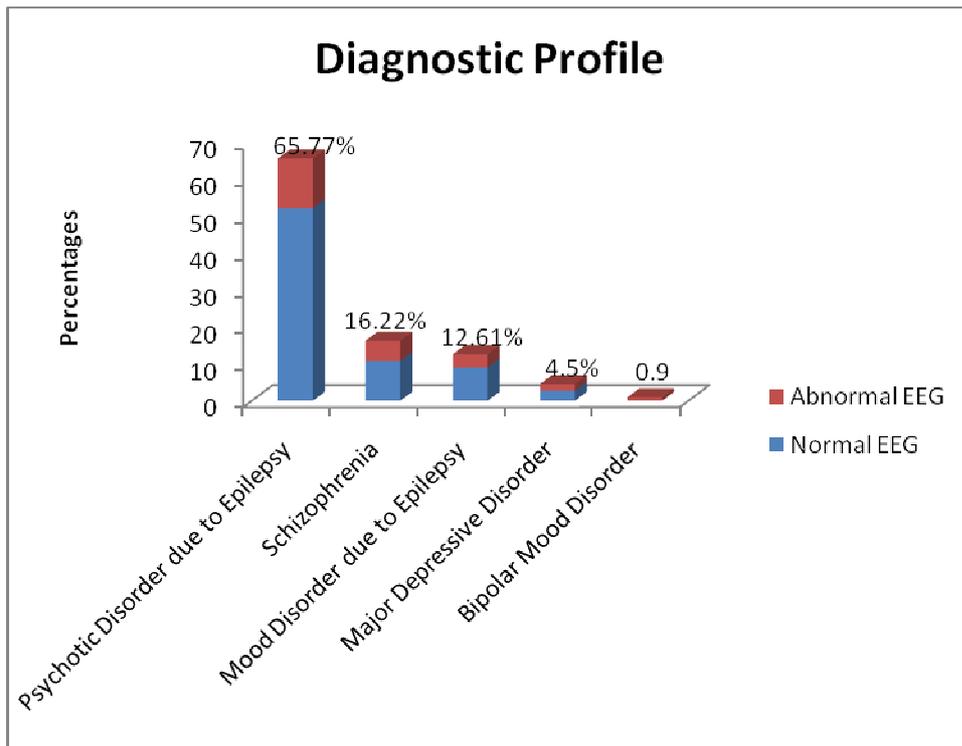
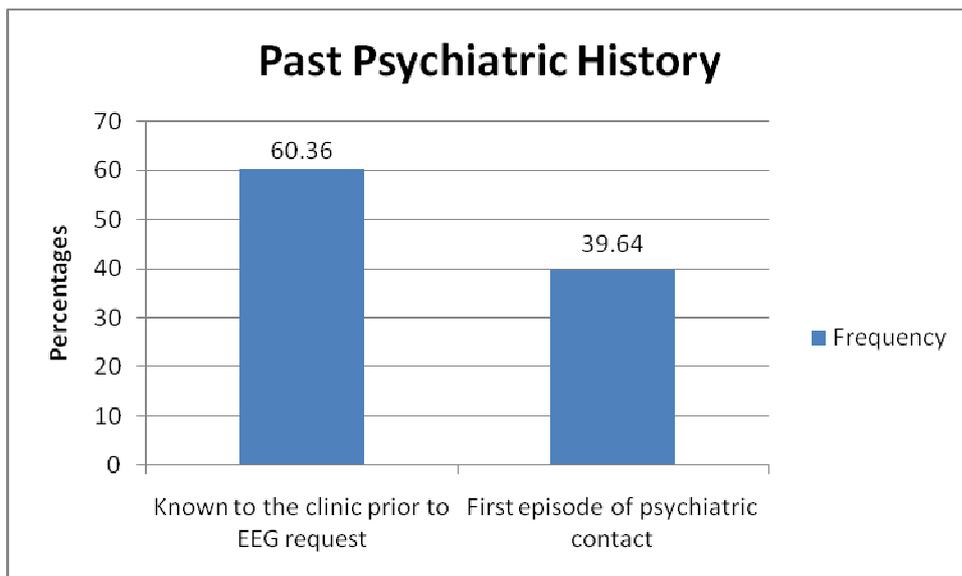


Figure 4: Distribution of patients according to their psychiatric diagnosis

#### 4.5 Distribution of Patients based on the onset of the psychiatric presentation

Figure 5 presents distribution of patients, according to the onset of the psychiatric history of all patients who were send for EEG test. About 44 patients (39.64%) were presenting for the first time at DGMH psychiatric unit, and 67 patients (60.36%) were already known to the psychiatric clinic. **Majority of the sample population were already known to the psychiatric clinic at DGMH prior to being sent for EEG request during the study period.**



**Figure 5: Past psychiatric history of patients**

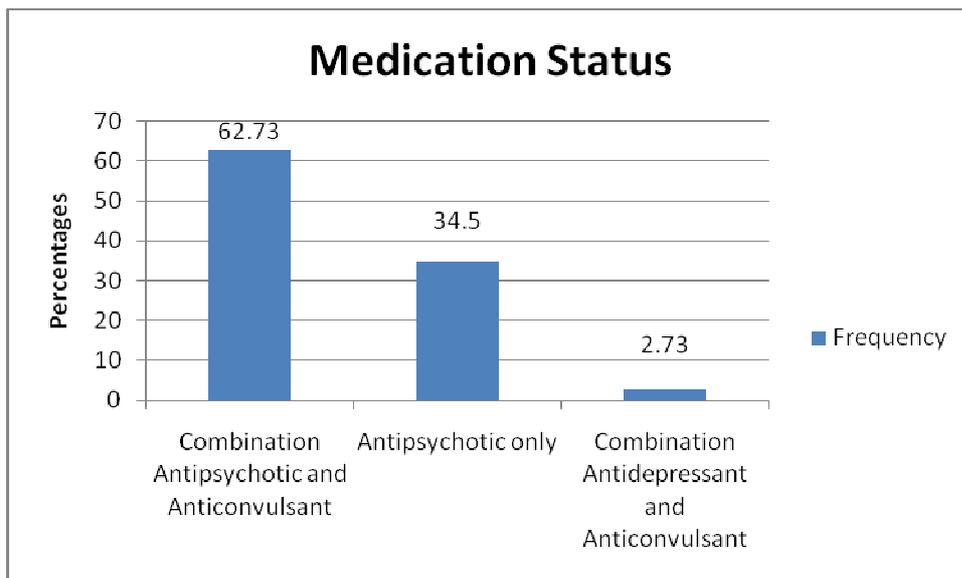
#### **4.6 Medication Status**

***Majority of the patients (62.73%) 69 patients, were on a combination treatment of antipsychotic drugs and anticonvulsant treatment prior to the requested EEG test, and a total of 38 patients (34.55%) were on treatment of monotherapy of antipsychotic medication, prior to EEG test. Only 3 patients (2.73%) were on a combination of anticonvulsant and medication. None of these patients were on anticonvulsant only prior to EEG request and none of the patients were not on treatment prior to EEG test. Refer to figure 6***

MEDICATION	FREQUENCY	PERCENTAGE
Antipsychotic only	38	34.55%
Combination Antipsychotic and Anticonvulsant	69	62.73%
Anti-depressant and Anticonvulsant	3	2.73%
Anticonvulsant Only	0	0%

**TABLE 5: Distribution of patients according to the medication they received prior to EEG test**

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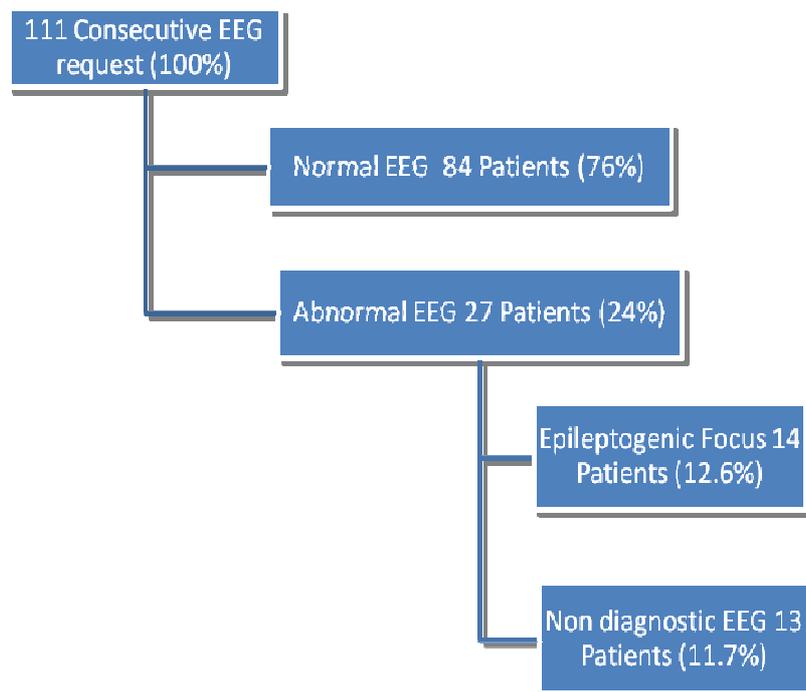


**Figure 6: Medication profile of patients**

## 4.7 Diagnostic Yield of 111 EEG Referrals from Psychiatry

The EEG results were classified blindly according to the details on the request form. 76% of EEG reports were normal and 24% of EEG reports were abnormal. The abnormal EEG reports were subdivided into two categories namely; the non diagnostic EEG reports (suggesting a non specific EEG pattern), and a clear Epileptogenic focus on the EEG report. A total number of 13 patient's EEG reports (11.7%) demonstrated non diagnostic EEG findings such as diffuse slowing, asymmetry and mild slowing, and only 14 patients EEG reports (12.6%) demonstrated a clear Epileptogenic focus.

As demonstrated in figure 7, majority of patients' EEG reports were found to be normal, including those patients who were highly suspected of having a diagnosis of epilepsy. Only 12.6% of the entire patients sample demonstrated, a clear Epileptogenic focus on the EEG results .Amongst all the patients who demonstrated Epileptogenic focus on EEG results, none were not suspected of having a diagnosis of epilepsy prior to the EEG test.



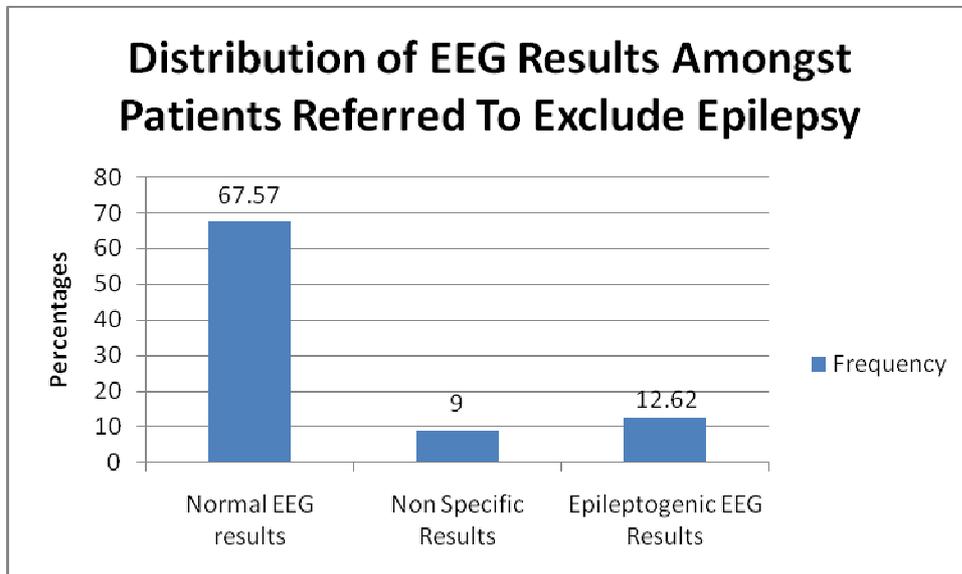
**Figure 7: Distribution of patients according to the EEG patterns**

#### 4.8 DISTRIBUTION OF PATIENTS ACCORDING TO THE EEG PATTERN

Out of total number of 111 EEG request forms, 99 of the patients (67.57%) who were referred to exclude or confirm the diagnosis of epilepsy, only 14 patients (12.62%) demonstrated a clear Epileptogenic EEG results and 9% had no specific EEG findings. The total of 75 patients (67.57%), demonstrated normal EEG pattern despite a high index of suspicion of a diagnosis of epilepsy.

REASON OF REFERRAL	NORMAL EEG		NON SPECIFIC ABNORMAL EEG		EPILEPTOGENIC EEG RESULTS	
	FREQUENCY	PERCENTAGE	FREQUENCY	PERCENTAGE	FREQUENCY	PERCENTAGE
To exclude epilepsy 99	75 pt	67.57%	10 pt	9%	14 pt	12.62%
Change from previous EEG 11	9 pt	8.1%	2	1.8%	0 pt	0%
Unspecified Reason	0 pt	0%	1	0.9%	0 pt	0%
TOTAL	84 pt	76%	13 pt	11.7 %	14 pt	12.62 %

**TABLE 6: EEG PATTERN OF PATIENTS ACCORDING TO REASON OF REFERRAL**



**FIGURE 8: EEG PATTERN OF PATIENTS REFERRED FOR EXCLUSION OF EPILEPSY**

# CHAPTER 5

## DISCUSSIONS

### 5.1 Reason of EEG Referral

An overwhelming majority of the patients (89.19%) were referred for EEG evaluation mainly to exclude epilepsy as the aetiological factor to the presenting psychiatric symptoms. As strongly suggested by numerous studies and the work of John Stone et al, it is demonstrated that the most frequent reason for EEG request amongst psychiatric patients in their study was to exclude epilepsy. This study has shown that EEG is still a popular investigation in patients with psychiatric disorders. Although progress continues to be made in the use of sophisticated EEG techniques such as quantitative EEG in research of psychiatric disorders. Conventional EEG remains to be the available technique used by most South African hospitals in evaluating the patients for evidence of epilepsy. <sup>1,3</sup>

### 5.2 Diagnostic outcome of EEG amongst psychiatric patients

From a summary of the available study results, examining the distribution of EEG pattern in all 111 psychiatric patients, it is clear that the diagnosis of epilepsy was confirmed by an Epileptogenic EEG results, in a very small proportion of patients (12.6%). However most of the international literature on the prevalence of EEG abnormalities in adult psychiatric patients, reported very low yield. Comparable prevalence figures between two south African studies, on the usefulness of EEG in psychiatry exists (44%), however in this study only 12.6% received a diagnosis of epilepsy based on EEG findings.

During the 60 years in which the EEG has been studied, it has become evident that EEG abnormalities do exist in psychiatric patients despite the presence of a diagnosis of epilepsy. The presence of abnormal EEG findings and its relevance in non epileptic psychiatric patients, adds to the controversy that exist regarding the use of EEG amongst psychiatric patients. In this study about 11, 7 % of patients demonstrated non specific EEG patterns of various forms. During the last six decades there has been a large amount of international literature on electroencephalographic abnormalities in a high proportion of psychiatric patients. The publishers work by Kennard reviewed two decades of pioneering literature affirming the positive correlations of abnormal EEG in psychological disorders.<sup>17</sup>

About two decades earlier, the work of Bridgers again confirmed the occurrence of epileptiform dysrhythmic abnormalities in population of non-epileptic hospitalised psychiatric patients. The EEG findings were found to correlate with conditions such as anorexia nervosa, depression, mania, personality disorders, suicidal patients without depression, schizophrenia, non psychotic explosive behaviour and the effect of psychotropic medication. The epileptiform EEG abnormalities were documented in 2.6% of patients and consisted of photo paroxysmal responses, focal temporal complexes, generalised spike wave or polyspike wave discharge and focal complexes.<sup>4, 3</sup> In this study we did not find the EEG epileptiform dysrhythmia amongst non-epileptic psychiatric population group, however it was determined that this group demonstrated non specific EEG abnormalities and may reflect underlying cerebral dysfunction without necessarily indicating and increased liability seizures.

A study done by Houston et al found that, although 31% of 698 psychiatric inpatient EEG were found to be abnormal, only 1, 7% led to change in the diagnosis towards support of epilepsy. In other studies their finding reported lower prevalence of a clear epileptiform EEG results among psychiatric, <1% which is similar to the prevalence rate of epileptiform EEG findings among normal subjects (0, 5% – 2%)<sup>8</sup>.

From our search majority of patients who were suspected of a diagnosis of epilepsy, demonstrated a normal EEG pattern, of which is not an exclusion of the diagnosis of epilepsy. EEG still remains an important additional tool in the diagnosis of epilepsy, however it has a lot limitations, and it is influenced by a variety of factors including the timing of EEG, medication and others.

### **5.3 Psychiatric Diagnostic Profile of patients prior to EEG test**

In this study adult patients whom the psychiatrist made a diagnosis of epilepsy prior to EEG evaluation test, presented with a variety of psychiatric diagnosis, ranging from a diagnosis of a psychotic disorder due to epilepsy, schizophrenia, bipolar mood disorder, major depressive disorder and mood disorder due to epilepsy.

Other studies reported the presence of other psychiatric diagnosis amongst their study population e.g. anorexia nervosa, personality disorders, psychopaths which could have influenced the EEG

outcome of their studies. In this study it is clear that the psychiatric presentation amongst the 111 psychiatric patients in our study is limited to either a mood disorder or psychotic disorder. The reason for this finding could be based on the common pattern of psychiatric presentation frequently seen amongst psychiatric patients at DGMH, and the other supporting reason could be that, patients with epilepsy tend to present more frequently with mood disorders and schizophrenia like psychosis, as evidenced by most literature. However the chosen sample population doesn't represent the entire population of adult epileptic patients seen at DGMH psychiatry Unit.

#### **5.4 Gender and EEG Outcome**

From the above data, it is clear that there were more male population in the study than women population. Something of note in this study is that there wasn't significant difference between males and females in terms of the abnormal EEG findings reported. Another important point of note is that, out of a total of 69 male patients who underwent EEG during the study period, only 15 male patients had abnormal EEG findings and amongst female population, only 12 female patients out of a total number of 42 female patients demonstrated abnormal EEG findings. From these findings, it is clear that gender could not be used as a predictive factor for EEG outcome. There is no literature demonstrating an association between gender and EEG outcome.

#### **5.5 Age and EEG Outcome**

A number of factors influence whether patients with epilepsy will show interictal epileptiform dysrhythm in the EEG. Children were reported to be more likely than adults to present with IED (inter ictal epileptiform dysrhythmia). From the study it is not clear which age group category demonstrated highest prevalence of IED. Majority of the sample population belonged to the 28 – 37 year group category, (36% of patients)

## 5.6 Limitations of the Study

It is important to highlight limitations of this study. Firstly this is a retrospective study; this study is also hampered by lack of clinical follow up. It is not known whether the EEG abnormalities that were picked up, turned out to be clinically relevant in terms of affecting the change of the diagnosis and treatment thereafter.

## CONCLUSION AND RECOMMENDATIONS

Diagnosis of epilepsy based on discovery of epileptiform abnormalities on EEG report should be approached with caution since other psychiatric diagnosis with no epilepsy could present with epileptiform EEG findings. Epilepsy remains foremost a clinical diagnosis made on the basis of history taken from the patient and collateral information. The presence of false negative rate of interictal EEG findings found amongst psychiatric disorders and the effect of antipsychotic treatment could be heightened. So ideally we need a South African study that is prospective in design and includes consecutive adult psychiatric inpatients. It would be useful to determine whether specific features on history or examination are predictive of an EEG abnormalities that may lead to a change in patients diagnosis or management .Each patient should be carefully assessed for any clinical evidence of organic disease prior to being referred for EEG, preferably by more than one psychiatrist.EEG interpretation should be performed by more than one neurologist, blinded to the patient's clinical state.

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## DATA COLLECTION SHEET

Demographic Data

Patient No: \_\_\_\_\_

<b>GENDER</b>	
A: Male	
B: Female	

<b>AGE</b>			
	<b>Male</b>	<b>Female</b>	<b>Total number</b>
A: 18 - 25			
B: 26 - 35			
C: 36 - 45			
D: 46 - 55			
E: 56 - 65			
F: > 66			

<b>REASON OF REFERRAL</b>	
A: Rule out epilepsy	
B: Rule out organic brain disease	
C: Localization of epilepsy	
D: Change in previous EEG	

<b>PAST PSYCHIATRIC HISTORY</b>	
A: First episode	
B: Known psychiatric patient	

<b>CURRENT PSYCHIATRIC DIAGNOSIS</b>

<b>A:Schizophrenia</b>  <b>B:Bipolar mood disorder</b>  <b>C:Psychotic disorder due to general medical condition(EPILEPSY,HIV,HEAD INJURY)</b>  <b>D:Mood disorder due to general medical condition</b>  <b>E: Substance induced mood disorder</b>  <b>F:Substance induced psychotic disorder</b>  <b>G: Major depressive disorder</b>	
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<b>BIOLOGICAL TREATMENT</b>	
A: Antipsychotics	
B: Anti epileptic	
C: Anti manic	
D: Benzodiazepine	
E: Anxiolytics	

<b>DIAGNOSTIC YIELD OF REQUESTED EEG</b>	
A: Normal	
B: Abnormal -Non-diagnostic EEG	
-diffuse slowing	
-diffuse excess activity	
-Temporal lobe dysfunction	
D:Abnormal- Clear epileptogenic focus	