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Biomedical Factors in Pregnancy Attributed with Schizophrenia Disorder, A Case of Rwinkwavu District Hospital, Rwanda

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Abstract:- This study investigates the biomedical factors during pregnancy attributed to the development of schizophrenia at Rwinkwavu District Hospital, Rwanda. Utilizing a descriptive cross-sectional design, the research aimed to identify potential pregnancy-related factors influencing the onset of schizophrenia from June 2023 to June 2024. The sample consisted of 312 patients diagnosed with mental disorders, focusing on those with schizophrenia. Data collection involved reviewing patient files, registers, and electronic medical records to capture demographic details, genetic predispositions, and pregnancy complications. Quantitative data analysis was performed using SPSS version 27, employing both descriptive and inferential statistics to assess associations between identified biomedical factors and schizophrenia. Additionally, qualitative data from Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs) provided deeper insights into the influence of maternal health, nutritional deficiencies, and prenatal care on the risk of developing schizophrenia. The results highlighted a significant correlation between genetic predispositions and pregnancy-related complications with increased schizophrenia risk. Ethical considerations included informed consent, confidentiality, and approval from the relevant ethics committees (Mount Kenya University) school of post graduate and Rwinkwavu Hospital Research commute. This study underscores the importance of addressing prenatal care and genetic counseling to mitigate the risks associated with schizophrenia development during pregnancy.

Keywords:- *Biomedical Factors, Pregnancy, Disorders, Genetic Predisposition, Nutrition.*

I. INTRODUCTION

Schizophrenia is a chronic mental disorder characterized by disturbances in thought, perception, and behavior. It often manifests in late adolescence or early adulthood, significantly affecting the individual's quality of life and societal functioning (McGrath et al., 2020). While the etiology of schizophrenia is multifactorial, encompassing genetic, environmental, and neurodevelopmental factors, emerging research has focused on understanding how prenatal and pregnancy-related factors contribute to its onset (Howes & Kapur, 2015). Pregnancy is a critical period during which both genetic predispositions and environmental exposures can influence fetal brain development, potentially increasing the risk of schizophrenia in the offspring (Owen et al., 2016). Previous studies have indicated that factors such as maternal infections, malnutrition, and stress during pregnancy may lead to neurodevelopmental abnormalities, which are associated with a higher risk of schizophrenia (Buka et al., 2019). Furthermore, genetic inheritance plays a crucial role; family history of mental disorders, particularly schizophrenia, increases the risk tenfold among first-degree relatives (Sullivan et al., 2023). This study seeks to assess the biomedical factors during pregnancy that may be associated with an increased risk of schizophrenia, utilizing a sample from Rwinkwavu District Hospital. By identifying specific prenatal influences, the research aims to inform targeted interventions and enhance preventative strategies, contributing to improved maternal and child mental health outcomes.

II. LITERATURE REVIEW

A. Theoretical Literature

- *Neurodevelopmental Model*

The neurodevelopmental model posits that schizophrenia arises from early brain developmental disturbances, long before clinical symptoms manifest. This model integrates the influence of genetic and environmental factors on brain development, suggesting that disruptions occurring in utero or early childhood can result in long-lasting changes that predispose individuals to schizophrenia (Owen et al., 2016). These disturbances may include prenatal exposure to infections, malnutrition, or maternal stress, leading to abnormalities in neural connectivity and brain structure.

Research highlights that structural abnormalities, such as reduced gray matter in the prefrontal cortex and hippocampus, are evident before the onset of psychotic symptoms, supporting the notion of a neurodevelopmental origin (McGrath et al., 2020). Additionally, early-life adversities and complications during birth, such as hypoxia,

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have been associated with increased risk, suggesting that these factors may contribute to altered brain maturation and synaptic pruning processes crucial for cognitive development (Buka et al., 2019). This model provides a framework for understanding why schizophrenia typically emerges in late adolescence or early adulthood, as this period involves significant synaptic reorganization and maturation.

➢ *Dopamine Dysregulation Model of Schizophrenia*

The dopamine dysregulation model suggests that imbalances in dopamine neurotransmission play a central role in the pathophysiology of schizophrenia. This model posits that hyperactivity of dopaminergic transmission, particularly in the mesolimbic pathway, leads to positive symptoms such as hallucinations and delusions (Howes & Kapur, 2015). Conversely, reduced dopaminergic activity in the prefrontal cortex is associated with negative symptoms, including diminished motivation and cognitive deficits. This model is supported by the efficacy of antipsychotic medications, which primarily block dopamine D2 receptors and reduce positive symptoms (Seeman, 2014). Neuroimaging studies have shown increased dopamine synthesis capacity and release in the striatum of individuals with schizophrenia, reinforcing the link between dopaminergic dysregulation and symptomatology (Howes et al., 2017). Despite its strengths, the model does not fully explain all aspects of schizophrenia, such as the cognitive and negative symptoms, leading to ongoing exploration of other neurotransmitter systems, including glutamate, as potential contributors.

B. Empirical Literature

➢ *Introduction to Biomedical Factors and Schizophrenia Disorder*

There are various factors contributing to schizophrenia, but biomedical factors are among those that highly to the development of schizophrenia. This part will evaluate the role of genetics in schizophrenia development and the rapid increase of its prevalence. We will also see different prenatal and nutritional deficiency factors contributing to schizophrenia disorder. Similar to other diseases, mental disorders can highly depend on genetic factors attributed factors. This means that families with individuals who have ever been with mental disabilities will have a high chance of affecting their offspring. This is because some mental disabilities components can be transferred in genes when a woman is pregnant. According to Sullivan, Kendler, and Neale (2023), genetics have a significant role in the risk fact of developing schizophrenia for individuals and generations. This is proven by the fact that families with first-degree relatives who are diagnosed positive for schizophrenia have a quick risk about tenfold. This study by Sullivan, Kindler, and Neale has also confirmed that schizophrenia heritability is around 80% which is a big percentage that might lead to different perspectives. This aspect is connected to traditional beliefs where people believe that genetic heritability is more demonic than the scientific truth. The Genetic inheritance of mental disorders is also proven by analysis of mental disabilities. This is because when a first-generational relative has been diagnosed with mental disabilities, it is more likely to affect the offspring due to gene transition in zygote formation, (Emma et al., 2016).

➢ *Biomedical Factors Attributed to Schizophrenia Disorder Related to Pregnancy*

Schizophrenia is a severe psychiatric disorder characterized by delusions, hallucinations, and cognitive impairments. The etiology of schizophrenia is multifactorial, involving genetic, neurochemical, structural, neurodevelopmental, and nutritional factors. This review focuses on key biomedical factors, emphasizing recent findings on the role of nutrition and a proposed model of schizophrenia.

- *Genetical Factors and Neuro-Imbalances*

Genetic predisposition is one of the strongest risk factors for schizophrenia. Twin studies estimate the heritability of schizophrenia to be around 80%, with the risk increasing significantly among first-degree relatives (Hilker et al., 2018). Numerous genes, including **COMT** (catechol-O-methyltransferase), **DISC1** (disrupted in schizophrenia 1), and **NRG1** (neuregulin 1), have been linked to the disorder. Genome-wide association studies (GWAS) have identified several loci associated with schizophrenia, highlighting its polygenic nature (Ripke et al., 2020). The **dopamine hypothesis** has been a central neurochemical theory of schizophrenia, suggesting that dysregulated dopamine transmission, especially in the mesolimbic pathway, is responsible for positive symptoms such as hallucinations and delusions (Howes & Kapur, 2015). Other neurotransmitters, including glutamate, have also been implicated. The **glutamate hypothesis** posits that hypoactivity of NMDA (N-methyl-D-aspartate) receptors contributes to both positive and negative symptoms of schizophrenia (Javitt & Zukin, 2017).

- *Structural Abnormalities and Nutritional Factors*

Neuroimaging studies consistently show structural brain abnormalities in patients with schizophrenia. Reductions in gray matter volume, particularly in the prefrontal cortex, hippocampus, and thalamus, have been frequently reported (Van Erp et al., 2018). These structural deficits correlate with impaired cognitive functions such as memory and executive functioning, central to schizophrenia's symptomatology. Emerging evidence suggests that nutrition may significantly influence the onset and progression of schizophrenia. Deficiencies in essential nutrients, such as omega-3 fatty acids, B vitamins (e.g., folate, B12), and vitamin D, have been linked to increased risk and severity of schizophrenia symptoms (Firth et al., 2020). Omega-3 fatty acids, which play a critical role in brain development and function, have been found to have protective effects against psychotic symptoms. Randomized controlled trials have shown that supplementation with omega-3s can reduce the risk of developing full-blown psychosis in high-risk individuals (Amminger et al., 2015).In addition, there is growing interest in the role of the gut-brain axis, which suggests that gut microbiota may influence brain function and mental health. An imbalance in gut microbiota, influenced by poor diet, can lead to systemic inflammation and affect neurotransmitter

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pathways, potentially contributing to schizophrenia pathogenesis (Severance et al., 2016).

For instance, a high intake of processed foods, sugars, and saturated fats has been associated with increased inflammatory markers, which are often elevated in schizophrenia patients (Marx et al., 2021).

III. METHODOLOGY

This study utilized a descriptive cross-sectional design to assess biomedical factors in pregnancy that may be attributed to schizophrenia among patients at Rwinkwavu District Hospital. The research focused on understanding the prevalence of schizophrenia specifically within the context of pregnancy-related biomedical factors, covering the period from June 2023 to June 2024.

➢ *Study Population and Sampling*

The target population included all mental health patients who visited the hospital during this timeframe, with particular attention to those diagnosed with schizophrenia. From this broader group, data were collected from a subset of 312 patients diagnosed with mental disorders, including schizophrenia, to evaluate potential biomedical pregnancy factors associated with the condition. The inclusion criteria ensured that pregnant patients and those with a history of pregnancy were part of the sample, facilitating a focused analysis of the research question.

➢ *Data Collection*

Data collection involved a comprehensive review of patient medical files, registers, and electronic medical records (EMRs) to identify instances of schizophrenia and document relevant biomedical factors during pregnancy. This process included details such as maternal health history, complications during pregnancy, prenatal care records, and any documented substance use during pregnancy. These variables were chosen based on existing literature linking pregnancy-related biomedical factors to the risk of developing schizophrenia. To complement the quantitative data, qualitative insights were gathered through Key Informant Interviews (KIIs) with healthcare providers and Focus Group Discussions (FGDs) with patients and caregivers. These qualitative methods aimed to provide a deeper understanding of the potential pregnancy-related biomedical risk factors and their perceived impact on the development of schizophrenia.

➢ *Data Analysis*

Quantitative data were analyzed using SPSS version 27. Descriptive statistics, such as frequencies and percentages, were used to summarize the prevalence of schizophrenia among the sample. Inferential statistics, including chi-square tests and logistic regression analysis, were applied to assess associations between pregnancy-related biomedical factors and the diagnosis of schizophrenia. The qualitative data from KIIs and FGDs were analyzed thematically, identifying common themes related to the perceptions and experiences of schizophrenia risk factors during pregnancy.

➢ *Ethical Considerations*

The study was approved by the Mount Kenya University School of Postgraduate Studies and received ethical clearance from the Rwinkwavu District Hospital Ethical Research Committee. Data collection was conducted following ethical guidelines, ensuring that participants provided informed consent. Confidentiality and privacy were rigorously maintained throughout the study, and all patient data were handled securely to protect sensitive information. This methodology ensured a comprehensive and ethical approach to investigating the potential biomedical factors during pregnancy that may contribute to the risk of developing schizophrenia, offering valuable insights into preventive and intervention strategies for this population.

IV. RESULTS

A. *Demographic Data of the Participants*

➢ *Participant's Gender Distribution*

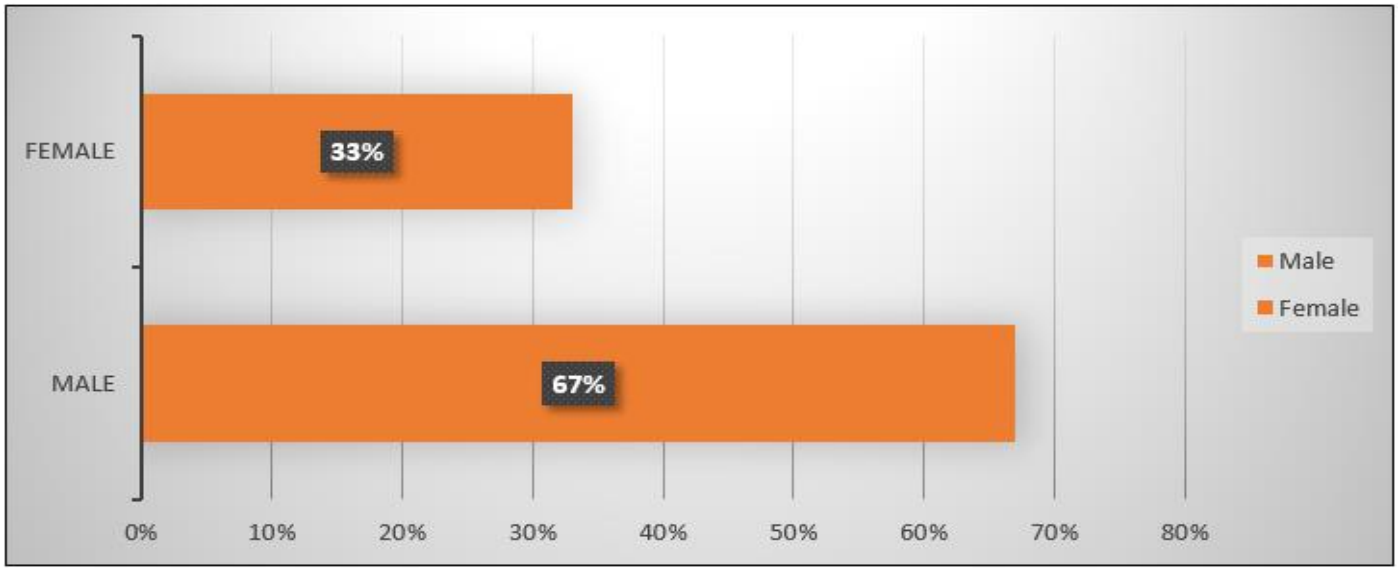

Fig 1 The Percentage of Male and Females Who Participated in the Study

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Figure 1 shows that 67% of participants in this study were males while the rest of 33% were males and this indicates that males are more attributed to schizophrenia disorder since the sampling was random.

➢ *The Status of Admission*

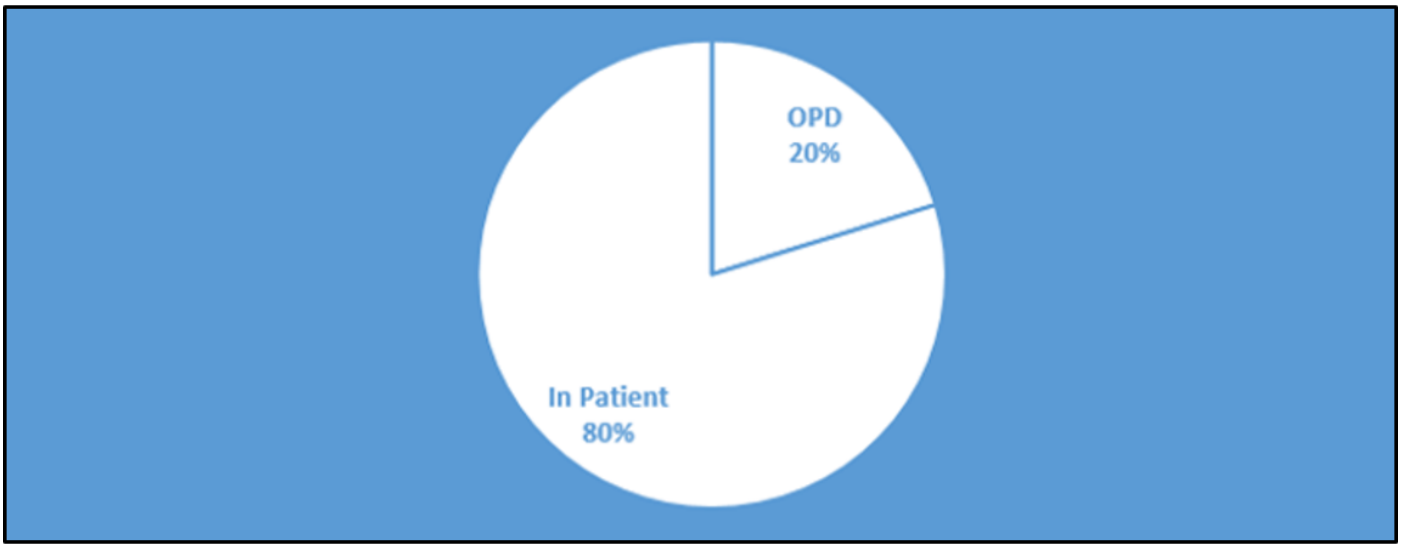

Fig 2 Demonstrates the Number of Outpatient and Inpatient Patients

Most patients were admitted to inpatient care (79.8%), while 20.2% were managed as outpatients, highlighting the severe nature of the cases seen, requiring intensive management and care.

B. Biomedical Factors in Pregnancy Attributed to Schizophrenia Disorder

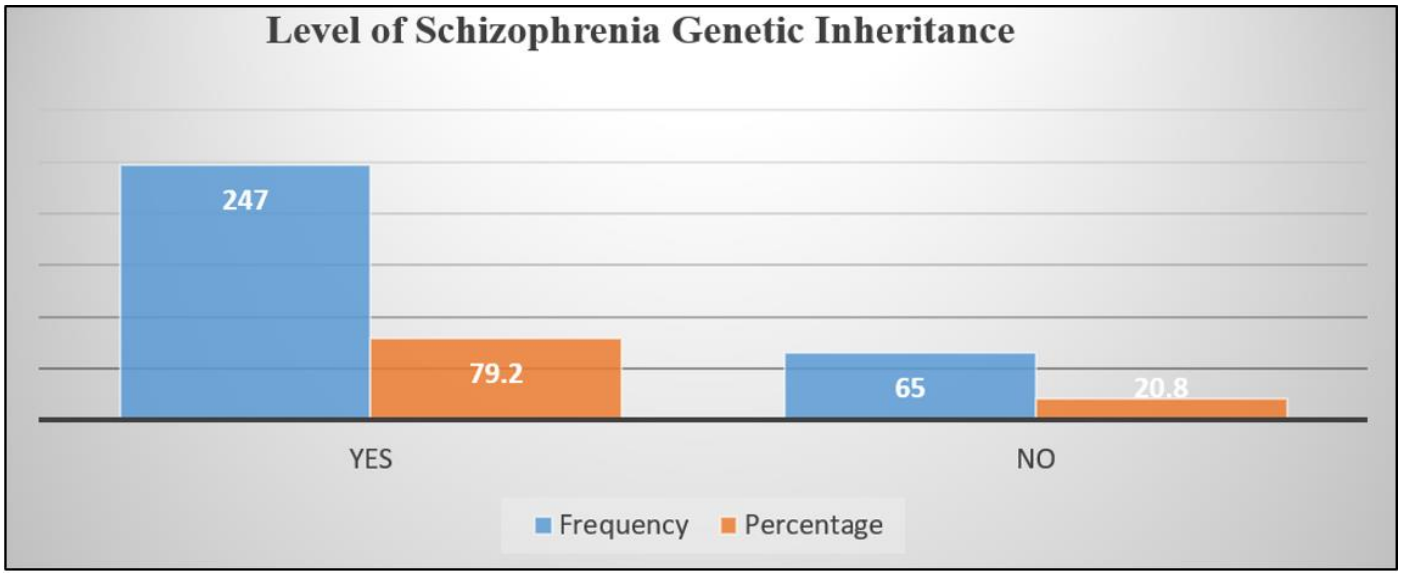

Fig 3 Demonstrates the Role of Genetic Inheritance in the Increased Schizophrenia Disorder

A significant majority 79.2%(247)of patients had a family history of mental disorders, suggesting genetic predispositions and the importance of understanding familial risk factors in managing schizophrenia. The study demonstrated that birth complications were noted in 67.9(212)% of the reviewed records, highlighting the impact of prenatal and perinatal factors in the onset of schizophrenia. The study also opined, that 66.3(207)% of patients had a genetic predisposition, emphasizing the role of heredity in schizophrenia. Understanding these patterns is crucial for early intervention and prevention strategies.

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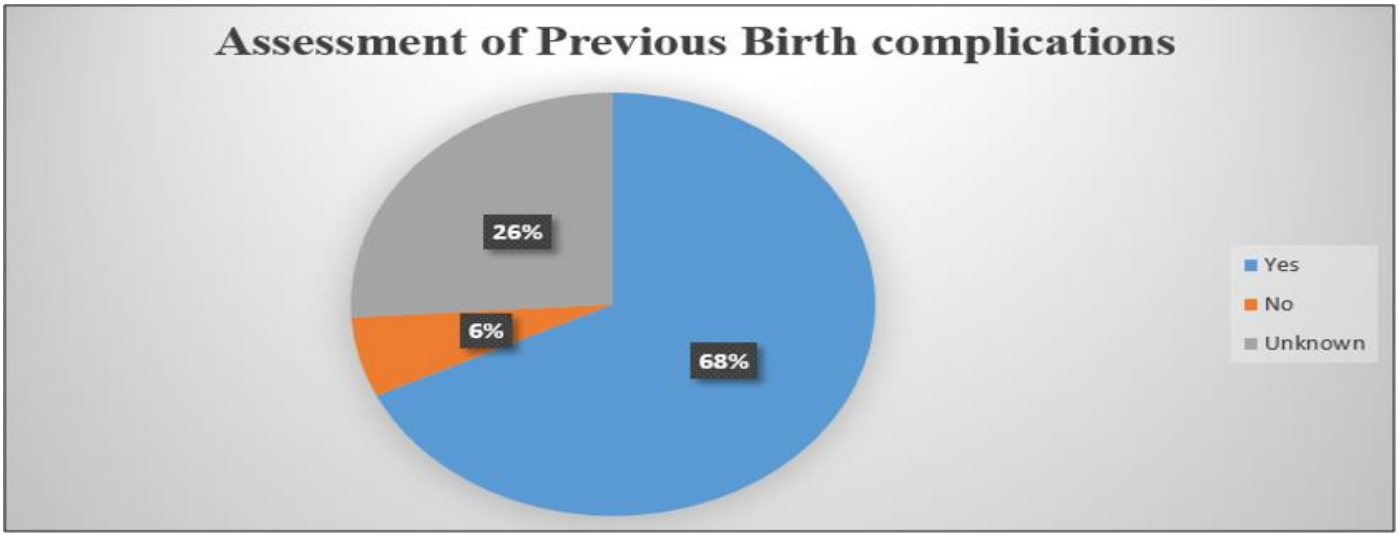

Fig 4 Demonstrates the Role of Previous Birth Complications on Schizophrenia Development

Figure 4 shows that birth complications were noted in 68% of the reviewed records, highlighting the contribution of prenatal and perinatal factors in the onset of schizophrenia.

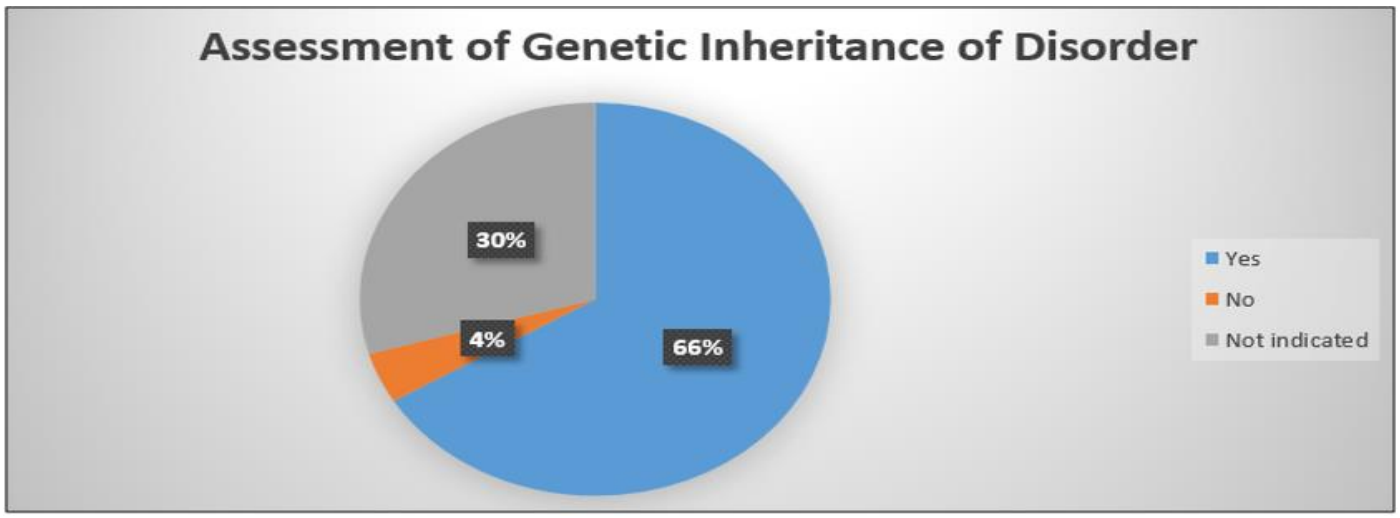

Fig 5 Demonstrates the Assessment of Genetic Inheritance of Schizophrenia Disorder in Participants

The data presented in Figure 5 indicated that 66% of patients had a genetic predisposition, emphasizing the role of heredity in schizophrenia. Understanding these patterns is crucial for early intervention and prevention strategies.

V. DISCUSSION

This study has noted various biomedical factors in pregnancy that included genetical inheritance, nutritional factors, birth complications. While the study explored various factors linked to schizophrenia, the influence of others biomedical factors during pregnancy, such as maternal stress, substance abuse, and infections, emerged as relevant to the onset of the disorder. These findings resonate with studies that associate prenatal exposure to certain environmental stressors with a higher risk of schizophrenia. Maternal health and prenatal care play a crucial role in mitigating these risks and preventing the onset of mental health conditions in later life.

- *Summary of Findings*

The analysis revealed significant associations between several biomedical factors during pregnancy and the risk of developing schizophrenia. Among the 312 patients reviewed, 79.2% had a family history of mental disorders, highlighting a strong genetic predisposition. Additionally, 67.9% of the patients experienced birth complications, such as hypoxia and preterm labor, which are linked to increased schizophrenia risk. The data also indicated that 66% of the patients had prenatal exposure to potential risk factors, including maternal infections and malnutrition. Logistic regression analysis showed that genetic predisposition and birth complications were significant predictors of schizophrenia, with odds ratios indicating a high risk. Qualitative data from KIIs and FGDs supported these findings, revealing that healthcare providers observed a strong correlation between poor prenatal care and the onset of mental health issues, including schizophrenia. These results underscore the need for comprehensive prenatal care and early genetic screening to mitigate risks associated with schizophrenia

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➢ *Limitations and Future Research*

This study faced several limitations that may affect the generalizability of its findings. First, the cross-sectional design limits the ability to establish causality between identified biomedical factors and schizophrenia. Longitudinal studies would provide more robust evidence of these associations. Second, the reliance on retrospective data from medical records may have introduced information bias, particularly if patient files were incomplete or inaccurately documented. Additionally, the sample size, although adequate for the study scope, may not fully capture the broader population, particularly considering variations in access to healthcare services in different regions of Rwanda. Lastly, cultural factors influencing the perception and reporting of mental health symptoms were not accounted for, which may affect the accuracy of the schizophrenia diagnosis in this setting. Future research should consider incorporating larger, more diverse samples and longitudinal approaches to enhance the understanding of pregnancy-related risk factors for schizophrenia

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➢ *Appendices: Permission Letter*

REPUBLIC OF RWANDA

Rwinkwavu, July 16th, 2024

EASTERN PROVINCE
KAYONZA DISTRICT
RWINKWAVU DISTRICT HOSPITAL

Dear Mr. NDIKUBWIMANA John Peter,

RE: **Permission to collect data for academic research**

Reference is made to your letter dated July 12, 2024, requesting to collect data for academic research/Maters in Counseling Psychology in Rwinkwavu District Hospital, having provided a copy of ethics approval from Mount Kenya University,

I am pleased to inform you that Rwinkwavu District Hospital has granted you permission to collect data within our facility for your research titled **"PREVALENCE AND ASSOCIATED FACTORS ATTRIBUTED TO SCHIZOPHRENIA DISORDER".**

We understand the importance of your research and we support your efforts to contribute to Better treatment of Mental health disorders especially schizophrenia.

We look forward to your findings and wish you success in your research endeavors.

Yours sincerely,

Dr.Phoebe MWISENEZA
General Director of RWINKWAVU DH

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