ENSIGN GLOBAL UNIVERSITY, KPONG

EASTERN REGION, GHANA

FACULTY OF PUBLIC HEALTH

DEPARTMENT OF COMMUNITY HEALTH

PREVALENCE AND RISK FACTORS OF GLAUCOMA AMONG ADULTS IN SELECTED RURAL COMMUNITIES IN THE WESTERN REGION OF GHANA

By

YEVUGAH JEROME-JERRY KWASI

247100310

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DECLARATION AND CERTIFICATION

I hereby declare that this thesis is an original work done by myself under supervision of my supervisor. All sources used have been duly referenced and acknowledged and this work has not been presented wholly or in part for the award of any degree elsewhere.

Yevugah Jerome-Jerry Kwasi (ID – 247100310) …….. ……

(Student) Signature Date

Certified by:

Dr. Edward Kofi Sutherland (Supervisor) …….. ……

Signature Date

Certified by:

Prof. Stephen Manortey …….. ……

(Head of Academic Program) Signature Date

DEDICATION

I dedicate this work to the Almighty God; whose grace and guidance made this study possible. I also dedicate it to my family for their unwavering love, encouragement, and sacrifices throughout my academic journey.

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I am and will always remain highly indebted to the Most High God, our Lord Jesus Christ, for His grace, strength, and guidance in all my achievements so far.

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Abstract

Background: Glaucoma is a leading cause of irreversible blindness globally. In Ghana, glaucoma accounts for approximately 19.4% of blindness cases, with rural populations disproportionately affected due to limited access to eye care services, low awareness, and health-seeking barriers. Despite this burden, community-level data on glaucoma prevalence and risk factors in rural Ghana, particularly in the Western Region, remains scarce. This study sought to determine the prevalence and associated risk factors of glaucoma among adults aged 40 years and above in selected rural communities within the Western Region of Ghana.

Methodology: A cross-sectional, quantitative study design was employed. A sample of 408 participants were interviewed across nine rural communities. Data was collected through structured questionnaires, assessing socio-demographic characteristics, health history, lifestyle behaviors, and glaucoma awareness. Data was analyzed using STATA version 18.

Results: The prevalence of glaucoma in the study population was 30.6%, with an additional 8.1% identified as suspected cases requiring further confirmation. Awareness of glaucoma was moderate (59.5%), yet only 55.6% of participants demonstrated good knowledge about its risk factors and prevention.

Significant predictors of glaucoma included family history of the disease (AOR = 3.58; 95% CI: 1.98–6.46; $p < 0.001$), alcohol consumption (AOR = 1.76; 95% CI: 1.13–2.73; $p = 0.012$), and physical inactivity (AOR = 2.38; 95% CI: 1.28–4.40; $p = 0.006$). Other variables such as sex and income were not significant.

Conclusion:

Glaucoma prevalence among adults in rural Western Region was found to be high, suggesting that a considerable proportion of cases remain undiagnosed. Although awareness levels were moderate, knowledge about specific causes and preventive practices was limited despite over half of respondents demonstrating good general awareness. Family history, alcohol consumption, and physical inactivity were identified as significant predictors of glaucoma. Strengthening community-based screening programmes, continuous public health education, and integrating glaucoma awareness into routine primary healthcare services are recommended to enhance early detection and reduce preventable vision loss in rural Ghana.

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ABBREVIATIONS

Abbreviation	Full Meaning
GHS	Ghana Health Service
GHS	Ghana Cedi
IOP	Intraocular Pressure
JHS	Junior High School
MOH	Ministry of Health
NCD	Non-Communicable Disease
NGO	Non-Governmental Organisation
OR	Odds Ratio
POAG	Primary Open-Angle Glaucoma
SD	Standard Deviation
SDH	Social Determinants of Health
SHS	Senior High School
SPSS/STATA	Statistical Package for the Social Sciences / Data Analysis Software
VCDR	Vertical Cup-to-Disc Ratio
WHO	World Health Organization

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

Glaucoma is a chronic and progressive group of optic neuropathies characterized by damage to the optic nerve, usually associated with elevated intraocular pressure (IOP). This silent condition is one of the leading causes of irreversible blindness globally, affecting more than 76 million people as of 2020, a figure projected to rise to over 111 million by 2040 due to ageing populations and demographic shifts (Quigley & Broman, 2021). What makes glaucoma especially concerning from a public health standpoint is its asymptomatic nature in early stages, which often leads to late diagnosis and irreversible vision loss. According to the World Health Organization (WHO, 2022), glaucoma is responsible for approximately 15% of all blindness cases globally, highlighting the need for sustained screening, awareness, and early intervention strategies.

Sub-Saharan Africa has one of the highest prevalence rates globally, and populations of African descent are known to have a higher susceptibility to the most common type (primary open-angle glaucoma (POAG)) compared to other racial groups (Kyari *et al*., 2018). Studies suggest that nearly 1 in 20 adults over the age of 40 in West Africa may have glaucoma, but most remain undiagnosed until the disease has significantly progressed (Ogun *et al*., 2021). This heightened vulnerability has been linked to genetic predisposition, socioeconomic disparities, and limited access to specialized eye care services (Adekoya *et al*., 2020).

In Ghana, glaucoma has been identified as the leading cause of irreversible blindness, accounting for about 19.4% of blindness cases nationally (Ghana Health Service, 2022). It is estimated that over 700,000 Ghanaians live with glaucoma, with a significant proportion unaware of their condition (Frimpong *et al*., 2020). Primary open-angle glaucoma is the most common form in

Ghana, and like other parts of Africa, it often presents at a younger age and progresses rapidly. Unfortunately, despite the considerable burden, national efforts in glaucoma surveillance, community-level screening, and targeted education remain inadequate especially in rural areas where health infrastructure is limited (Ofosu *et al*., 2024). Although tertiary hospitals in urban centres offer some diagnostic and treatment services, many rural communities in Ghana lack the resources and trained personnel to carry out routine eye examinations, contributing to a high rate of undiagnosed and untreated cases (Morny *et al*., 2019).

Rural communities often face substantial barriers to accessing healthcare, including long distances to facilities, poor transportation networks, inadequate health personnel, and high out-of-pocket costs (Osei *et al*., 2016). Additionally, public awareness about eye diseases like glaucoma remains low in rural Ghana, with many individuals attributing vision loss to aging, spiritual beliefs, or fate (Budenz *et al*., 2018). These misconceptions are further compounded by low health literacy and limited mass media outreach in native languages. The Ghana Blindness and Visual Impairment Survey (GHS, 2022) revealed that individuals in rural areas are significantly less likely to undergo regular eye checks, even among those at high risk.

In particular, adults aged 40 years and older represent a demographic at higher risk for glaucoma. With advancing age comes a natural increase in intraocular pressure and optic nerve vulnerability. Studies have consistently shown that the prevalence of glaucoma increases with age, especially after 40 (Aboagye *et al*., 2019). In the absence of national screening guidelines targeting this age group, glaucoma often remains undetected until severe vision loss occurs.

The Western Region of Ghana, known for its mix of urban and predominantly rural communities, presents a relevant yet underexplored context for studying glaucoma (Boadi-Kusi, 2014). While the region has seen improvements in maternal and child health indicators, data on non-

communicable ocular diseases like glaucoma remains limited (Ocansey *et al*., 2021). As a result, little is known about the actual prevalence of glaucoma in this region. Given the high rate of undiagnosed cases observed in other regions, it is plausible that the Western Region may be facing a silent crisis in glaucoma-related vision impairment.

1.2 Problem Statement

Glaucoma remains one of the most pressing yet under-addressed public health challenges globally. As the second leading cause of blindness worldwide and the foremost cause of irreversible vision loss, it affects more than 76 million individuals, a number expected to exceed 111 million by 2040 (Quigley & Broman, 2021). Alarmingly, over 90% of glaucoma cases in low- and middle-income countries are undiagnosed until the late stages, when vision loss is irreversible (WHO, 2022). This delay in diagnosis and treatment significantly compromises the quality of life, productivity, and economic independence of affected individuals, especially in resource-constrained settings.

In sub-Saharan Africa, the burden is even more severe. Studies show that individuals of African descent are four to five times more likely to develop primary open-angle glaucoma than other populations and tend to experience earlier onset and more aggressive disease progression (Kyari *et al*., 2018; Adekoya *et al*., 2020). Despite this heightened vulnerability, eye health services remain largely under-resourced in many African countries. Late presentation, low public awareness, and poor access to screening facilities continue to fuel preventable blindness in the region (Ogun *et al*., 2021).

Ghana, in particular, bears a significant share of this burden. Glaucoma is the leading cause of irreversible blindness in the country, contributing to over 19% of total blindness cases, yet it remains underdiagnosed and undertreated (GHS, 2022). Current estimates suggest that over

700,000 Ghanaians live with glaucoma, with a significant proportion unaware of their condition (Frimpong *et al*., 2020). Rural populations are especially at risk due to health system limitations, including shortages of trained eye care professionals, limited diagnostic equipment, and widespread misconceptions about eye diseases (Budenz *et al*., 2018).

Despite the disproportionate risk, there is a lack of community-based studies assessing the prevalence and risk factors of glaucoma in Ghana's rural regions, including the Western Region. Without reliable data on how many are affected, who is most at risk, and what knowledge gaps exist, it becomes nearly impossible to design targeted interventions. The absence of such evidence hinders early detection efforts and causes avoidable vision loss among vulnerable populations. 1.3

1.3 Rationale for the Study

Glaucoma continues to pose a major public health challenge due to its silent progression and the high burden of undiagnosed cases, especially in sub-Saharan Africa (Kyari *et al*., 2018). In Ghana, where the disease accounts for nearly one-fifth of all blindness cases (GHS, 2022), its management has remained largely hospital-based and urban-focused, leaving rural populations underserved.

This study is therefore relevant to public health practice, as it provides evidence to support the integration of glaucoma screening and education into existing community health and primary care services. It will guide policy formulation by supplying local data for regional and national eye health strategies, particularly those targeting early detection and prevention of irreversible blindness in rural settings.

From a research perspective, the study addresses a major evidence gap by providing community-level prevalence data and identifying context-specific risk factors in the Western Region — information that can inform future epidemiological and intervention studies.

In terms of health education, the findings will enhance awareness among both community members and frontline health workers, strengthening their capacity to recognize early warning signs and promote regular eye examinations. Overall, the study contributes to Ghana's efforts toward achieving Universal Health Coverage and reducing avoidable visual impairment through data-driven public health action.

1.4 Conceptual Framework

This study is guided by the Social Determinants of Health (SDH) framework, which emphasises that health outcomes are not shaped by biology alone but by the broader social and economic conditions in which people live. The World Health Organization defines SDH as the non-medical factors that influence health outcomes, including education, income, occupation, and social context, as well as the systems that determine access to care (WHO, 2021). These determinants create inequalities in risk exposure and in access to preventive and curative services, which in turn produce health inequities across populations. For chronic conditions like glaucoma, social determinants are especially critical because they largely determine whether individuals are screened and treated before irreversible vision loss occurs (WHO, 2019).

The SDH framework distinguishes between structural determinants and intermediary determinants (Solar & Irwin, 2010). Structural determinants refer to social position shaped by education, income, occupation, age, sex, and other socio-demographic factors that governs an individual's access to resources and opportunities. Intermediary determinants are the mechanisms through which these social positions affect health, including material conditions, health behaviours, psychosocial influences, access to care, and health-related knowledge. These two levels interact to produce health outcomes, in this case the prevalence of glaucoma in rural Ghana.

Reflecting the schematic model used in this study, three structural inputs, socio-demographic factors (age, sex, marital status), education, and income/occupation influence the intermediary determinant of knowledge and awareness of glaucoma, which ultimately shapes the clinical outcome (glaucoma prevalence). Education is particularly powerful in this pathway. Individuals with higher levels of schooling tend to have better health literacy and a greater ability to navigate healthcare systems, making them more likely to recognise symptoms or seek screening (Awuah *et al*., 2025). In contrast, limited education can reinforce misconceptions, such as attributing glaucoma to spiritual causes or ageing, and may delay care-seeking. Similarly, income and occupation determine the resources available for routine eye checks, the ability to pay for transport or consultation fees, and exposure to health information. In Ghana, people engaged in farming and informal trading often face economic constraints and irregular contact with health services, contributing to later presentation and higher disease burden (Gyasi *et al*., 2023).

Socio-demographic characteristics further stratify exposure and behaviours. Age is a central determinant because glaucoma risk rises sharply after 40 years; yet older adults in Ghana often normalise declining vision as part of ageing and may not seek help until blindness is advanced (Frimpong *et al*., 2020). Sex also plays a role, as gender norms influence health-seeking behaviour; women may access healthcare more frequently through maternal and child health services, while men may delay routine checks, leading to differences in diagnosis (Kyari *et al*., 2018). Marital status can shape social support and decision-making power, affecting whether individuals are encouraged to seek care.

At the centre of the framework is knowledge and awareness of glaucoma, which mediates the effect of structural determinants on clinical outcomes. Accurate knowledge—such as recognizing family history and intraocular pressure as risk factors or understanding that glaucoma leads to

irreversible blindness—can prompt individuals to prioritise screening. Conversely, misinformation or lack of awareness keeps many cases undiagnosed until late stages. Evidence from Ghana indicates that awareness of glaucoma remains moderate, and knowledge of biomedical causes is still low in underserved communities (Ocansey *et al*., 2023).

Finally, the outcome node, clinical prevalence of glaucoma, is shaped by the interaction of these determinants. Where education and income are low, and awareness is weak, prevalence of undiagnosed glaucoma is higher because individuals do not seek screening until symptoms appear. By contrast, groups with higher education or income may report higher "diagnosed prevalence" because of increased detection, even if their underlying risk is not greater (Budenz *et al*., 2018). This dual effect illustrates how social determinants shape not only the distribution of risk but also how it is measured through case-finding.

In summary, the SDH framework situates glaucoma outcomes within the wider social and economic realities of rural Ghana. Structural determinants such as education, income/occupation, and socio-demographic factors create unequal opportunities for health. These operate through the intermediary determinant of glaucoma knowledge and awareness, which then influences the clinical outcome of disease prevalence. By applying this framework, the study recognizes that preventing avoidable blindness from glaucoma requires not only biomedical interventions but also strategies that address inequities in education, income, health information, and access to care

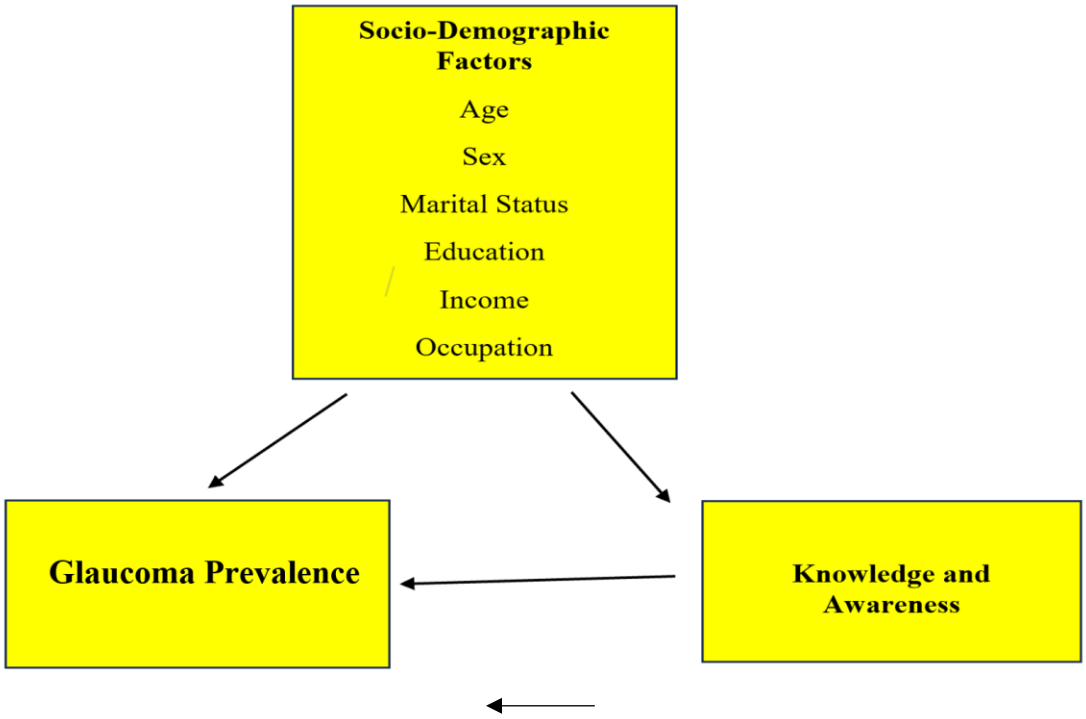

Figure 1 Conceptual Framework

Source: Author's own Construct

1.5 General Objective

To determine the prevalence and associated risk factors of glaucoma among adults aged 40 years and above in selected rural communities in the Western Region of Ghana.

1.6 Specific Objectives

i. To determine the prevalence of glaucoma among adults aged 40 years and above in the selected rural communities.

ii. To assess the level of awareness and knowledge about glaucoma among adults aged 40 years and above in the selected rural communities.

iii. To identify the factors associated with glaucoma among adults aged 40 years and above in the selected rural communities.

1.7 Research Questions

i. What is the prevalence of glaucoma among adults aged 40 years and above in the selected rural communities?
ii. What is the level of awareness and knowledge among adults aged 40 years and above in the selected rural communities?
iii. What factors are associated with glaucoma among adults aged 40 years and above in the selected rural communities?

1.8 Profile of the Study Area

The Western Region of Ghana, located in the southwestern part of the country, is bordered by Côte d'Ivoire to the west, the Central Region to the east, the Western North Region to the north, and the Gulf of Guinea to the south. It spans a land area of approximately 13,842 square kilometers, making it the fourth-largest region in the country (GSS, 2021). The region was administratively restructured in 2019, leading to the creation of the Western North Region, and it now comprises 14 districts and municipalities.

According to the 2021 Population and Housing Census, the Western Region has a population of approximately 2,060,585, accounting for about 6.5% of Ghana's total population (GSS, 2021). The sex distribution is nearly balanced, with males making up 50.7% and females 49.3%. Age-wise, the population is predominantly youthful. About 3.4% of the population is aged 65 and older, while individuals aged 40–64 make up over 18%.

The region exhibits a relatively balanced urban–rural distribution, with 51.6% of the population residing in urban areas and 48.4% in rural settlements (GSS, 2021). Rural districts such as Nzema East, Jomoro, and Ellembelle have limited access to specialized health services.

Educational attainment and literacy levels in the Western Region are moderately high but still reveal significant disparities. About 75.6% of persons aged 11 years and older are literate, while 24.4% are either semi-literate or not literate at all (GSS, 2021). In sum, the Western Region's diverse demographic structure, sizable adult population, and rural–urban health service disparity makes it an ideal setting for a community-based investigation into the prevalence and risk factors of glaucoma.

Figure 2 Map of Western Region

1.9 Scope of the study

This study focused on adults aged 40 years and above in selected rural communities of the Western Region of Ghana, where the risk of glaucoma is known to be higher due to both biological and social factors. The scope was deliberately limited to this age group because glaucoma prevalence increases significantly after 40 years. Nine rural communities were purposively selected to capture a representative sample of rural populations with limited access to specialized ophthalmic services.

The study was restricted to examining three main objectives: first, to determine the prevalence of glaucoma within the study population; second, to assess awareness and knowledge about the disease; and third, to identify socio-demographic, medical, and lifestyle factors associated with glaucoma. The research adopted a quantitative, cross-sectional design and used structured questionnaires combined with basic clinical eye screening.

The findings are context-specific and cannot be generalized to the entire population of Ghana or to urban communities where risk exposures, healthcare access, and literacy levels differ. However, the insights generated provide valuable evidence for rural health planning, policy design, and community education initiatives.

1.10 Organization of the study

This study is organized into six chapters. Chapter One introduces the study by presenting the background, problem statement, rationale, conceptual framework, objectives, research questions, and profile of the study area. Chapter Two reviews relevant literature on glaucoma, drawing attention to its epidemiology, levels of awareness and knowledge, associated risk factors, and the existing gaps in research, with particular focus on sub-Saharan Africa and Ghana.

Chapter Three outlines the methodology adopted for the study, including the research design, study site and population, inclusion and exclusion criteria, sample size determination, sampling procedures, data collection methods, data analysis plan, ethical considerations, and dissemination strategies.

Chapter Four presents the results, describing the demographic characteristics of respondents, the prevalence of glaucoma, awareness and knowledge levels, and statistical associations with potential risk factors.

Chapter Five discusses these findings in the context of existing literature, highlighting their implications for public health practice and glaucoma management in Ghana.

Finally, Chapter Six provides the conclusion and recommendations, summarising the major findings and suggesting policy, practice, and research directions for addressing glaucoma in rural communities.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

This section systematically synthesises existing knowledge on the prevalence and risk factors of glaucoma, with a focus on populations of African descent and, specifically, on rural communities within Ghana. It interrogates the current evidence base on glaucoma epidemiology, awareness, and risk determinants, situating these findings within the broader context of public health and health systems challenges.

2.2 Introduction to Glaucoma

Glaucoma refers to a group of chronic, progressive optic neuropathies characterized by degeneration of the optic nerve, often associated with elevated intraocular pressure (IOP), leading to irreversible visual field loss and potentially complete blindness if untreated. It is not a single disease but a collection of pathologies that share similar outcomes, damage to the optic nerve and visual field deficits (Weinreb *et al*., 2014). The condition typically progresses silently, making it difficult for affected individuals to recognize vision loss until substantial, irreversible damage has occurred. There are several forms of glaucoma, but primary open-angle glaucoma (POAG) is the most common globally and especially prevalent in populations of African descent (Tham *et al*., 2014).

The significance of glaucoma lies not only in its impact on vision but also in its public health implications. As a non-communicable, age-related condition, glaucoma affects quality of life, independence, and productivity, mainly among older adults. The asymptomatic nature of the disease during its early stages poses a challenge to timely detection, especially in low-resource settings where routine eye examinations are not standard practice (Kapetanakis *et al*., 2016).

Biologically, the disease is marked by optic nerve cupping, progressive thinning of the retinal nerve fibre layer, and corresponding visual field defects. Elevated IOP remains a key modifiable risk factor, but disease progression can occur even at normal IOP levels, a phenomenon referred to as normal-tension glaucoma (Kapetanakis *et al*., 2016).

Globally, glaucoma is the second leading cause of blindness and the leading cause of irreversible vision loss. According to the World Health Organization, over 76 million people were estimated to be living with glaucoma by 2020, with projections rising to 111.8 million by 2040 due to population ageing and increased life expectancy (Tham *et al*., 2014; WHO, 2022). Despite advancements in diagnostic techniques and treatment modalities, late diagnosis remains common, especially in low- and middle-income countries (LMICs), where up to 90% of cases may be undiagnosed (Flaxman *et al*., 2017). These missed cases often result in avoidable blindness that carries personal, economic, and social burdens.

In Africa, the situation is particularly concerning. Primary open-angle glaucoma is more prevalent and more aggressive in individuals of African ancestry, who are reported to develop the disease at a younger age with a more rapid progression compared to other ethnic groups (Kyari *et al*., 2015). Estimates suggest that glaucoma affects approximately 4% of people aged 40 and above in sub-Saharan Africa, yet most remain unaware of their condition due to limited access to eye care services and cultural misconceptions about eye health (Bourne *et al*., 2017). The lack of effective national screening programmes and the scarcity of trained ophthalmologists exacerbate the problem, especially in rural areas.

In Ghana, glaucoma represents the leading cause of irreversible blindness, accounting for nearly 19.4% of all blindness cases according to the Ghana Health Service (GHS, 2022). It is estimated that more than 700,000 Ghanaians are affected by the disease, with a large proportion undiagnosed.

Studies have indicated that the majority of glaucoma cases in Ghana are primary open-angle glaucoma, and the disease often goes unnoticed until significant visual impairment occurs (Frimpong *et al*., 2020). Rural populations are especially at risk due to inadequate health infrastructure, limited public awareness, and poor access to specialized ophthalmic services. Moreover, socio-cultural beliefs often attribute vision loss to ageing or spiritual causes, further delaying health-seeking behaviours (Budenz *et al*., 2018). The implications are most severe in rural areas where eye care is scarcely prioritized. Understanding glaucoma's clinical nature and its broader social and epidemiological context is essential in shaping effective local interventions and informing national strategies aimed at blindness prevention.

2.3 Epidemiology of Glaucoma

Glaucoma is increasingly recognized as a major public health concern due to its high prevalence and irreversible nature. While it is not the most common cause of visual impairment globally, it remains the leading cause of permanent blindness, posing a significant burden on health systems, particularly in low- and middle-income countries. The epidemiology of glaucoma reveals not only widespread distribution but also considerable disparities in detection, access to care, and outcomes across different regions and populations.

Globally, glaucoma affects more than 76 million people as of 2020, and this number is projected to rise to 111.8 million by 2040, with ageing populations being a primary driver of this increase (Tham *et al*., 2014). Among the different forms of the disease, primary open-angle glaucoma (POAG) is the most prevalent, accounting for the majority of cases worldwide. The burden of glaucoma is unevenly distributed, with the highest prevalence observed in populations of African descent and in developing countries where health infrastructure is often inadequate (Flaxman *et*

al., 2017). In these settings, up to 90% of glaucoma cases remain undiagnosed until significant vision loss has occurred (Hawkins *et al*., 2024).

In sub-Saharan Africa, the epidemiological profile of glaucoma is particularly concerning. The region has one of the highest prevalence rates of POAG globally, with studies indicating that the condition often presents at a younger age and progresses more rapidly than in other populations (Kyari *et al*., 2015). The aggressive nature of the disease in African populations has been attributed to a combination of genetic susceptibility, lack of routine screening, and limited access to treatment. According to Bourne *et al*. (2017), the prevalence of glaucoma-related blindness in sub-Saharan Africa is among the highest globally, with a significant proportion of cases going untreated. A scoping review by Owusu-Sarfo *et al*. (2024) further confirmed that elderly populations in the region are especially vulnerable, with age-specific prevalence reaching as high as 7.3% among those aged 60 and above.

Ghana shares in this disproportionate burden, with glaucoma being the leading cause of irreversible blindness in the country. Estimates suggest that over 700,000 Ghanaians are living with the condition, with a significant number unaware of their status (Ghana Health Service, 2022). A study conducted in urban clinics revealed that 94% of newly diagnosed glaucoma patients had no prior knowledge of their condition, underscoring the low level of disease awareness and the high rate of undiagnosed cases (Frimpong *et al*., 2020). Further, a population-based survey indicated that the national prevalence of POAG is approximately 8.5% among adults aged 40 years and above, higher than the global average (Aboagye *et al*., 2019).

The rural–urban disparity in glaucoma diagnosis and management in Ghana remains a critical concern. Rural communities are often underserved in terms of eye health infrastructure, with limited access to ophthalmologists, diagnostic equipment, and affordable care. Moreover, the

cultural beliefs surrounding vision loss, often seen as a normal part of ageing or attributed to supernatural causes contribute to delays in seeking care (Budenz *et al*., 2018). A study comparing rural and urban glaucoma patients in Ghana found that those in rural areas presented with significantly higher intraocular pressure and more advanced optic nerve damage at the time of diagnosis (Ocansey *et al*., 2016). The Ghana Blindness and Visual Impairment Survey reported that rural residents were less likely to have undergone an eye examination in the past year, even among those at risk (GHS, 2022).

The epidemiological evidence reflects a complex and unequal distribution of glaucoma, with the heaviest burden falling on low-resource settings, particularly in sub-Saharan Africa and rural Ghana. The combination of high prevalence, poor awareness, and limited access to early diagnosis creates a silent epidemic of avoidable blindness. Addressing these disparities will require not only increased screening and treatment infrastructure but also targeted education and culturally sensitive interventions.

2.3 Awareness and Knowledge of Glaucoma

Awareness and knowledge of glaucoma are critical determinants of health-seeking behaviour, early diagnosis, and treatment adherence. Given the asymptomatic nature of the disease in its early stages, individuals with limited knowledge are more likely to delay seeking care until visual impairment has already occurred. Public understanding of glaucoma involves not only recognising the name of the condition but also grasping its causes, risk factors, and the importance of routine eye examinations, particularly for individuals over 40 years of age.

Globally, inadequate awareness remains a persistent barrier to timely glaucoma detection. Studies have consistently shown that a significant proportion of those affected are unaware of the condition

prior to diagnosis. A global survey conducted by the Glaucoma Research Foundation revealed that 16% of African Americans and 9% of Caucasians were unaware of the term "glaucoma," despite its significantly higher prevalence among these groups. While 74% of respondents reported having routine eye examinations, only 43% had undergone dilated eye exams, which are essential for early glaucoma detection (Glaucoma Research Foundation, 2025). A population-based study from a mixed urban–rural setting in India found that only 7.74% of participants had ever heard of glaucoma, making it one of the lowest levels of awareness recorded globally. This rate was comparable to awareness levels reported in Nepal (5.2%) (Bhagat *et al*., 2023). In another study involving healthcare personnel in North India, which included individuals serving military populations, only 22% of respondents reported being aware of glaucoma, and just 12% were able to correctly answer knowledge-based questions about the disease, indicating that even among health workers, understanding of glaucoma remains limited (Singh *et al*., 2024).

In many high-income countries, public education campaigns and integrated health systems have contributed to moderate levels of awareness. For example, a large survey of 3,654 Australian adults aged 49 and over found 93% were aware of glaucoma (Gyawali *et al*., 2025). Similarly, a Canadian facility-based study reported that 73% of respondents had heard of glaucoma, and 34% were able to define it correctly (Buys *et al*., 2021). However, in low- and middle-income countries (LMICs), public knowledge is still very low. The lack of structured glaucoma education within general health promotion strategies, especially at the primary care level, contributes to the overall gap in awareness.

In sub-Saharan Africa, where the prevalence and severity of glaucoma are disproportionately high, awareness levels remain unacceptably low. In a community-based study in Woliso Town, Ethiopia, only 33.6% of adults aged 18 and above had ever heard of glaucoma (Fekadu *et al*., 2017).

Similarly, in Northern Nigeria, awareness among rural adult populations was reported at around 47% in one study, while another rural area study observed about 60% awareness among community members, though knowledge remained limited (Kizor-Akaraiwe *et al*., 2021).

Ghana reflects similar patterns of limited awareness, with rural and semi-urban communities showing particularly low levels of knowledge about glaucoma. A study in Abokobi revealed that although 39.3% of respondents had heard of glaucoma, only 28% understood that its blindness is irreversible, and just 20.7% had ever undergone eye screening, with only 4.3% screened specifically for glaucoma (De-Gaulle & Dako-Gyeke, 2016). A population-based survey across rural and urban Ghana found that only 27.6% of respondents had ever undergone an eye screening; among those aware of glaucoma, only 30.4% had high knowledge, and just 19.8% perceived themselves to be at risk (Ocansey *et al*., 2021).

Community-level factors such as education, exposure to health campaigns, and prior interaction with eye care services were identified as significant predictors of glaucoma knowledge (Ocansey *et al*., 2021). In contrast, misconceptions attributing vision loss to ageing or spiritual causes were common, especially in remote areas. Urban residents in Ghana generally report higher awareness levels than rural counterparts, largely due to improved access to health facilities, media, and public education platforms. Rural residents, however, face barriers such as long travel distances, limited personnel, and unaffordable services, making early screening less likely (De-Gaulle & Dako-Gyeke, 2016).

Overall, the knowledge gap surrounding glaucoma is a critical public health concern in Ghana and across much of sub-Saharan Africa. The evidence suggests that improving awareness and health literacy could significantly enhance early diagnosis and reduce the burden of avoidable blindness.

This underscores the need for health education campaigns, community-based screening programmes, and integration of glaucoma education into primary health care outreach initiatives.

2.4 Risk Factors Associated with Glaucoma

Glaucoma pathogenesis is multifactorial, involving demographic, genetic, medical, lifestyle, and healthcare access components. While elevated intraocular pressure (IOP) remains a central modifiable risk factor, epidemiological studies highlight complex interactions of multiple determinants across populations.

Evidence shows that advanced age and male sex significantly influence glaucoma risk. In rural Korea, the prevalence of glaucoma was estimated at 3.4% among those aged 50 and older, rising sharply with age, from 2.2% in those aged 50–59 to 13.0% in those over 80 (Kim et al., 2011). Population ageing in sub-Saharan Africa is expected to drive similar increases in glaucoma incidence, especially where health system capacity is limited (Sarfo et al., 2025). Ethnic disparities are notable: individuals of African or Asian descent have higher susceptibility to primary open-angle glaucoma (POAG) and often present at younger ages with more rapid progression (Wright & Tawfik, 2022).

A positive family history is also a strong predictor. First-degree relatives of people with POAG have a two- to fourfold higher risk, reflecting both genetic predisposition and shared environmental exposures (Wiggs & Pasquale, 2017).

Elevated IOP remains the most consistent medical predictor of glaucoma. Studies have demonstrated that high IOP independently predicts both POAG and angle-closure glaucoma. Vascular and ocular hemodynamic disturbances such as hypertension, nocturnal hypotension, and atherosclerosis have also been implicated, likely due to impaired optic nerve perfusion (Brazionis

et al., 2018). Similarly, diabetes mellitus has been strongly associated with glaucoma and ocular hypertension; a large meta-analysis found a 1.48-fold increased risk among individuals with diabetes compared with non-diabetics (Li *et al*., 2024).

Lifestyle-related factors are increasingly examined. Although associations between smoking or alcohol use and glaucoma remain inconclusive, large cohort studies suggest former smokers may experience more rapid disease progression, possibly due to oxidative and vascular stressors (Stuart et al., 2024). Additionally, obesity and physical inactivity have been linked to elevated IOP. In Korean adults, obesity was significantly associated with ocular hypertension, and sedentary individuals had a higher prevalence of elevated IOP (Kim et al., 2025).

Finally, environmental and healthcare access factors shape glaucoma outcomes, particularly in low-resource settings. Surveys of optometrists in Ghana and Nigeria found that less than half diagnosed more than ten glaucoma cases weekly, indicating limited clinical outreach (Ocansey et al., 2023). Broader systemic challenges such as poverty, lack of health insurance, uneven distribution of eye-care facilities, and insufficient numbers of ophthalmologists further delay diagnosis and worsen outcomes (Frimpong et al., 2020).

2.6 Gap in Literature

Despite the expanding literature on glaucoma epidemiology and risk factors, several critical gaps persist, particularly in the context of rural and underserved populations in Ghana. Most existing studies are concentrated in urban or peri-urban settings, often utilizing hospital-based samples that may not accurately reflect the true burden of disease in remote communities (Alaazi, 2020; Ocansey, *et al*., 2021; Sarfo *et al*., 2025). The paucity of population-based research in rural Ghana

limits understanding of the prevalence, awareness levels, and unique socio-cultural determinants influencing glaucoma outcomes in these areas.

There is also a notable deficiency in studies that explore the intersection of cultural beliefs, health-seeking behaviours, and systemic barriers to accessing glaucoma care within rural contexts. Most investigations focus predominantly on clinical and demographic risk factors, with insufficient attention to broader social determinants of health, such as poverty, educational attainment, and healthcare infrastructure (Enimah, 2020; Ofosu *et al*., 2018).

However, evidence from Ghana reveals a disproportionate focus on urban settings and tertiary care centres, with limited community-based data from rural regions where health disparities are most pronounced (de-Graft Aikins *et al*., 2014; Okine, 2024). This creates a critical knowledge gap in understanding the true burden of disease and risk distribution at the population level. By focusing on rural communities in the Western Region, this study aims to contribute valuable insights that can inform targeted interventions, improve health literacy, and strengthen glaucoma prevention strategies within Ghana's primary healthcare framework.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study Design

This study employed a **community-based analytical cross-sectional survey design**. The analytical cross-sectional approach was appropriate because it enabled the researcher to collect data on both exposure variables (such as socio-demographic, medical, and lifestyle factors) and outcome variables (glaucoma diagnosis) at a single point in time. This design allowed for the identification of associations and potential predictors of glaucoma within the study population. The analytical cross-sectional design was selected because it is ideal for estimating disease prevalence while simultaneously assessing relationships between variables. It provides a cost-effective and time-efficient means of identifying statistically significant associations that can inform future longitudinal or interventional studies. The design was also suitable for a community-based setting, where data could be collected during organized outreach and screening exercises without the need for follow-up.

Despite its usefulness, the analytical cross-sectional design has certain limitations that must be acknowledged. The main limitation is that it does not establish causal relationships between exposure and outcome variables because both are measured at the same point in time. Additionally, the design is prone to recall bias since participants may not accurately remember or report past exposures, such as lifestyle behaviours or medical history. However, the design remains valuable for generating hypotheses and providing baseline evidence for future longitudinal research.

3.2 Study Site

The study was conducted in nine rural communities in the Western Region of Ghana: Bonyere Junction, Elubo, Aiyinase, Axim, Bogoso, Kwesimintsin, Kojokrom, Tarkwa Nsuaem, and Agona

Junction. These communities were selected due to their predominantly rural characteristics, limited access to specialized ophthalmic services, and significant representation of the adult population aged 40 years and above. According to the Ghana Statistical Service (GSS, 2021), nearly 48.4% of the Western Region's population resides in rural areas, with a sizable proportion aged 40 years and above, making these communities appropriate for community-level glaucoma research.

3.3 Study Population

The target population comprised adults aged 40 years and above who were residents of the selected communities. This age group was chosen because glaucoma risk increases significantly after the age of 40.

3.4 Inclusion Criteria

- Adults aged 40 years and above residing in the selected communities.
- Individuals who provide informed consent to participate in the study.

3.5 Exclusion Criteria

- Temporary visitors or non-residents of the selected communities.

3.6 Sample Size Determination

The sample size was calculated using Cochran's formula for estimating proportions in large populations:

$$n = \frac{Z^2 \times pq}{e^2}$$

Where:

- Z= 1.96 (for 95% confidence interval)
- P=estimated prevalence of glaucoma in adults aged 40+ (50%)
- q=1-p
- e= 0.05 (margin of error)

$$n = \frac{(1.96)^2 \times (0.5 \times 0.5)}{(0.05)^2} \cong 384$$

To account for a 10% non-response rate: 120 x 0.1 = 12 + 120 = 423

Therefore, a total sample size of 423 participants will be targeted for the study.

3.7 Sampling Procedure

Nine rural communities were selected from the Western Region — **Bonyere Junction, Elubo, Aiyinase, Axim, Bogoso, Kwesimintsin, Kojokrom, Tarkwa Nsuaem, and Agona Junction** — based on their predominantly rural characteristics, accessibility, and limited access to specialized ophthalmic services.

A **multi-stage systematic random sampling technique** was then employed to select participants for the study. In the first stage, the number of participants to be selected from each community was determined using **proportionate allocation** according to the size of the adult population aged 40 years and above. Out of the total 408 respondents, 76 were selected from Elubo, 52 from Axim, 57 from Tarkwa Nsuaem, 45 from Bonyere Junction, 41 from Aiyinase, 39 from Agona Junction, 37 from Bogoso, 33 from Kwesimintsin, and 28 from Kojokrom.

In the second stage, **systematic random sampling** was applied within each community. Lists of eligible adults who registered for the community eye screening served as the sampling frames. Sampling intervals were calculated for each community based on the number of eligible adults and the required sample size. Every was selected to be included in the study.

A random starting point between 1 and 4 was selected in each community, and thereafter, every 4th eligible individual was included until the required sample size was achieved. In cases where a selected individual declined participation or did not meet the inclusion criteria, the next eligible person on the list was chosen. This approach ensured fairness, equal representation of the target population, and minimized selection bias.

3.8 Data Collection Methods and Instruments

Data was collected using a structured, interviewer-administered questionnaire developed specifically for this study. The instrument was adapted from previous community-based glaucoma studies conducted in Ghana and other sub-Saharan African countries (Kyari *et al*., 2018; Frimpong *et al*., 2020) and modified to suit the local context. The questionnaire was divided into four main sections, each addressing one of the study objectives.

Section A: Socio-Demographic Information

This section gathered background data on participants' age, sex, marital status, education, occupation, religion, and monthly income. These variables were used to describe the sample and to examine associations between socio-demographic factors and glaucoma outcomes.

Section B: Knowledge and Awareness of Glaucoma

This section assessed participants' awareness of glaucoma, knowledge of its causes, effects, prevention, and appropriate screening practices. Items 1–3 captured awareness and information

sources (multiple-response tick options). Items 4–8 measured factual knowledge using multiple-choice questions with "Yes/No/Don't know" or single-response categorical options. A knowledge-scoring system was applied: each correct response was scored "1", while incorrect or "Don't know" responses scored "0". For multiple-response items, one point was awarded if the participant selected at least one correct answer. A composite knowledge score (range 0 – 6) was computed by summing individual items. Scores equal to or above the mean (4.18) were classified as "good knowledge", while those below the mean were categorised as "poor knowledge."

Section C: Prevalence of Glaucoma

This section recorded participants' self-reported glaucoma history and findings from the on-site screening. Questions covered prior diagnosis, treatment status, and common ocular symptoms, using Yes/No and multiple-response tick boxes. The final question was completed by trained health personnel to document clinical screening outcomes as No glaucoma, Glaucoma confirmed, or Suspected case.

Section D: Risk Factors Associated with Glaucoma

This section explored potential behavioural and medical risk factors. Items addressed family history, hypertension, diabetes, smoking, alcohol intake, physical activity, use of protective eyewear, distance to health facilities, and health-seeking preference. Most items used categorical responses (e.g., Yes/No, Never/Occasionally/Regularly, or Distance categories). These data were used to identify significant predictors of glaucoma in bivariate and multivariate analyses.

Overall, the questionnaire contained 29 items, predominantly close-ended for ease of coding and quantitative analysis.

3.9 Pre-testing

The questionnaire and screening procedures were pre-tested in a rural community in the Western North Region that was not included in the final sample. A total of 15 adults aged 40 years and above participated in the pre-test to assess the clarity, cultural appropriateness, and flow of the instrument. Results from the pre-test showed that respondents understood the majority of the items clearly; however, a few questions required modification. Specifically, minor revisions were made to simplify technical terms related to eye conditions. The layout of the questionnaire was also adjusted to improve the logical flow from socio-demographic information to health-related items.

Reliability analysis was performed on the knowledge and awareness scale using Cronbach's alpha, which yielded a coefficient of 0.81, indicating good internal consistency. The average administration time per interview was approximately 15–20 minutes. Based on the pre-test feedback, the final instrument was refined and validated for use in the main study.

3.10 Data Management and Confidentiality

Data collected via tablets using KoboCollect were uploaded daily to a secure, password-protected server. All personal identifiers were removed prior to analysis to maintain anonymity. Only the researcher had access to the dataset, which was securely backed up and stored. Data will be kept for five years before being permanently deleted in line with ethical data governance protocols.

3.11 Data Analysis

Data was analyzed using STATA version 18. The analysis began with data cleaning and validation to ensure accuracy and completeness. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize respondents' socio-demographic

characteristics, levels of awareness, knowledge, and the prevalence of glaucoma. Results were presented in tables and figures for clarity.

The prevalence of glaucoma was determined from clinical screening results by calculating the proportion of respondents diagnosed with the condition out of the total number examined. Awareness and knowledge levels were assessed using a series of structured questions. A composite knowledge score was generated from six key items related to awareness, causes, prevention, and screening practices. The overall mean score served as the cut-off point for classifying respondents as having either good or poor knowledge of glaucoma.

To explore associations between glaucoma and potential risk factors, bivariate analysis was conducted using Pearson's chi-square test, with a significance level of $p < 0.05$. Variables that were statistically significant or of theoretical importance were included in a multivariable logistic regression model to identify independent predictors of glaucoma while adjusting for potential confounders. Results from the regression were expressed as Crude Odds Ratios (COR) and Adjusted Odds Ratios (AOR) with 95% confidence intervals. The regression model included demographic, clinical, and lifestyle factors such as sex, education, income, religion, family history, alcohol use, and physical activity, as reflected in Chapter Four.

3.14 Ethical Consideration

Ethical approval was obtained from the Ensign Global University Institutional Review Board. Permission was sought from the Regional Health Directorate and local traditional authorities. Written informed consent will be obtained from all participants. Participation was voluntary, with the right to withdraw at any time. There was no physical risk; however, participants found to have elevated intraocular pressure or suspicious optic nerve findings were referred to the nearest eye

clinic for further assessment. Confidentiality, anonymity, and data protection protocols were strictly observed.

CHAPTER FOUR

4.0 RESULTS

4.1 Demographic Characteristics

Out of the 423 targeted adults, 408 completed the survey, yielding a response rate of 96.5%. The study surveyed respondents aged 40 years and above. The age distribution shows that the majority of participants were within the 60–69 years 130 (31.9%) and 70–79 years 118 (28.9%) brackets, together accounting for over half of the sample. Respondents aged 50–59 years constituted 61 (15.0%), while those aged 40–49 years and 80 years or older represented 48(11.8%) and 51 (12.5%) respectively. In terms of sex, the sample was slightly skewed towards females, who made up 243(59.6%) of respondents, compared to n=165 (40.4%) males.

Regarding marital status, more than half of respondents were married 223(54.7%). A sizeable proportion were widowed 87 (21.3%), reflecting the older age structure of the population. Single respondents accounted for 73(17.9%), while divorced individuals made up 25(6.1%). Educational attainment was relatively low, as expected in rural Ghanaian settings. The largest group of respondents had completed junior high school (JHS) 137(33.6%), while no formal education was reported by 92(22.6%). About 109(26.7%) had attained senior high school (SHS), and smaller proportions reported primary education 23(5.6%) or tertiary-level education 47(11.5%).

Occupational distribution revealed that most respondents were engaged in farming 108(26.9%) and trading/business activities 138(34.8%), which together accounted for over 60% of the sample. Smaller groups worked in transport 17(3.8%), artisan or skilled labour 13(2.8%), and professional or clerical occupations 28(6.7%). A notable 96(24.0%) were retired or pensioners. Students 5(0.8%) and unemployed persons 3(0.3%) formed very minor categories.

Monthly income levels were generally low. About 155(38.0%) of respondents earned less than GHS 500 monthly, while 150(36.8%) reported incomes between GHS 500–999. Only 59(14.5%) earned between GHS 1000–1999, and fewer still reported 2000–2999 31(7.2%) or more than 3000 (n=13; 2.6%).

Table 4.1 Demographic Characteristics

Variable	Category	Frequency	Percentage (%)
Age of Respondent	40–49	48	11.76
	50–59	61	14.95
	60–69	130	31.86
	70–79	118	28.92
	80+	51	12.5
	Total(N)	**408**	**100**
Education Level	JHS	137	33.58
	No formal education	92	22.55
	Primary	23	5.64
	SHS	109	26.72
	Tertiary	47	11.52
	Total	**408**	**100**
Marital Status	Divorced	25	6.13
	Married	223	54.66
	Single	73	17.89
	Widowed	87	21.32
	Total	**408**	**100**
Monthly Income	<500	155	37.99
	500–999	150	36.76
	1000–1999	59	14.46
	2000–2,999	31	7.6
	>3000	13	3.19
	Total	**408**	**100**
Occupation	Farming	108	26.47
	Trading/Business	138	33.82
	Transport	17	4.17
	Artisan/Skilled	13	3.19
	Professional/Clerical	28	6.86
	Pension/Retired	96	23.53
	Student	5	1.23
	Unemployed	3	0.74
	Total	**408**	**100**
Sex	Female	243	59.56
	Male	165	40.44
	Total	**408**	**100**

4.2 Prevalence of glaucoma among adults aged 40 years and above

Glaucoma prevalence in this study was estimated based on findings from the community screening (clinical examination). Of the 408 respondents examined, 125 (30.6%) were confirmed to have glaucoma, representing the prevalence in the study population. The majority, 250 (61.3%), were found not to have glaucoma, while 33 (8.1%) were recorded as suspected cases requiring further clinical confirmation.

In addition to the clinical results, respondents' self-reports of a previous professional diagnosis of glaucoma were captured for descriptive purposes. Among them, 142 (34.8%) indicated they had been diagnosed with glaucoma before, while 266 (65.2%) reported they had never been diagnosed. These self-reports were not used in the calculation of prevalence but provide supplementary insights into awareness and prior detection of glaucoma in the community.

Table 4.2 Prevalence of glaucoma among adults aged 40 years and above

Variable	Category	Frequency	Percentage (%)
Clinical Exam Result	No	250	61.27
	Yes	125	30.64
	Suspected	33	8.09
Self-report Diagnosis	No	266	65.2
	Yes	142	34.81

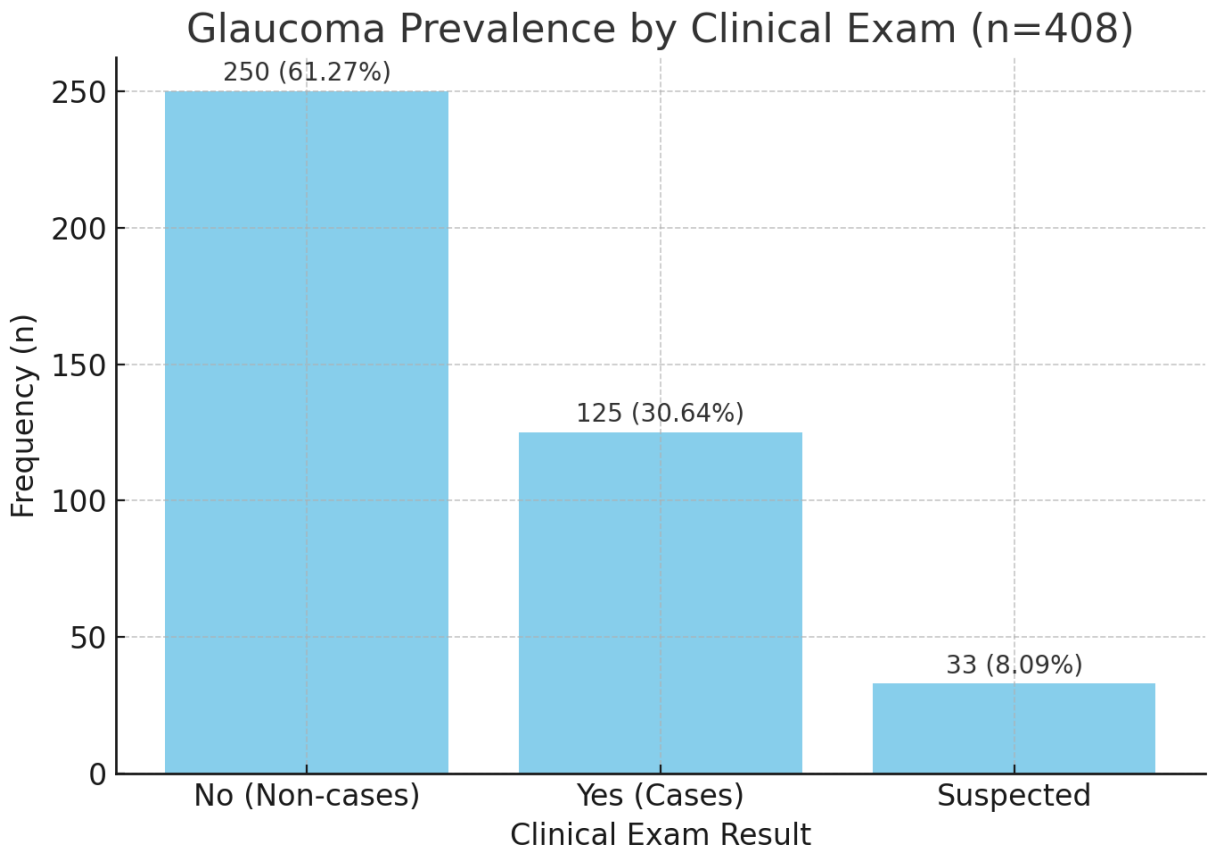

Figure 4.1 Prevalence of Glaucoma

4.3 Awareness and knowledge about glaucoma among adults aged 40 years and above

The study assessed awareness and knowledge of glaucoma among 408 respondents. Overall, 243 (59.5%) of participants had heard of glaucoma, while 165 (40.5%) reported no prior awareness of the condition.

Among those who had heard of glaucoma, the main sources of information were health professionals 328 (80.4%) and radio/television 157 (38.5%). Far fewer respondents cited family and friends 37 (9.1%), social media 29 (7.1%), or other channels 17 (4.2%). In terms of perceived causes, most respondents associated glaucoma with old age 249 (61.0%), followed by poor diet 114 (27.9%) and high eye pressure 121 (29.7%). Some mentioned hereditary

factors 70 (17.2%), eye injury 38 (9.3%), or spiritual causes 19 (4.7%). Misconceptions also emerged, with 13 (3.2%) attributing glaucoma to the use of certain medications and 7 (1.7%) to excessive use of the eyes. Notably, 57 (14.0%) admitted that they did not know any cause. Encouragingly, knowledge of the effects of glaucoma was relatively high: 330 (80.9%) believed that glaucoma can lead to blindness. Similarly, 323 (79.2%) recognized that glaucoma can be prevented or treated if detected early. However, about one in seven respondents 55 (13.5%) and 60 (14.7%) respectively were uncertain on both issues.

With regard to recommended screening practices, most respondents 314 (77.0%) believed that regular eye checks should begin before age 30, while 44 (10.8%) suggested between ages 30 and 39. Very small proportions chose later ages (40–49 years, 8 [2.0%]; 50 years and above, 9 [2.2%]). A further 33 (8.1%) reported that they did not know the appropriate starting age. On the frequency of eye checks, more than half 224 (55.0%) recommended annual examinations, though 62 (15.2%) thought checks were only needed when a problem arises, 36 (8.8%) suggested every 2–3 years, and 86 (21.0%) admitted not knowing the correct interval.

Respondents were more familiar with age as a risk factor than with intraocular pressure or hereditary predisposition, and a considerable minority held inaccurate beliefs about causes and prevention.

Table 4.3 Awareness and knowledge about glaucoma among adults aged 40 years and above

Knowledge Item	Category	Frequency (n)	Percentage (%)
Awareness of Glaucoma	Yes	243	59.5
	No	165	40.5
Sources of Information on Glaucoma	Radio/TV	157	38.5
	Health professional	328	80.4
	Family/friends	37	9.1
	Social media	29	7.1
Perceived Causes of Glaucoma	Old age	249 frequency	61.0 percentage
	High eye pressure	121	29.7
	Hereditary	70	17.2
	Eye injury	38	9.3
	Use of certain medicines	13	3.2
	Excessive use of the eyes	7	1.7
	Spiritual causes	19	4.7
	Poor diet	114	27.9
	Don't know	57	14.0
Can glaucoma lead to blindness?	Yes (correct)	330	80.9
	No	23	5.6
	Don't know	55	13.5
Can glaucoma be prevented/treated if detected early?	Yes	323	79.2
	No	25	6.1
	Don't know	60	14.7
At what age should people start regular eye checks?	Below 30	314	77.0
	30–39	44	10.8
	40–49	8	2.0
	50+	9	2.2
	Don't know	33	8.1
How often should people get their eyes checked?	Once a year	224	55.0
	Only when there's a problem	62	15.2
	Every 2–3 years	36	8.8
	Don't know	86	21.0
Total (N)		**408**	**100**

4.4 Overall Knowledge about glaucoma among adults aged 40 years and above

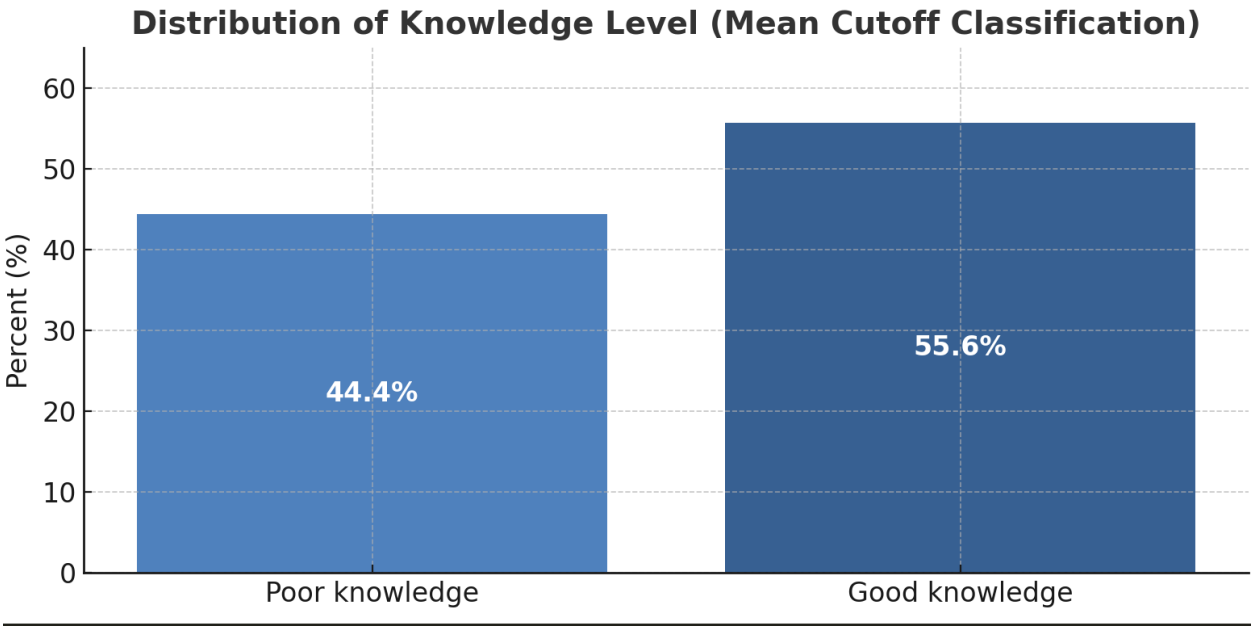

Figure 4.3 Overall Knowledge level

To assess respondents' knowledge of glaucoma, a composite knowledge score was generated from six items: awareness of glaucoma, knowledge that it can lead to blindness, knowledge of its prevention or treatment, knowledge of the correct age to begin eye examinations, knowledge of the appropriate frequency of such checks, and knowledge of its causes.

The mean of the knowledge score was then calculated (4.18) and used as the threshold for classification. The results showed that out of 408 respondents, 55.6% were classified as having good knowledge, while 44.4% fell into the poor knowledge category.

4.5 Factors associated with glaucoma among adults aged 40 years and above

A majority of respondents 262 (64.2%) reported not knowing their family history of glaucoma, while 84 (20.6%) indicated no family history and 59 (14.5%) reported a positive family history. Nearly half of the participants 189 (46.3%) had ever been diagnosed with hypertension, whereas 219 (53.7%) had not, and 69 (16.9%) reported a diagnosis of diabetes compared with 339 (83.1%) who had not. Almost all respondents 403 (98.8%) reported never smoking, with only 3 (0.7%) indicating past use and 1 (0.2%) current use. With respect to alcohol consumption, 296 (72.5%) reported never drinking, 89 (21.8%) indicated past use, and 23 (5.6%) were current users. In terms of physical activity, 227 (55.6%) reported engaging in daily activity, 59 (14.5%) weekly, 51 (12.5%) rarely, and 71 (17.4%) never. Regarding eye protection, 299 (73.3%) reported not using sunglasses or hats, while 101 (24.8%) reported use.

Table 4.4 Factors associated with glaucoma among adults aged 40 years and above

Variable	Category	Count	Percent
Do you have a family history of glaucoma?	Don't know	262	64.2
	No	84	20.6
	Yes	59	14.5
Have you ever been diagnosed with;			
Hypertension	No	219	53.7
	Yes	189	46.3
Diabetes	No	339	83.1
	Yes	69	16.9
Do you smoke cigarettes or tobacco?	Never	403	98.8
	Used to	3	0.7
	Yes	1	0.2
Do you consume alcohol?	Never	296	72.5
	Used to	89	21.8
	Yes	23	5.6
How often do you engage in physical activity			
(e.g., walking, farming, exercise)?	Daily	227	55.6
	Never	71	17.4
	Weekly	59	14.5
	Rarely	51	12.5

Do you wear sunglasses or hats to protect your eyes in the sun?	No	299	73.3
	Yes	109	26.8
Total(N)		**408**	**100**

4.6 Bivariate Analysis of Factors associated with Glaucoma among Adults aged 40 years and above

The chi-square analysis examined the association between glaucoma status and selected socio-demographic, clinical, and lifestyle factors among adults aged 40 years and above. Overall, 39.2% of respondents were diagnosed with glaucoma, while 60.8% did not present with the condition.

Sex was significantly associated with glaucoma ($\chi^2(1)=5.445$, $p=0.020$). Glaucoma prevalence was higher among males (46.1%) compared to females (34.6%). Educational level also showed a significant association ($\chi^2(4)=17.505$, $p=0.002$). The highest prevalence was observed among respondents with SHS education (54.1%), followed by those with no formal education (38.0%) and tertiary education (38.3%), while the lowest was among those with primary education (17.4%). Income was significantly associated with glaucoma ($\chi^2(4)=11.285$, $p=0.024$). Respondents earning above 3000 reported the highest prevalence (60.0%), followed by those in the 1000–1999 income bracket (53.6%), whereas those earning less than 500 had the lowest prevalence (34.4%). Religion also showed a significant association with glaucoma ($\chi^2(2)=7.972$, $p=0.019$), with a higher prevalence among Muslims (56.9%) compared to Christians (36.3%) and practitioners of traditional religion (33.3%). Family history of glaucoma was strongly associated with disease status ($\chi^2(2)=19.181$, $p=0.000$). Respondents who reported a family history had the highest prevalence (64.4%), compared to 39.3% among those with no family history and 33.6% among those uncertain of their history. Smoking was also significantly associated with glaucoma ($\chi^2(2)=6.236$, $p=0.044$), as all respondents who smoked or had ever smoked were glaucoma cases,

compared with 38.7% among those who never smoked. Alcohol consumption showed a significant relationship ($\chi^2(2)=10.570$, $p=0.005$), with higher prevalence among former drinkers (53.9%) compared to current (30.4%) and never drinkers (35.5%). Frequency of physical activity was also associated with glaucoma ($\chi^2(3)=8.576$, $p=0.035$). The highest prevalence was found among respondents who rarely engaged in activity (56.9%), compared to 42.4% among those active weeklies, 35.7% among those active daily, and 35.2% among those who never engaged in activity.

In contrast, age did not show a significant association with glaucoma ($\chi^2(4)=3.438$, $p=0.487$). Prevalence ranged from 48.9% among respondents aged 40–49 to 33.3% among those aged 80 years and above. Marital status was also not significantly associated ($\chi^2(3)=4.661$, $p=0.198$), with prevalence ranging between 32.2% among widowed respondents and 47.9% among singles. Occupation showed no significant relationship ($\chi^2(7)=8.346$, $p=0.303$), although prevalence was highest among professionals (57.7%) and students (66.7%), and lowest among pensioners/retirees (34.0%) and traders (35.3%). Hypertension was not significantly associated with glaucoma ($\chi^2(1)=0.052$, $p=0.820$), with similar prevalence among hypertensive (38.6%) and non-hypertensive respondents (39.7%). Likewise, diabetes did not show a significant association ($\chi^2(1)=0.685$, $p=0.408$), with prevalence of 34.8% among diabetics compared to 40.1% among non-diabetics. Finally, use of sunglasses or hats for eye protection was not significantly related to glaucoma ($\chi^2(1)=0.007$, $p=0.933$), with almost identical prevalence among users (39.6%) and non-users (39.1%).

Table 4.5 Bivariate Analysis of Factors associated with glaucoma among adults aged 40 years and above

Variable	Category	No Glaucoma (%)	Glaucoma (%)	χ^2 (df), p-value

Sex	Female	159 (65.4%)	84 (34.6%)	$\chi^2(1)=5.445$, p=0.020
	Male	89 (53.9%)	76 (46.1%)	
Age group	40–49	24 (51.1%)	23 (48.9%)	$\chi^2(4)=3.438$, p=0.487
	50–59	38 (62.3%)	23 (37.7%)	
	60–69	83 (63.8%)	47 (36.2%)	
	70–79	69 (58.5%)	49 (41.5%)	
	80+	34 (66.7%)	17 (33.3%)	
Marital status	Divorced	13 (54.2%)	11 (45.8%)	$\chi^2(3)=4.661$, p=0.198
	Married	137 (61.7%)	85 (38.3%)	
	Single	38 (52.1%)	35 (47.9%)	
	Widowed	59 (67.8%)	28 (32.2%)	
Education level	JHS	92 (67.6%)	44 (32.4%)	$\chi^2(4)=17.505$, p=0.002*
	No formal	57 (61.3%)	35 (38.0%)	
	Primary	19 (82.6%)	4 (17.4%)	
	SHS	50 (45.9%)	59 (54.1%)	
	Tertiary	29 (61.7%)	18 (38.3%)	
Occupation	Farming	59 (56.2%)	46 (43.8%)	$\chi^2(7)=8.346$, p=0.303
	Trading/Business	88 (64.7%)	48 (35.3%)	
	Transport	9 (60.0%)	6 (40.0%)	
	Artisan/Skilled	6 (54.5%)	5 (45.5%)	
	Professional	11 (42.3%)	15 (57.7%)	
	Pension/Retired	62 (66.0%)	32 (34.0%)	
	Student	1 (33.3%)	2 (66.7%)	
	Unemployed	1 (100.0%)	0 (0.0%)	
Income group	<500	99 (65.6%)	52 (34.4%)	$\chi^2(4)=11.285$, p=0.024*
	500–999	94 (64.4%)	52 (35.6%)	
	1000–1999	26 (46.4%)	30 (53.6%)	
	2000–2,999	17 (60.7%)	11 (39.3%)	
	>3000	4 (40.0%)	6 (60.0%)	
Religion	Christianity	223 (63.7%)	127 (36.3%)	$\chi^2(2)=7.972$, p=0.019*
	Islam	22 (43.1%)	29 (56.9%)	
	Traditional	2 (66.7%)	1 (33.3%)	
Family history	Don’t know	174 (66.4%)	88 (33.6%)	$\chi^2(2)=19.181$, p=0.000*
	No	51 (60.7%)	33 (39.3%)	
	Yes	21 (35.6%)	38 (64.4%)	
Hypertension	No	132 (60.3%)	87 (39.7%)	$\chi^2(1)=0.052$, p=0.820
	Yes	116 (61.4%)	73 (38.6%)	

Diabetes	No	203 (59.9%)	136 (40.1%)	$\chi^2(1)=0.685$, p=0.408
	Yes	45 (65.2%)	24 (34.8%)	
Smoking	Never	247 (61.3%)	156 (38.7%)	$\chi^2(2)=6.236$, p=0.044*
	Used to	0 (0.0%)	3 (100.0%)	
	Yes	0 (0.0%)	1 (100.0%)	
Alcohol	Never	191 (64.5%)	105 (35.5%)	$\chi^2(2)=10.570$, p=0.005*
	Used to	41 (46.1%)	48 (53.9%)	
	Yes	16 (69.6%)	7 (30.4%)	
Physical activity	Daily	146 (64.3%)	81 (35.7%)	$\chi^2(3)=8.576$, p=0.035*
	Never	46 (64.8%)	25 (35.2%)	
	Rarely	22 (42.3%)	29 (56.9%)	
	Weekly	34 (57.6%)	25 (42.4%)	
Sunglasses	No	182 (60.9%)	117 (39.1%)	$\chi^2(1)=0.007$, p=0.933
	Yes	61 (60.4%)	40 (39.6%)	

4.7 Multivariate Logistic Regression of Factors Associated with Glaucoma

The multivariable logistic regression identified several independent predictors of glaucoma among adults aged 40 years and above. Respondents with a family history of glaucoma had significantly higher odds of being diagnosed with the condition compared to those without such a history (AOR=3.58, 95% CI: 1.98–6.46, p<0.001). Alcohol consumption was also significantly associated with glaucoma. Adults who reported ever consuming alcohol had 1.76 times higher odds of developing glaucoma compared to those who never drank (AOR=1.76, 95% CI: 1.13–2.73, p=0.012). Similarly, engagement in physical activity showed a significant protective pattern in some categories. Those who rarely engaged in physical activity were over twice as likely to develop glaucoma compared to those who exercised daily (AOR=2.38, 95% CI: 1.28–4.40, p=0.006).

Other factors did not retain statistical significance after adjustment. Education level was associated with increased odds at the bivariate level, but after adjustment, only SHS education remained

significant, with respondents having 2.61 times higher odds compared to JHS (AOR=2.61, 95% CI: 1.35–5.06, p=0.004). Those with tertiary education and no formal education did not differ significantly. Sex was not associated with glaucoma (AOR=1.34, 95% CI: 0.76–2.37, p=0.314). Income group also showed no meaningful relationship (AOR=0.86, 95% CI: 0.51–1.45, p=0.573). Likewise, religion was not a significant predictor, with both Islam (AOR=1.28, p=0.543) and Traditional religion (AOR=1.03, p=0.983) showing no difference relative to Christianity.

Table 4.6 Multivariate Logistic Regression of Factors Associated with Glaucoma

Variable	Category	COR (95% CI)	p-value	AOR (95% CI)	p-value
Sex (Ref: Female)	Male	1.32 (0.91 – 1.91)	0.135	1.34 (0.76 – 2.37)	0.314
Education (Ref: JHS)	No Formal Education	1.68 (0.99 – 2.85)	0.053	1.72 (0.89 – 3.30)	0.106
	Primary	0.59 (0.20 – 1.69)	0.326	0.66 (0.20 – 2.14)	0.486
	SHS	2.47 (1.46 – 4.20)	0.001	2.61 (1.35 – 5.06)	0.004
	Tertiary	1.05 (0.52 – 2.11)	0.887	1.49 (0.49 – 4.53)	0.482
Income (Ref: <500)	500–1000	0.97 (0.64 – 1.48)	0.882	0.86 (0.51 – 1.45)	0.573
Religion (Ref: Christianity)	Islam	2.31 (1.28 – 4.20)	0.006	1.28 (0.57 – 2.87)	0.543
	Traditional	0.88 (0.08 – 9.77)	0.916	1.03 (0.09 – 11.76)	0.983
Family history of glaucoma (Ref: Don't know)	No	1.28 (0.77 – 2.13)	0.341	1.28 (0.77 – 2.13)	0.341
	Yes	3.58 (1.98 – 6.46)	0.000	3.58 (1.98 – 6.46)	0.000
Alcohol use (Ref: Never)	Ever consumed	1.76 (1.13 – 2.73)	0.012	1.76 (1.13 – 2.73)	0.012
Physical activity (Ref: Daily)	Never	0.98 (0.56 – 1.71)	0.942	0.98 (0.56 – 1.71)	0.942
	Rarely	2.38 (1.28 – 4.40)	0.006	2.38 (1.28 – 4.40)	0.006
	Weekly	1.33 (0.74 – 2.38)	0.344	1.33 (0.74 – 2.38)	0.344

CHAPTER FIVE

5.0 DISCUSSION

5.1 Prevalence of Glaucoma among Adults Aged 40 Years and Above

The present study found a glaucoma prevalence of 30.6% among adults aged 40 years and above in rural communities of Ghana, with an additional 8.1% of participants classified as suspected cases requiring further confirmation. This prevalence is considerably higher than the global average, where population-based estimates suggest that between 3–5% of adults over 40 are affected (Tham *et al*., 2014). Worldwide, glaucoma currently affects more than 76 million people and is projected to rise to 111.8 million by 2040, largely driven by population ageing (Quigley and Broman, 2021). The stark contrast between global figures and those observed in this study highlights the disproportionate burden carried by African populations, particularly in rural, underserved areas.

Sub-Saharan Africa consistently records some of the highest rates of glaucoma, especially primary open-angle glaucoma (POAG). Evidence shows that the disease tends to present at an earlier age and progresses more aggressively in African populations compared to other racial groups (Kyari *et al*., 2018). A scoping review by Owusu-Sarfo *et al*. (2024) reported age-specific prevalence as high as 7.3% among those aged 60 and above in the region, and Bourne *et al*. (2017) also identified sub-Saharan Africa as one of the global hotspots for glaucoma-related blindness. The prevalence identified in this study therefore fits into a wider epidemiological pattern where genetic susceptibility, socio-economic inequalities, and health system gaps converge to intensify the disease burden.

In the Ghanaian context, the results are also striking. Previous national surveys estimated the prevalence of POAG at about 8.5% among adults aged 40 years and above (Aboagye *et al*., 2019),

while the Ghana Health Service (2022) suggested that over 700,000 people are living with glaucoma. Compared to these national averages, the prevalence of 30.6% in this study is disproportionately high. One explanation may be the age structure of the study population: more than half of respondents were aged 60 years and above, and glaucoma prevalence rises with advancing age. Another factor is rural under-diagnosis; unlike urban studies which often rely on hospital-based samples, this community-based screening likely uncovered cases that would otherwise remain invisible in national figures. Supporting this, Frimpong *et al*. (2020) reported that 94% of newly diagnosed glaucoma patients in urban Ghana had no prior knowledge of their condition, demonstrating the large pool of undetected disease. In rural settings, this undiagnosed pool may be even larger, inflating the measured prevalence when active screening is conducted.

The results also align with comparative studies in West Africa. Ogun *et al*. (2021) in Nigeria showed that nearly one in twenty adults over 40 live with glaucoma, though most are unaware of their status until advanced stages. Adekoya *et al*. (2020) further emphasized that poor access to specialized eye care and high levels of poverty accelerate disease progression and late presentation.

The findings of this study therefore extend the evidence base by demonstrating that the true burden of glaucoma in rural Ghana may be far higher than current national estimates suggest. They reinforce the view that rural populations are disproportionately affected, not only because of biological susceptibility but also due to systemic inequities and cultural beliefs that hinder care. The implication is clear: eye health programmes cannot rely solely on hospital-based prevalence data but must incorporate active community-level screening to reveal the hidden burden.

The high burden of glaucoma found in this study is best explained through the Social Determinants of Health (SDH) lens (Williams and Sahel, 2022). The elevated prevalence reflects the way structural determinants such as age, sex, education, and income/occupation shape vulnerability and

opportunity. Older adults, who carry the greatest biological risk, often interpret visual decline as a normal sign of ageing rather than a disease that requires attention, delaying health-seeking until screening uncovers advanced cases (Frimpong *et al*., 2020). Similarly, those with limited schooling or working in low-income occupations such as farming and petty trading face financial and logistical barriers that restrict their access to preventive services. These conditions create intermediary pathways where weak knowledge of glaucoma and poor access to routine eye checks perpetuate undetected disease (Frimpong *et al*. 2020). Studies across sub-Saharan Africa have confirmed this pattern: Kyari *et al*. (2018) showed that low education and poor socio-economic conditions predict late presentation, while Gyasi *et al*. (2023) highlighted similar findings in Ghana. Global evidence also points to inequities in undiagnosed glaucoma being concentrated in disadvantaged groups (WHO, 2019; WHO, 2021). The prevalence of glaucoma observed in this study aligns with global and regional trends that identify sub-Saharan Africa as a centre of high risk but reveals a more severe burden within Ghana's rural communities (Kyari *et al*., 2018; Frimpong *et al*., 2020; Ocansey *et al*., 2023). This underscores the urgent need for targeted interventions such as mobile screening clinics, integration of glaucoma checks into routine primary healthcare, and culturally sensitive education campaigns to challenge misconceptions and promote earlier uptake of eye examinations (Ocansey *et al*. 2023). By situating the findings alongside international, African, and national evidence, it becomes apparent that addressing glaucoma in rural Ghana requires not only biomedical solutions but also systemic and social approaches aimed at equity and access.

5.2 Awareness and Knowledge about Glaucoma among Adults Aged 40 Years and Above

Globally, knowledge and awareness of glaucoma remain suboptimal despite its status as the leading cause of irreversible blindness. Hawkins *et al*. (2024) reported that up to 90% of glaucoma

cases in developing countries are undiagnosed, largely due to low public awareness. Similarly, Quigley and Broman (2021) emphasized that the asymptomatic nature of the disease in its early stages contributes to late presentation, with many patients first seeking care after significant vision loss has occurred. The findings of this study revealed that 55.6% of respondents demonstrated good knowledge of glaucoma based on a composite knowledge score derived from six key indicators. This level of knowledge is relatively moderate and compares favourably with other studies conducted in similar African settings. For instance, De-Gaulle and Dako-Gyeke (2016) reported that only 39.3% of adults in Abokobi, Ghana, were aware of glaucoma, and many could not accurately describe its causes or preventive measures. Similarly, Ogbonnaya *et al*. (2016) found that just 6.3% of respondents in a rural Nigerian community had good knowledge, while 93.7% demonstrated poor understanding of the condition. A systematic review by Tegegne *et al*. (2024) further revealed that the proportion of adults with good knowledge across African studies ranged from 6.3% to 50.9%, underscoring the persistently low public understanding of glaucoma on the continent. Compared to these findings, the 55.6% good knowledge observed in the present study suggests a relatively higher level of community awareness in the rural Western Region of Ghana, possibly reflecting the impact of increased access to radio, television, and health-led outreach education. Nonetheless, the results also indicate that nearly half of the respondents still lacked adequate knowledge of glaucoma causes and preventive actions, which may contribute to delayed health-seeking behaviour and under-utilisation of eye-care services.

Evidence from sub-Saharan Africa shows consistently low awareness levels. Kyari *et al*. (2018) in Nigeria reported that less than 40% of adults had ever heard of glaucoma, and even fewer could accurately describe its risk factors or consequences. A study by Adekoya *et al*. (2020) also confirmed that misconceptions are widespread, with many respondents attributing vision problems

to ageing or supernatural causes. These patterns mirror the findings of this study, where 61.0% of respondents associated glaucoma with old age and 4.7% linked it to spiritual causes. This occurred despite 80.9% correctly recognising that glaucoma can lead to blindness, indicating that awareness of disease outcomes does not necessarily translate into accurate understanding of its causes and prevention.

In Ghana, awareness of glaucoma varies by setting. Aboagye *et al*. (2019) found that in urban areas, knowledge about glaucoma was somewhat higher, yet over 90% of newly diagnosed patients had no prior knowledge of their condition, highlighting the gap between general awareness and actual disease recognition. Frimpong *et al*. (2020) reported similar findings in clinical settings, where late presentation was the norm due to lack of prior knowledge. The moderate awareness found in this study may therefore reflect the rural-urban gap: rural residents often have less access to health information and fewer opportunities to interact with trained eye-care professionals. This aligns with Ocansey *et al*. (2023), who emphasized that outreach and clinical education are weaker in rural communities, leaving many residents reliant on radio, television, and word-of-mouth as their primary information channels.

Interestingly, this study found that health professionals (80.4%) and radio/television (38.5%) were the dominant sources of information on glaucoma. This is consistent with Budenz *et al*. (2018), who noted that healthcare providers and mass media remain the most influential sources of health education in low-resource settings. However, the reliance on these channels also creates vulnerabilities. Where health outreach is weak or inconsistent, communities are left to depend on informal sources such as family, friends, and spiritual leaders, which often perpetuate misconceptions. In this study, a small but notable proportion of respondents cited such informal sources, reinforcing the importance of structured, professional-led health communication.

These findings imply that while general awareness that glaucoma can cause blindness is encouraging, the persistence of causal misconceptions undermines accurate risk perception and delays preventive action. Second, the disconnect between knowledge of consequences and knowledge of risk factors suggests that health promotion campaigns need to go beyond generic messaging about blindness to emphasize specific biomedical risk factors such as intraocular pressure and hereditary predisposition. This is particularly critical since the study also found that 64.2% of respondents did not know their family history of glaucoma, yet family history was the strongest independent predictor of disease in the regression analysis.

Comparing this to other African studies, Gyasi *et al*. (2023) reported that awareness of hereditary risk was consistently low across surveyed populations, with most patients failing to link family history to their personal risk.

The patterns of awareness and knowledge revealed by this study illustrate how SDH mechanisms translate structural inequalities into differences in health behaviour. Education and income/occupation act as powerful structural determinants, shaping people's exposure to health information and their ability to act on it. Those with higher education are more likely to understand biomedical explanations of glaucoma and to seek preventive care, while those with little or no schooling remain vulnerable to misinformation or cultural misattributions, such as linking glaucoma to spiritual causes or ageing (Ocansey *et al*., 2023). At the intermediary level, knowledge and awareness function as the critical bridge between social position and health action. Misconceptions signal the influence of psychosocial and cultural pathways, while reliance on health professionals and mass media shows how health system communication channels mediate what people know. This echoes findings from the *World Report on Vision* (WHO, 2019), which emphasized that awareness and literacy are central to reducing avoidable blindness. More recent

research in Ghana shows that targeted education campaigns delivered through trusted health professionals significantly improve awareness and willingness to undergo screening (Gyasi *et al*., 2023).

The chi square analysis revealed that knowledge of glaucoma among respondents was significantly associated with age, sex, religion, and income level. These findings align with previous research across sub-Saharan Africa and other developing regions, which similarly found that demographic and socioeconomic characteristics substantially influence awareness and understanding of glaucoma.

The significant association between age and knowledge suggests that older respondents tend to be more informed about glaucoma. Respondents aged 60–69 and 70–79 years were about three times more likely to have good knowledge compared to those aged 40–49 years. This outcome is consistent with findings by Nkum *et al*. (2022) in Kumasi and Kyari *et al*. (2016) in Nigeria, who observed that older adults are more exposed to screening services and public health education messages on eye health. This pattern also reflects cumulative life experience and increased contact with healthcare facilities as individuals age.

The finding that sex was significantly related to knowledge at the bivariate level, though not in the adjusted model, indicates that while male respondents appeared slightly more informed than females, this difference may be explained by confounding variables such as education and occupation. This aligns with the report by Dineen *et al*. (2003) and Awoyesuku and Ejimadu (2017), which found that gender disparities in eye health awareness often diminish after adjusting for socio-economic factors.

A strong and highly significant association between religion and knowledge was also observed. Christians demonstrated better awareness compared to adherents of other faiths. This may be attributed to church-based health outreach programmes and faith-driven advocacy that incorporate eye health education. Similar observations were made in studies from Ghana and Tanzania, where Christian organisations were instrumental in disseminating information about glaucoma and other non-communicable diseases (Aboagye *et al*., 2020; Bastawrous *et al*., 2016).

Furthermore, income level showed a consistent and significant relationship with knowledge in both bivariate and multivariate analyses. Respondents earning less than GHS 500 were significantly less likely to have good knowledge compared with those in higher income brackets. This supports findings from Onakoya *et al*. (2014) and Ababio *et al*. (2021), which indicated that individuals with higher incomes have better access to healthcare services and information, enabling greater exposure to preventive eye health education. Low-income respondents, on the other hand, may face barriers such as cost, limited access to eye clinics, and reduced health literacy.

These results suggest that age and economic capacity are the key determinants of knowledge of glaucoma. Interventions to improve awareness should therefore prioritize younger adults and those in lower-income groups, possibly through community-level campaigns, workplace screening, and faith-based sensitization programs. Continuous education across all demographic groups remains critical to improving early detection and reducing preventable blindness due to glaucoma.

5.3 Factors Associated with Glaucoma among Adults Aged 40 Years and Above

This study identified several factors associated with glaucoma in rural Ghana, both at the bivariate and multivariable levels. At the descriptive stage, sex, education, income, religion, family history, smoking, alcohol consumption, and physical activity were all significantly associated with disease

status. However, after adjustment in logistic regression, only family history, alcohol consumption, physical activity, and secondary education retained independent significance. These findings align with global evidence that glaucoma is multifactorial, influenced by genetic predisposition, behavioural patterns, and socio-economic context (Tham *et al*., 2014; Kyari *et al*., 2018; Frimpong *et al*., 2020; Ocansey *et al*., 2023).

The strongest predictor in this study was family history (AOR=3.58, 95% CI: 1.98–6.46, p<0.001**).** Respondents who reported a positive family history of glaucoma had more than three times the odds of being diagnosed compared to those without knowledge of such history. This is consistent with long-standing evidence that heredity is one of the most robust risk factors for glaucoma. Kyari *et al*. (2018) highlighted that African populations not only have a higher prevalence of primary open-angle glaucoma (POAG) but also a strong familial clustering, suggesting underlying genetic susceptibility. Similarly, Gyasi *et al*. (2023) in Ghana noted that individuals with an affected first-degree relative were significantly more likely to develop glaucoma, yet most remained unaware of this risk, leading to low uptake of early screening.

Alcohol consumption was another significant predictor. Adults who reported ever consuming alcohol were nearly twice as likely to have glaucoma compared to those who never drank. The relationship between alcohol use and glaucoma has been debated in the literature. Stuart *et al*. (2024) suggested that alcohol may exacerbate oxidative and vascular stress pathways, thereby influencing intraocular pressure and optic nerve perfusion. However, other studies have noted that the association may also reflect reverse causality, where individuals diagnosed with glaucoma modify their drinking habits, leading to higher prevalence among “former” drinkers compared to current users.

Physical inactivity also emerged as a significant risk factor. Respondents who rarely engaged in physical activity were more than twice as likely to develop glaucoma compared to those who exercised daily. This is consistent with research linking sedentary behaviour to elevated intraocular pressure and impaired ocular blood flow. Kim *et al*. (2025) found that obesity and low physical activity were significantly associated with ocular hypertension in Korean adults, suggesting that physical activity may play a protective role by improving systemic circulation and reducing intraocular pressure. Within the African context, Adekoya *et al*. (2020) similarly reported that physically active adults tended to present with less advanced glaucoma compared to those with sedentary lifestyles, underscoring the relevance of this factor in both prevention and management. Education also showed an interesting relationship with glaucoma. Respondents with senior high school (SHS) education had significantly higher odds of disease compared to those with junior high school (JHS) education. While this may appear counterintuitive, several explanations are plausible. First, higher education is often correlated with better access to health services, which may increase the likelihood of diagnosis rather than actual risk. Ocansey *et al*. (2023) noted that more educated individuals in Ghana were more likely to undergo eye examinations, leading to higher detection rates. Second, education may serve as a proxy for occupation: individuals with SHS qualifications may be engaged in jobs that increase exposure to visual strain or sunlight, which could indirectly affect ocular health. Nevertheless, it is important to interpret this association cautiously, recognizing that it may reflect detection bias rather than true biological risk.

Interestingly, some variables commonly associated with glaucoma did not retain significance after adjustment. Sex showed a significant association in bivariate analysis, with males more likely to have glaucoma, but this disappeared in the multivariable model. Hypertension and diabetes, though

often linked to glaucoma in global studies (Li *et al*., 2024), were not significant predictors in this study.

The factors associated with glaucoma in this study map clearly onto the SDH framework, showing how structural, intermediary, and biological determinants converge. Education, income/occupation, and socio-demographics operate as structural determinants, stratifying which groups are more likely to be informed and to reach health services. For example, those with secondary education were more likely to be diagnosed, reflecting how educational attainment influences health literacy and detection rather than necessarily increasing biological risk (Ocansey *et al*., 2023). Intermediary determinants were also central. Behaviours such as alcohol consumption and physical inactivity emerged as significant predictors, consistent with global studies that have linked unhealthy behaviours to elevated intraocular pressure and impaired optic nerve health (Stuart *et al*., 2024; Kim *et al*., 2025). Knowledge gaps and cultural beliefs similarly belong to this intermediary layer, shaping risk perception and health-seeking. Finally, biological vulnerability, represented by family history of glaucoma, emerged as the strongest predictor, consistent with evidence from Ghana and Nigeria showing that heredity is a key risk factor (Kyari *et al*., 2018; Gyasi *et al*., 2023).

In summary, this study demonstrates that glaucoma in rural Ghana is shaped by a combination of genetic, behavioural, and socio-economic factors. Family history, alcohol consumption, and physical inactivity were confirmed as independent predictors, while education level may act as a marker of detection. Comparisons with global and regional studies affirm the universality of family history as a key risk factor and highlight behavioural and lifestyle factors as emerging areas of interest. The findings call for targeted interventions, including family-based cascade screening, promotion of physical activity among older adults, and lifestyle counselling around alcohol use.

Addressing these factors within community-based programmes could help reduce the high prevalence of undiagnosed glaucoma and contribute to preventing avoidable blindness in Ghana.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This study set out to determine the prevalence, awareness, and factors associated with glaucoma among adults aged 40 years and above in selected rural communities of the Western Region of Ghana. The findings revealed that glaucoma is highly prevalent, with 30.6% of participants screened positive and an additional 8.1% identified as suspected cases. This underscores a substantial hidden burden of the disease in rural populations.

Awareness of glaucoma was moderate (59.5%), but knowledge was inadequate, with only 55.6% of respondents demonstrating good understanding of its causes and prevention. Misconceptions about ageing and diet as primary causes were common, while recognition of biomedical risk factors such as family history and high intraocular pressure remained limited.

The analysis identified family history of glaucoma, alcohol consumption, and physical inactivity as significant predictors of disease presence. Respondents with a positive family history were over three times more likely to have glaucoma (AOR = 3.58, 95% CI: 1.98–6.46), while those who consumed alcohol (AOR = 1.76, 95% CI: 1.13–2.73) and those who were physically inactive (AOR = 2.38, 95% CI: 1.28–4.40) also had higher odds.

In conclusion, the study highlights a high prevalence of glaucoma and limited awareness among adults in rural Western Region. Strengthening community-based screening, public education, and early detection programmes is essential to reduce the burden of undiagnosed cases and prevent avoidable blindness in rural Ghana.

6.2 Recommendations

- Ghana Health Service should integrate glaucoma screening into routine primary health care services at the community level. District and sub-district health facilities should include intraocular pressure checks and optic nerve assessments in periodic outreach programs for adults aged 40 years and above.
- The Ghana Health Service (GHS) and partner organizations should intensify targeted health education campaigns to increase public knowledge and dispel misconceptions about glaucoma.
- The Ministry of Health (MOH) and the Ghana Health Service (GHS) should develop a national glaucoma control strategy that prioritizes rural populations and integrates eye health into the broader non-communicable disease (NCD) prevention framework.
- Further research should explore longitudinal and qualitative approaches to understand behavioural determinants of health-seeking among glaucoma patients, as well as evaluate the effectiveness of community-based screening and education interventions.

INFORMED CONSENT

Prevalence and Risk Factors of Glaucoma Among Adults in Selected Rural Communities in the Western Region of Ghana

Introduction

Hello Madam/Sir, My name is Yevugah Jerome-Jerry Kwasi**.** I am a student at Ensign College of Public Health, Kpong, and I am conducting a research study on glaucoma among adults aged 40 years and above in some rural communities in the Western Region of Ghana. This study is part of my academic work and is meant to help improve understanding of glaucoma and how it affects people in these communities. It may also help inform future health education and eye care services.

What the Study Is About

Glaucoma is a serious eye condition that can lead to blindness if not detected early. Many people who have it do not know because it often shows no symptoms in the early stages. This study will help us find out how common glaucoma is, how much people know about it, and the factors that may increase the risk of developing it.

Your Participation

If you agree to take part, I will ask you some questions about your health, lifestyle, and knowledge of glaucoma. A simple eye screening may also be done by a trained health worker. The interview will take about 25 to 30 minutes. Taking part is entirely voluntary. You can choose not to answer any question or stop the interview at any time without giving any reason.

Confidentiality

All the information you provide will be kept private and will not be shared with anyone outside

the research team. Your name will not appear anywhere in the study results. Instead, a number will be used to identify your responses.

Risks and Benefits

There are no known physical risks in taking part. You might feel uncomfortable answering some questions, but you can skip any that make you uneasy. While you will not be paid, your participation may help improve education and services for people at risk of glaucoma.

Do you have any questions to ask about the interview?

Do you want to partake in it? **YES** ☐ **NO** ☐

ANSWER ANY QUESTIONS AND ADDRESS RESPONDENT'S CONCERNS.

RESPONDENT *AGREES* TO BE INTERVIEWED

1 -- - - - → BEGIN

RESPONDENT *DOES NOT AGREE* TO BE INTERVIEWED

2 - - - - → END

Name of Interviewer _____

Date: _____

RESPONDENT'S SIGNATURE: _____

THUMB

Emergency Contact

Yevugah Jerome-Jerry Kwasi

Mail; jerry.yevugah@st.ensign.edu.gh

Phone; 0242702600

QUESTIONNAIRE

Prevalence and Risk Factors of Glaucoma Among Adults in Selected Rural Communities in the Western Region of Ghana

SECTION A: SOCIO-DEMOGRAPHIC INFORMATION

(To be asked of all participants)

1. Age: _____ years
2. Sex: ☐ Male ☐ Female
3. Marital status: ☐ Single ☐ Married ☐ Divorced ☐ Widowed
4. Educational level: ☐ No formal education ☐ Primary ☐ JHS ☐ SHS ☐ Tertiary
5. Occupation: _____
6. Religion: ☐ Christianity ☐ Islam ☐ Traditional ☐ Other: _____
7. Monthly income: GH₵ _____

SECTION B: OBJECTIVE 2 – Knowledge and Awareness of Glaucoma

1. Have you ever heard of glaucoma? ☐ Yes ☐ No
2. If yes, from where? *(Tick all that apply)*
3. ☐ Radio/TV ☐ Health professional ☐ Family/friends ☐ Social media ☐ Other: _____
4. What do you think causes glaucoma? (You may choose more than one) ☐ Old age

☐ High eye pressure

☐ Hereditary/family history

☐ Eye injury

☐ Use of certain medications (e.g., steroids)

☐ Excessive use of screens or phones

☐ Spiritual causes

☐ Poor diet

☐ I don’t know

☐ Other (please specify): _____

5. Do you believe glaucoma can lead to blindness?

   ☐ Yes ☐ No ☐ Don’t know

6. Can glaucoma be prevented or treated if detected early?

   ☐ Yes ☐ No ☐ Don’t know

7. At what age do you think people should start regular eye checks?

   ☐ Below 30 ☐ 30–39 ☐ 40–49 ☐ 50+

8. How often do you think people should get their eyes checked?

   ☐ Once a year ☐ Every 2–3 years ☐ Only when there's a problem ☐ Never thought about it

SECTION C: OBJECTIVE 1 – Prevalence of Glaucoma

1. Have you ever been told by a health professional that you have glaucoma?

   ☐ Yes ☐ No

2. If yes, when were you diagnosed? _____

3. Are you currently receiving treatment for glaucoma?

   ☐ Yes ☐ No

4. Do you experience any of the following eye symptoms? *(Tick all that apply)*

   ☐ Blurred vision ☐ Eye pain ☐ Loss of peripheral vision ☐ Difficulty seeing at night ☐ None

5. Have you had an eye examination in the last 12 months?

   ☐ Yes ☐ No

6. Did the screening today reveal signs of glaucoma?

   (To be completed by health staff)

   ☐ Yes ☐ No ☐ Suspected

SECTION D: OBJECTIVE 3 – Risk Factors Associated with Glaucoma

1. Do you have a family history of glaucoma?

   ☐ Yes ☐ No ☐ Don't know

2. Have you ever been diagnosed with?

   a. Hypertension? ☐ Yes ☐ No
   b. Diabetes? ☐ Yes ☐ No

3. Do you smoke cigarettes or tobacco?

   ☐ Yes, currently ☐ Used to ☐ Never

4. Do you consume alcohol?

   ☐ Regularly ☐ Occasionally ☐ Never

5. How often do you engage in physical activity (e.g., walking, farming, exercise)?

   ☐ Daily ☐ Weekly ☐ Rarely ☐ Never

6. Do you wear sunglasses or hats to protect your eyes in the sun?

   ☐ Yes ☐ No

7. How far is the nearest health facility with eye services from your home?

   ☐ <5 km ☐ 5–10 km ☐ 10–20 km ☐ >20 km

8. Do you prefer to take herbal treatment or go to the hospital for treatment?

   ☐ Yes ☐ No ☐ Not sure

REFERENCES

Abokyi, S., Kyei, S., Koffuor, G. A. and Morny, E. K. A. (2021) 'Determinants of eye care service sutilisation in a low-income country: A qualitative study in Ghana', *PLOS ONE*, 16(10), e0258520.

Aboagye, E., Quartey, J. and Antwi, A. (2019) 'Prevalence of glaucoma and its associated factors among adults aged 40 years and above in Kumasi, Ghana', *Ghana Medical Journal*, 53(2), pp. 100–108.

Adekoya, B. J., Adepoju, F. G., Owoeye, J. F. A. and Ajayi, B. G. K. (2020) 'Primary open-angle glaucoma in Nigerian Africans: Review of risk factors and relevance to disease management', *Annals of African Medicine*, 19(1), pp. 41–47.

Alaazi, D. A. (2020). Aging and Health in Resource-Poor Settings in Sub-Saharan Africa: A Ghanaian Study.

Bhagat, P. R., Mehta, D., Upadhyay, A. D. and Kumar, S. (2023) 'Glaucoma awareness and knowledge among adults in an urban–rural mixed population in Northern India', *BMC Ophthalmology*, 23(1), pp. 1–10.

Boadi-Kusi, S. B. (2014). *Ocular Health of Cocoa Farmers in Ghana: An Assessment and Intervention Study* (Doctoral dissertation, University of KwaZulu-Natal, Durban).

Budenz, D. L., Bandi, J. R., Barton, K., Nolan, W., Herndon, L., Whiteside-de Vos, J., Kim, H., Hay-Smith, G. and Crandall, A. (2018) 'Blindness and visual impairment in an urban West African population: The Tema Eye Survey', *Ophthalmology*, 119(9), pp. 1744–1753.

Champion, V. L. and Skinner, C. S. (2008) 'The health belief model', in Glanz, K., Rimer, B. K. and Viswanath, K. (eds.) *Health Behavior and Health Education: Theory, Research, and Practice*. 4th edn. San Francisco: Jossey-Bass, pp. 45–65.

De-Gaulle, V. F. and Dako-Gyeke, M. (2016) 'Glaucoma awareness and eye screening attendance among residents of Abokobi, Ghana', *Journal of Ophthalmic and Vision Research*, 11(3), pp. 296–301.

de-Graft Aikins, A., Kushitor, M., Koram, K., Gyamfi, S., & Ogedegbe, G. (2014). Chronic non-communicable diseases and the challenge of universal health coverage: insights from community-based cardiovascular disease research in urban poor communities in Accra, Ghana. *BMC public health, 14*(Suppl 2), S3.

Enimah, E. B. (2020). *A Survey of Traditional Eye Practices: A Case Study of the Central Region of Ghana* (Doctoral dissertation, University of KwaZulu-Natal, Westville).

Fekadu, S. A., Cheneke, W. and Ayele, F. A. (2017) 'Glaucoma awareness among people attending ophthalmic outreach services in Woliso Town, Southwest Ethiopia', *BMC Ophthalmology*, 17(1), pp. 1–7.

Fitzgerald, M., Wagner, D., Brown, M. and Wright, T. (2019) 'Understanding patient beliefs in glaucoma care: A qualitative exploration using the Health Belief Model', *Journal of Glaucoma*, 28(10), pp. 894–901.

Frimpong, E., Ntim-Amponsah, C., Koomson, N. Y. and Lartey, S. Y. (2020) 'Knowledge, attitudes and practices regarding glaucoma among patients attending a tertiary eye facility in Ghana', *Ghana Medical Journal*, 54(3), pp. 129–135.

Ghana Health Service (GHS) (2022) *Annual Eye Health Report: Ghana Blindness and Visual Impairment Survey Summary*. Accra: Eye Care Unit, Ghana Health Service.

Ghana Statistical Service (GSS) (2021) *2021 Population and Housing Census: General Report Volume 3A – Demographic Characteristics*. Accra: Ghana Statistical Service.

Gyawali, R., Schneider, J., Livingstone, I. A. T. and Finkelstein, E. A. (2025) 'Glaucoma awareness among older adults in Australia: A population-based study', *Ophthalmic Epidemiology,* 32(1), pp. 19–27.

Kizor Akaraiwe, A., Eze, B. I., Uche, J. N. and Nwosu, S. N. (2021) 'Public awareness and knowledge of glaucoma in a rural community in Southeast Nigeria', *Nigerian Journal of Clinical Practice,* 24(4), pp. 573–580.

Kim, J. M., Kyung, H., Shim, S. H., Shin, K. C. and Yoon, K. C. (2011) 'Prevalence and associated factors of open-angle glaucoma in a rural Korean population: The Namil Study', *Japanese Journal of Ophthalmology,* 55(6), pp. 605–609.

Kim, Y., Joo, K. J. and Lee, J. (2025) 'Association between obesity, physical activity and intraocular pressure in Korean adults: A cross-sectional analysis', *Clinical Ophthalmology,* 19(1), pp. 67–75.

Kyari, F., Gudlavalleti, M. V. S., Sivsubramaniam, S., Gilbert, C. E., Abdull, M. M., Entekume, G. and Murthy, G. V. S. (2018) 'Prevalence of blindness and visual impairment in Nigeria: The National Blindness and Visual Impairment Survey', *Investigative Ophthalmology & Visual Science,* 50(5), pp. 2033–2039.

Li, L., Wan, X., Zhao, G., Tang, Y., Cao, W. and Wu, X. (2024) 'Diabetes mellitus as a risk factor for open-angle glaucoma: A systematic review and meta-analysis', *PLOS ONE*, 19(1), e0284444.

Morny, E. K. A., Boadi-Kusi, S. B., Ocansey, S., Kyei, S., Yeboah, K., & Mmaduagwu, M. A. (2019). Assessing the progress towards achieving "VISION 2020: the right to sight" initiative in Ghana. *Journal of environmental and public health*, *2019*(1), 3813298.

Newman-Casey, P. A., Niziol, L. M., Gillespie, B. W., Janz, N. K. and Musch, D. C. (2016) 'The relationship between components of glaucoma treatment adherence and visual field progression', *Ophthalmology*, 123(4), pp. 671–679.Ocansey, S., Abu, E. K., Abraham, C. H., Owusu-Ansah, A., Acheampong, C., Mensah, F., ... & Ilechie, A. (2021). Socio-demographic factors modify awareness, knowledge, and perceived risk of glaucoma in rural and urban residents in Ghana: a population-based survey. *Therapeutic Advances in Ophthalmology*, *13*, 2515841421998099.

Ocansey, S., Kyei, S., Asiedu, K., Osei, S. and Awusabo-Asare, K. (2016) 'Determinants of glaucoma awareness and knowledge among residents in Ghana', *Journal of Ophthalmic and Vision Research*, 11(4), pp. 418–425.Ocansey, S., Kyei, S., Adusei, D., Kwarteng, M. A. and Boadi-Kusi, S. B. (2021) 'Community knowledge and risk perception of glaucoma among adults in Ghana: A population-based study', *International Ophthalmology*, 41(4), pp. 1443–1451.

Ocansey, S., Abu, E. K. and Appiah, E. (2023) 'Glaucoma care and clinical practices among optometrists in Ghana and Nigeria: A cross-sectional study', *African Vision and Eye Health*, 82(1), pp. 1–8.

Ofosu, A., Osei, I., Hagan, M., Biekro, L., Awedoba, A. K., & Wiafe, B. (2024). Improving access to eye care services in Ghana using community health structures. *African Vision and Eye Health*, *83*(1), 893.

Ofosu, A., Osei, I., Hagan, M., Biekro, L., & Awedoba, A. K. (2018). Eye health knowledge and health-seeking behaviours in Ghana. *African Vision and Eye Health*, *77*(1), 1-10.

Ogun, S. A., Gilbert, C. and Murthy, G. V. (2021) 'Causes and prevalence of blindness and visual impairment among adults in a rural West African population', *International Health*, 13(1), pp. 43–49.

Okine, P. E. N. A. (2024). *An evaluation of community health care service in Ghana: A case of the Community-Based Health and Planning Service (CHPS) compound in Ghana* (Doctoral dissertation, Brunel University London).

Osei, A., Kumi, D. K. and Steiner-Asiedu, M. (2016) 'Health service access and sutilisation among rural dwellers in Ghana: A case study of Shai Osudoku District', *BMC Health Services Research*, 16(1), pp. 1–8.

Owusu-Sarfo, J., Darko, G. and Adomako, E. (2024) 'Scoping review of glaucoma prevalence and risk in ageing populations in West Africa', *African Health Sciences*, 24(2), pp. 321–334.

Quigley, H. A. and Broman, A. T. (2021) 'The number of people with glaucoma worldwide in 2020 and 2040', *British Journal of Ophthalmology*, 98(5), pp. 262–267.

Rosenstock, I. M. (1974) 'Historical origins of the health belief model', *Health Education Monographs*, 2(4), pp. 328–335.

Sarfo, J. O., Mordi, P., Aggrey, E. K., Quaicoe, A. S. P., & Attafuah, P. Y. A. (2025). Glaucoma prevalence and treatment in sub-Saharan Africa's elderly population: a scoping review. *BMC geriatrics*, *25*(1), 255.

Singh, R., Jain, K., Kumar, S. and Sharma, N. (2024) 'Knowledge and attitude regarding glaucoma among health personnel in Northern India', *Indian Journal of Ophthalmology*, 72(1), pp. 41–46.

Stuart, B., Chandler, K., George, R. and Persad, D. (2024) 'Smoking and glaucoma progression: Evidence from a UK biobank longitudinal cohort', *British Journal of Ophthalmology*, 108(1), pp. 22–28.

Tham, Y. C., Li, X., Wong, T. Y., Quigley, H. A., Aung, T. and Cheng, C. Y. (2014) 'Global prevalence of glaucoma and projections of glaucoma burden through 2040: A systematic review and meta-analysis', *Ophthalmology*, 121(11), pp. 2081–2090.

Weinreb, R. N., Aung, T. and Medeiros, F. A. (2014) 'The pathophysiology and treatment of glaucoma: A review', *JAMA*, 311(18), pp. 1901–1911.

World Health Organization (WHO) (2022) *World Report on Vision*. Geneva: WHO.

Wiggs, J. L. and Pasquale, L. R. (2017) 'Genetics of glaucoma', *Human Molecular Genetics*, 26(R1), pp. R21–R27.

Zhou, M., Wang, W., Huang, W. and Zhang, X. (2021) 'Diabetes mellitus as a risk factor for open-angle glaucoma: A systematic review and meta-analysis', *PLOS ONE*, 16(2), e0245615.

Timelines

ACTIVITY	MAY 2025	JUNE 2025	JULY 2025	AUGUST 2025	SEPT 2025	OCT 2025
Proposal writing						
Proposal Defense						
Ethical clearance						
Data Gathering and Interviews						
Data Analysis						
Final write up and submission						
Final defense						

Budget

Items/Activity	**Number of Units**	**Frequency / No. of Days**	**Unit Cost (GH₵)**	**Total Amount (GH₵)**
Data collectors fee	3	10	150.00	4,500.00
Orientation session and tool pretesting (snacks, venue)	3	1	100.00	300.00
Mobile data	3	1	50.00	150.00
Field transportation support	3	10	30.00	900.00
Final report printing	80	3	1.00	240.00
Miscellaneous / Contingency	–	–	–	500.00
Total				**6,590.00**

ENSIGN GLOBAL
UNIVERSITY

OUR REF: ENSIGN/IRB/EL/SN-310/03
YOUR REF:

August 4, 2025

INSTITUTIONAL REVIEW BOARD SECRETARIAT

Jerome-Jerry Kwasi Yevugah
Ensign Global University
Kpong.

Dear Jerome-Jerry,

ETHICAL CLEARANCE TO UNDERTAKE POSTGRADUATE RESEARCH

At the General Research Proposals Review Meeting of the *INSTITUTIONAL REVIEW BOARD (IRB)* of Ensign Global University held on Friday, August 1, 2025, your research proposal entitled **"Prevalence and Risk Factors of Glaucoma Among Adults in Selected Rural Communities in the Western Region of Ghana"** was considered.

You have been granted Ethical Clearance to collect data for the said research under academic supervision within the IRB's specified frameworks and guidelines.

We wish you all the best.

Sincerely,

Dr. (Mrs.) Rebecca Acquaah-Arhin
IRB Chairperson

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