The common effects of T2DM on ocular functions in Mashonaland province of Zimbabwe

Tanya Chagaresango

B213375B

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Research Project

Department of Optometry

Faculty of Science and Engineering

Bindura University of Science Education

Supervisor: Dr Mtuwa

APPROVAL FORM

The undersigned certify that they have read and recommend to Bindura University of Science Education for acceptance, a dissertation entitled "The common effects of T2DM on ocular functions in Mashonaland province of Zimbabwe" submitted by Tanya Chagaresango Registration No B213375B in partial fulfillment of the requirements for the degree of Bachelor of Science Honours Degree in Optometry (HBScOpt).

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Dr C N Mtuwa

Supervisor's signature:

Optometry Department Chairperson's signature

Date: 28/07/2025.

Student's Name:

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DECLARATION

I, Chagaresango Tanya do hereby declare that this piece of work is my own and that all work of other people has been dully acknowledged and that this work has not been previously presented at the Bindura University of Science Education and indeed any other University for similar purposes.

Signature …….

Date …….

DEDICATION

I dedicate this research project to my parents, whose unwavering support, encouragement, and sacrifices have been the foundation of my academic journey. Their belief in my potential has been my greatest motivation.

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to all those who contributed to the successful completion of this research project.

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To my friends and classmates, thank you for the discussions, encouragement, and all the shared academic experiences. Your companionship made this process more manageable and memorable.

Above all, I thank the Almighty God for granting me the strength, wisdom, and perseverance to complete this research.

ABSTRACT

BACKGROUND**:** Type 2 Diabetes Mellitus (T2DM) is a growing public health concern globally, with a significant burden in sub-Saharan Africa. Among its numerous complications, ocular disorders are among the most common and debilitating, yet often underdiagnosed in resource-limited settings.

AIM: This study aimed to investigate the common ocular effects of T2DM and assess the knowledge and health-seeking behavior of affected individuals in Mashonaland Central Province, Zimbabwe.

METHODS**:** A descriptive cross-sectional study was conducted from February to June 2025 among 112 participants diagnosed with T2DM, recruited from Bindura Hospital and nearby mining communities. Data collection involved questionnaires, medical records review, and clinical eye examinations. Statistical analysis was carried out using SPSS version 21 to assess the prevalence of ocular symptoms and conditions, as well as demographic associations.

RESULTS**:** The most reported ocular symptoms were blurred vision (36.6%), eye pain (28.6%), and sudden loss of vision (18.8%). Clinically diagnosed ocular complications included diabetic retinopathy (34%), cataracts (21%), and glaucoma (15%). A significant proportion of participants (39.8%) also presented with hypertension as a comorbid condition. Alarmingly, only 46% of respondents reported visiting an eye specialist regularly, indicating a gap in preventive care and awareness.

CONCLUSION**:** The findings highlight a high prevalence of ocular complications among T2DM patients in Mashonaland Central, with many experiencing visual disturbances that could lead to irreversible vision loss if undetected. These results underscore the need for integrated diabetes management that includes routine eye screening, public health education, and improved access to ophthalmic care. Early intervention strategies are essential to prevent vision impairment and enhance quality of life for diabetic individuals.

ACRONYMS

T2DM:	Type 2 Diabetes Mellitus
T1DM:	Type 1 Diabetes Mellitus
MIDD:	Maternally Inherited Diabetes and Deafness
MODY:	Maturity-Onset Diabetes of the Young
LADA:	Latent Autoimmune Diabetes in Adults
DR:	Diabetic Retinopathy
IDF:	International Diabetes Federation
OCT:	Optical Coherence Tomography
WHO:	World Health Organization
MRCZ:	Medical Research Council of Zimbabwe
SPSS:	Statistical Package for the Social Sciences
VA:	Visual Acuity

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CHAPTER ONE

1.1 Introduction

Diabetes mellitus is a complicated chronic illness marked by poor insulin production, increased glucagon secretion, and/or hyperglycemia brought on by insulin resistance. Type 1 and type 2 diabetes mellitus are the two most prevalent forms of the disease. The autoimmune disease known as type 1 diabetes causes the pancreatic beta cells that produce insulin to be destroyed. Approximately 90% of all instances of diabetes are type 2, which is more prevalent. The primary cause is insulin resistance, which results in hyperglycemia when there is insufficient beta cell responsiveness. Other forms of diabetes include Maturity-Onset Diabetes of the Young (MODY) and Maternally Inherited Diabetes and Deafness (MIDD), which are caused by genetic mutations; Latent Autoimmune Diabetes in Adults (LADA), which is usually identified by the presence of glutamic acid decarboxylase (GAD) antibodies; and Gestational Diabetes, which develops during pregnancy; and Neonatal Diabetes, which develops during the first six months of life. The researcher discusses how type 2 diabetes affects eye function in Zimbabwe's Mashonaland Central Province in this chapter. Globally, the prevalence of diabetes has been rising to epidemic levels, highlighting the need for research to enhance treatment and avert complications.

1.2 Background and need

Diabetes was recognized by some of the first doctors in history. Diabetic symptoms have been documented in Ebers papyrus as early as 1500 BC. Additionally, in the 5th century BC, the renowned Indian surgeon Sushruta used the term "madhumeha," which means honey-like urine, to describe diabetes. The pee, he observed, had a sweet taste, was sticky, and attracted ants. Also, he noticed that it was more common among the upper castes and was associated with a diet high in rice, cereal, and sugar. Beginning in the eighth century AD, doctors observed eye problems, rodent ulcers, and furuncle infections as side effects of diabetes.

Physician Thomas Willis made remarks about the sweetness of urine in diabetes patients in the 17th century. He also created the term mellitus to distinguish between excessive production of sweet urine and "insipidus," which is the excessive production of non-sweet urine. He proposed

that blood affection, not renal affection, was the cause of diabetes mellitus. He identified diabetic neuropathy in the patients as well, characterizing it as "twinging of the tendons and muscles, frequent contractions or convulsions, and other disturbances." In 1794, Johann Peter Frank is recognized for having made the distinction between diabetes mellitus and diabetes insipidus.

Claude Bernard discovered in the 19th century that the liver was accumulating a starchy, water-insoluble material that he called glycogen. This substance was then transformed into sugar or glucose and released into the bloodstream. He postulated that diabetes was brought on by an overabundance of this hormone. Following pancreatectomies on dogs in the late 1800s, Joseph von Mering and Oskar Minkowski demonstrated that the pancreas was an internal secretory gland crucial to the preservation of glucose homeostasis. In 1923, John MacLeod, Charles Best, and Frederick Banting made the discovery of insulin.

Even though diabetics have been known to have vision difficulties since the eighth century AD, it wasn't until Hermann von Helmholtz invented the ophthalmoscope in 1951 that it became feasible to see the back of the eye. The first person to notice alterations in the macula associated with diabetes was Edward Jaegar, who in 1856 reported that one patient's macular region had "roundish or oval, yellowish spots and extravasations that permeated part of the whole thickness of the retina." Von Graefe criticized Jaegar, saying there was no evidence of a casual relationship. Jaegar's observations were later validated by additional research conducted by other individuals, such as Theodor Leber. However, until Arthur James Ballantyne's research indicated that diabetic retinopathy (DR) was a distinct vasculopathy, the controversy persisted into the 20th century. He gave an example of how changes to the capillary wall contribute to the development of maculopathy and DR.

1.3 Problem statement

Individuals who are more likely to develop type 2 diabetes are typically older, lead unhealthy lifestyles, have central adiposity or obesity, and engage in little physical activity. Type 2 diabetes is more likely to strike women who have experienced gestational diabetes in the future. Different ethnic groups are disproportionately affected by type 2 diabetes. Type 2 diabetes is more common in Asian Americans, Native Americans, African Americans, and Hispanic Americans. Additionally, type 2 diabetes has a strong hereditary propensity. The metabolic syndrome, which includes elevated triglycerides, low serum HDL cholesterol, hypertension, and a larger waist circumference, is frequently linked to type 2 diabetes.

Typical signs of type 2 diabetes include fatigue, impaired vision, thirst, polyuria, and infection susceptibility. But it is usually asymptomatic until hyperglycemia is established, so it may go years without being noticed. Screening procedures to identify diabetes are crucial because people might still develop diabetes consequences such glaucoma, cataracts, DR, and ocular surface diseases during this asymptomatic phase.

People with type 2 diabetes can get a variety of therapies, such as insulin, oral drugs, lifestyle changes, and other injectable treatments, depending on their level of glycemia.

1.4 Research question

To establish the common effects of types 2 diabetes on ocular functions in Mashonaland Central province of Zimbabwe.

1.5 Objectives

- To identify the systemic risk factors of T2DM.
- To investigate the effects of T2DM on the structures of the eye
- To determine how well-informed diabetes patients are about the condition and its symptoms in the eyes
- To describe treatment strategies and screening guidelines

1.6 Significance of study

Due to a lack of prior research, the results of this study may have clinical value in the Zimbabwean context. Since there haven't been many studies done in Zimbabwe on optometry, the results will contribute to the body of knowledge already in existence. It will also be used as a template for further studies. Due to the prevalence of diabetes and its complications around the world, medical practitioners are being asked to look for signs of diabetic eye disease before symptoms appear. Knowing how type 2 diabetes affects ocular functions can aid in early detection and the identification of preventive methods to lower the risk of vision loss. Type 2 diabetes is one of the main causes of blindness in the world. However, a large number of diabetics and medical professionals are ignorant of the importance of routine eye exams. This study aims to inform healthcare professionals and caregivers about the increasing incidence of diabetic-related eye illness and the steps they can take to combat it. In addition to improving care for individuals with diabetes by promoting integration and collaboration throughout the health system, this study intends to promote and facilitate early diagnosis and treatment of diabetic eye disease by educating people about eye disease as a possible complication of diabetes. This study will contribute to the creation of novel treatments and therapies by offering insightful information on the fundamental mechanisms driving diabetes-related ocular disorders.

2.0 CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter provides a preliminary analysis of the available research data about the common effects of type 2 diabetes on ocular functions.

2.2 Type 2 diabetes and ocular effects

2.2.1 Global review

It is commonly recognized that diabetics have decreased corneal sensitivity, which impairs reflex tear production (2011). Saito et al. (2003) found that reflex tearing might be considerably decreased with even a slight decrease in corneal sensation. Ironically, when corneal sensitivity decreases, fewer artificial tears are used (Nepp et al., 2000). Furthermore, chronic illness may harm the lacrimal gland's microvascular supply, which would hinder lacrimation (Kaiserman et al., 2005). In as many as two-thirds of their patients, Schultz et al. (1981) discovered anomalies of the corneal epithelium, ranging from superficial punctate keratitis to full thickness fractures. The patients' decreased peripheral feeling was also found to be correlated with the degree of keratopathy, indicating that their epithelial abnormalities were a further sign of polyneuropathy.

Additionally, Ljubimov et al. discovered that diabetes individuals had aberrant corneal basement membranes, which were more common in retinopathy patients. The development of persistent and recurring epithelial defects may be explained by anomalies in the corneal basement membrane, but they have also been linked to the corneas' diminished capacity to serve as an infection barrier. Gökka et al. and Göbbels et al. found that reduced corneal epithelial barrier function in diabetic patients was linked to higher HbA1c levels, a longer duration of the disease, and the development of diabetic retinopathy. This impaired barrier is likely the reason why diabetes people are more likely to develop ocular infections such fungal keratitis (Donaldson et al., 2006).

Corneal endothelial dysfunction caused by hyperglycemia has been linked to increased corneal thickness. Saini & Mittal found that type 2 diabetics had significantly lower corneal endothelial function than controls, and that individuals with diabetic retinopathy had the most adverse effects on endothelial function.

Nevertheless, a number of studies refuted the link between diabetes and uveitis. Moore, Waite & Beetham, Rothova et al. concluded that there was, in fact, such a link because type 1 diabetes was present in 63% of their patients with idiopathic anterior uveitis. Half of these individuals had chronic posterior synechiae or cataracts, and several of them had long-term uveitis issues. Most patients with diabetes and anterior uveitis also had a substantial systemic diabetic consequence, including nephropathy, neuropathy, or angiopathy. Guy et al. discovered a strong link between diabetic autonomic neuropathy and iritis. As a result, 30% of their type 1 diabetes patients with autonomic neuropathy experienced iritis, compared to 0.7% of those without the condition. Remarkably, in all but two of these cases, the onset of autonomic neuropathy was preceded by the development of iritis; in 11 of these patients, the recurring and bilateral iritis was present.

However, Wiemer et al. did note that diabetes had an impact on the posterior cornea's refractive power; as this alteration had no influence on the cornea's overall power, it is still plausible that the refractive changes observed in diabetics are caused by lens modifications. Newly diagnosed diabetics show alterations in accommodation in addition to refractive abnormalities. According to Waite and Beetham, 21% of diabetics experience temporary paralysis of accommodation; these patients are often between the ages of 20 and 50. Over the course of 25 years, Watanabe et al. discovered that 1% of diabetes participants had cranial nerve palsy, which was 7.5 times more common than in non-diabetic subjects. Interestingly, Trigler et al. (2003) found that diabetic individuals with cranial nerve palsies had a considerably lower rate of diabetic retinopathy. The Watanabe et al. investigation discovered that facial nerve palsies and oculomotor palsies were the most prevalent mononeuropathies in diabetes patients.

2.2.2 African review

Worldwide, the prevalence of diabetes mellitus (DM), a multisystemic disease marked by hyperlycemia, is rising.In 2000, it was estimated that 171 million people had diabetes mellitus(DM); estimates for the next three decades suggest that this number might rise to 366 million, with emerging nations being the most affected.According to reports, over 80% of the 7.5 million DM cases that occurred in Africa in 2000 were undetected.According to the International Diabetes Federation, the amount of persons with DM in subSaharan Africa is currently anticipated to

be over 7.1 million, and by 2025, the figure is likely to rise to 15 million. In Ghana, diabetes was estimated to affect between 0.2 and 0.4% of the population a few decades a go. At the Korle Bu Teaching Hospital in Accra, Ghana, diabetes currently accounts for 6.8% of adult admissions, indicating a steady change in the situation. The results of a population-based survey conducted in Accra, which found a prevalence of 6.3% among participants aged 25 and over, are comparable to this estimate. According to the president of the National Diabetes Association, around 4 million people in Ghana are currently estimated to have diabetes. Age, diet, obesity, and physical inactivity are some of the risk factors that may be responsible for this rise in prevalence. Patients with diabetes experience ocular abnormalities as well as other systemic consequences. Diabetes-related ocular problems are thought to affect 4.51 million people with diabetes in sub-Saharan Africa. The likelihood of vision loss is roughly 25 times larger for people with DM than for the people at large. With DR alone accounting for twelve thousand to twenty-four thousand recent occurrences of vision loss annually in the US, the prevalence of vision loss or blindness brought on by ocular consequences of diabetes poses a serious public health concern. Other recognized causes of diabetes-related blindness include macular degeneration, glaucoma, cataracts, and nerve palsies. Due to the nature of their condition, diabetic patients must be sufficiently informed about their condition in order to have a good attitude toward receiving medical care. Despite the higher risk of blindness, research indicates that the majority of diabetic individuals do not seek out the recommended eye exams (such a routine dilated fundus check) that are meant to prevent blindness and visual impairment.

2.2.3 Zimbabwean review

The need for this study comes from the lack of research on type 2 diabetes and its effect(s) on ocular functions.

3.0 CHAPTER THREE: METHODOLOGY

3.1 Introduction

This chapter outlines the study methodology that was employed to identify the typical effects associated with type 2 diabetes on the functions of the eyes.

3.2 Study setting

The Mashonaland central province will be the site of this investigation.

3.3 Study design

This study will be a descriptive cross-sectional study.

3.4 Study period

The research will be conducted from February 2025 to June 2025

3.5 Study population

The sample group will be mining employees in Bindura and patients attending to Bindura hospital, Mashonaland central.

3.6 Inclusion criteria

All participants with type 2 diabetes and ocular effects

All partcipants and employees who will give informed consent/Assent.

3.7 Exclusion criteria

Patients who refuse to engage in the study.

Patients with T2DM who doesn’t experience any eye problems.

Patients without ocular complications or type 2 diabetes.

3.8 Sampling method

The selection of study participants will be done via multi-stage random sampling or convenience sampling. Since it is an easy and direct way to get data, this method works effectively. This approach is to be used to elect those who have consented and meet the inclusion requirements.

3.9 Study instrument

A physical examination with a slit lamp is the basis for diagnosing diabetes's effects on the eyes. Using high brightness and magnification, this lamp enables the practitioner to examine your eye. Should the doctor require further testing, these could include

1. VA test
2. Slit lamp biomicroscopy
3. Fundus examination/ photography
4. Tonometer

3.10 Data collection

Data collection is the process of observation and measurement of data on variables of interest, in a systematic pre-specified manner that allows one to respond to research questions posed, test hypotheses and make outcome predictions (Dash 2017). Medical records and questionnaires will be used to collect data.

3.11 Data analysis

Statistical analysis was conducted with IBM SPSS Statistics for Windows, Version 21.0 (Chicago, IL, USA). Descriptive statistics in the means form were computed for the involved variables. Comparative analysis was employed to analyze comparisons between comparisons of associations between changes in the eyes and variables like age, sex, and presence/severity of eye disease among type 2 diabetic subjects.

3.12 Ethical considerations

Informed consent is the process by which a health care professional informs an individual patient concerning the benefits, risks, and alternatives of a particular intervention or procedure (McCarty et al, 2006). The ability to voluntarily choose whether to have the procedure or intervention must be held by the patient. Therefore, in order to make this morally sound, we will be adhering to the previously indicated ethical consideration.

Self-reliance in its most basic form, autonomy refers to an individual's capacity to behave in accordance with their own principles and objectives. Its meaning is "self-legislation" or "self-governance," and it comes from ancient Greek. The autonomous individual needs to feel good about themselves and respect themselves in order to accomplish these things.

Danger and damage according to the TUC, a hazard is "something that can cause harm," while a risk is "the chance, high or low, that any hazard will actually cause somebody harm." The danger that these circumstances could present would be a risk;for example, physical injury, chemical burns, RSI or increased stress levels.

Confidentiality is the term used to describe private information that is discussed with a lawyer, doctor, therapist, or other person and is typically not allowed to be shared with outside parties without the client's express approval. Conversely, privacy is the absence of interference with one's private affairs and personal data. In our daily lives, the phrases "privacy" and "confidentiality" are frequently used interchangeably. But from a legal perspective, they mean quite different things.

The Medical Research Council of Zimbabwe (MRCZ) and the Bindura University of Science Education Ethics Committee will adopt the aforementioned ethics in order to further the goals of research, which include knowledge, truth, and mistake prevention. For instance, laws that forbid the fabrication, falsification, or misrepresentation of research data encourage the truth, reduce mistake, and enhance transparency as well.

3.13 Dissemination

Dissemination refers to the deliberate and systematic distribution of information, knowledge, or innovations to specific audiences to promote awareness, understanding, and application (Rogers, 2003). It is a critical process in research, public health, education, and policy-making, ensuring

that findings or messages reach stakeholders effectively (Wilson et al., 2010). The results of this study will be disseminated to the public via conferences and seminars. People will learn more about the investigated topic during these events.

4.0 CHAPTER FOUR

4.1 Introduction

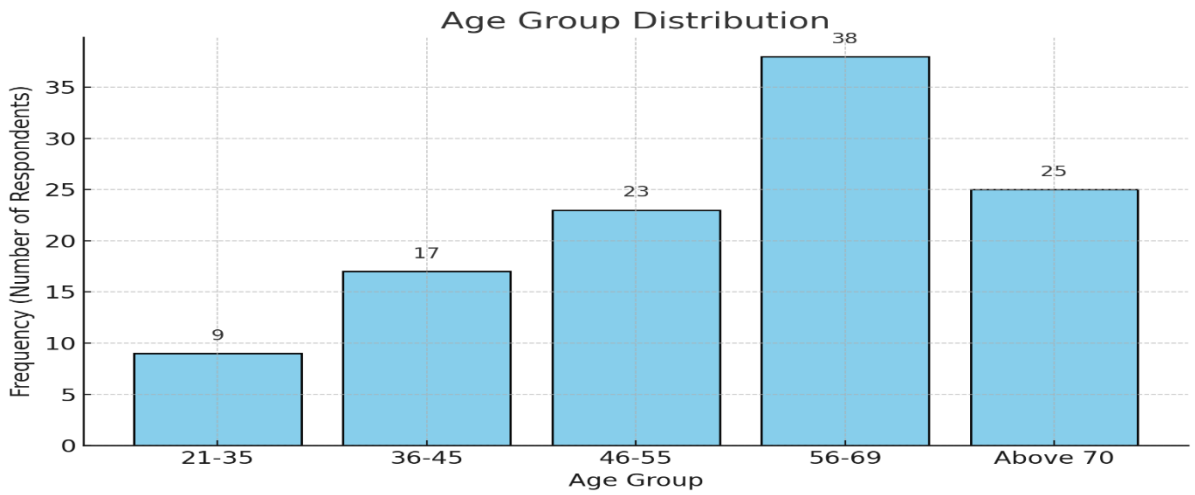
This chapter is dedicated to presenting the results of the investigation into the relationship between common ocular effects and type 2 diabetes. Details of the research participants' sociodemographic information are also provided in this chapter.

4.2 Demographics

Table 4.1 Demographic Data of Participants

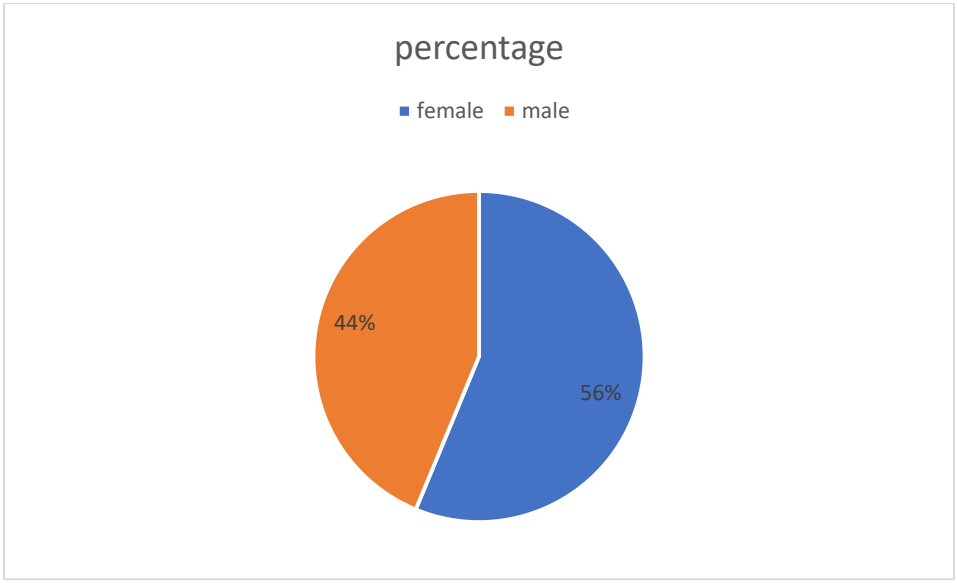
Variable	Total, n=112 Frequency (%)	Males n=49 Frequency (%)	Females n=63 Frequency (%)
Age group			
21-35	9(8.0)	4	5
36-45	17(15.2)	7	10
46-55	23 (20.5)	9	14
56-69	38 (33.9)	10	28
Above 70	25 (22.3)	11	14
Employment status			
Employed	80(71.4)	48	32
Unemployed	13(11.6)	5	8
Self employed	15 (13.4)	9	6
Student	4 (3.6)	1	3

Figure 4.1 Distribution of Respondents by Age



The distribution of type 2 diabetes by age is shown in the above figure, with patients aged 56 to 69 having the highest prevalence (33.9%) and those aged 21 to 35 having the lowest prevalence (8%). Age groups 36–45, 46–55, and over 70 had percentages of 15.2, 20.5, and 22.3 in between.

Figure 4.2 Distribution of ocular effects prevalence by gender



The chart above shows the prevalence of type 2 diabetes in both men and women. It is clear from that pie chart that women are more likely than men to have type 2 diabet es (56%) compared to 44% of men.

Table 4.2 Distribution of diabetes types among respondents.

Diabetes Type	Frequency	Percentage
Type 1	7	6.3%
Type 2	97	86.6%
Gestational	5	4.5%
Unsure	3	2.7%
Total	112	100%

The above table shows majority of respondents (86.6%) reported having Type 2 diabetes, while a small number reported Type 1 (6.3%), gestational diabetes (4.5%), or were unsure (2.7%).

Figure 4.3 Distribution of diabetes types

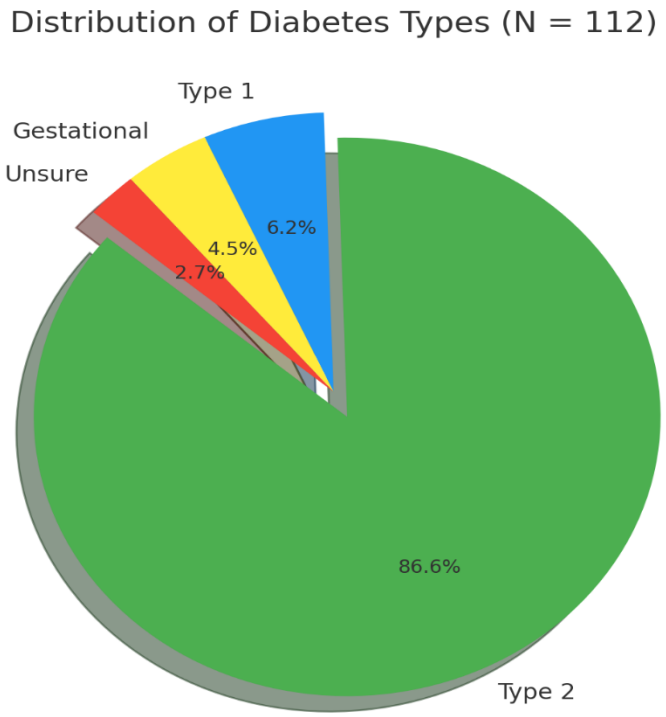
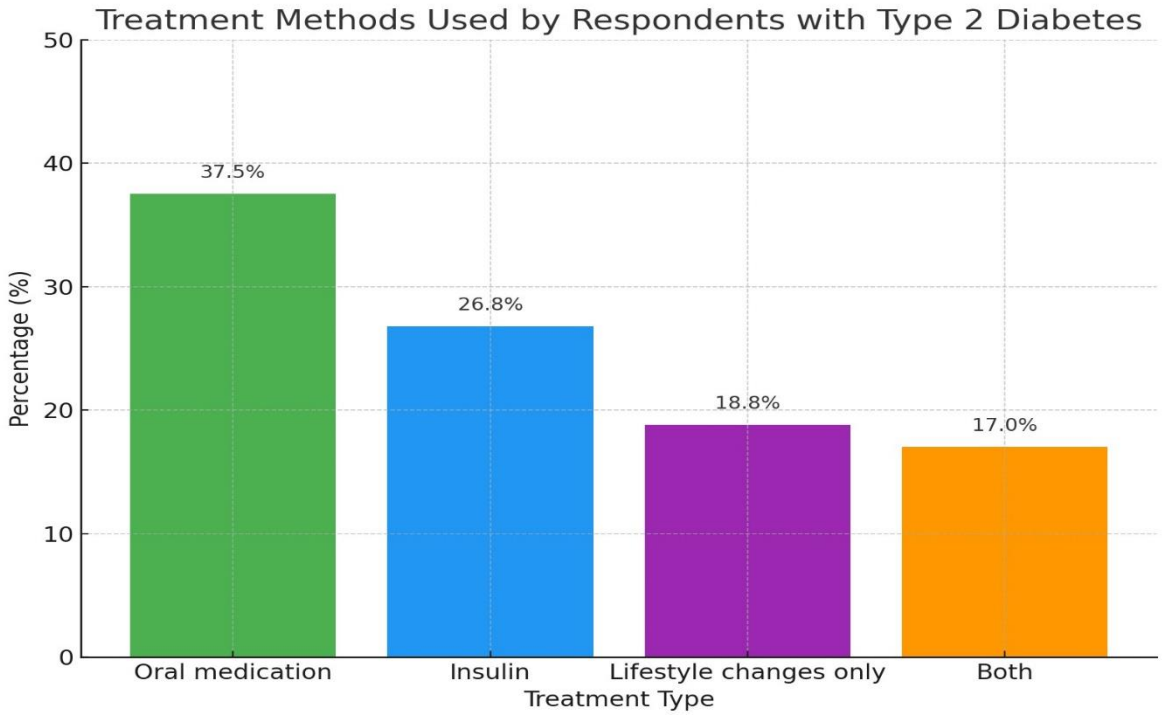
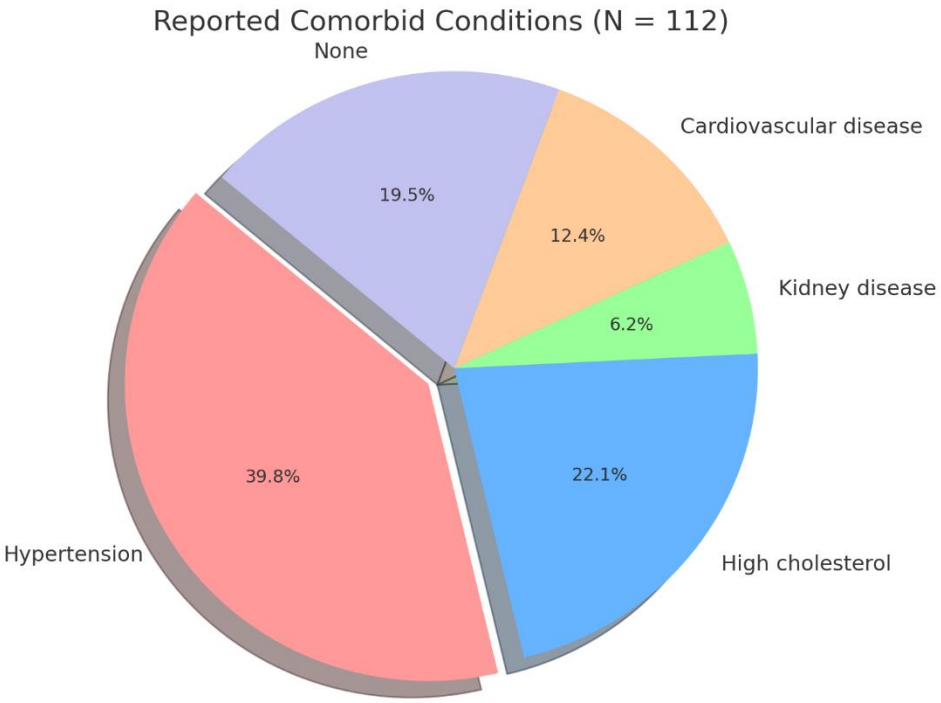


Figure 4.4 Treatment methods



The bar graph above illustrates the distribution of treatment methods among respondents with Type 2 Diabetes. The most commonly used method is oral medication (37.5%), followed by insulin therapy (26.8%). Lifestyle changes only account for 18.8%, while a combination of oral medication and insulin is the least common at 17%.

Figure 4.5 Distribution comorbid conditions among respondents



The above pie chart illustrates the distribution of reported comorbid conditions among the 112 respondents. Out of the 112 respondents, the most commonly reported comorbid condition was hypertension, affecting 39.8% of participants. This was followed by high cholesterol at 22.1%, and cardiovascular disease at 12.4%. Kidney disease was the least reported condition, noted by only 6.2% of the respondents. Notably, 19.5% of participants reported having no additional health complications. These findings suggest that a significant proportion of individuals are managing type 2 diabetes alongside other chronic conditions, particularly hypertension and lipid disorders. The presence of such comorbidities emphasizes the significance of integrated and all-inclusive care strategies in the management of type 2 diabetes.

Table 4.3 Summary of Reported Ocular Symptoms

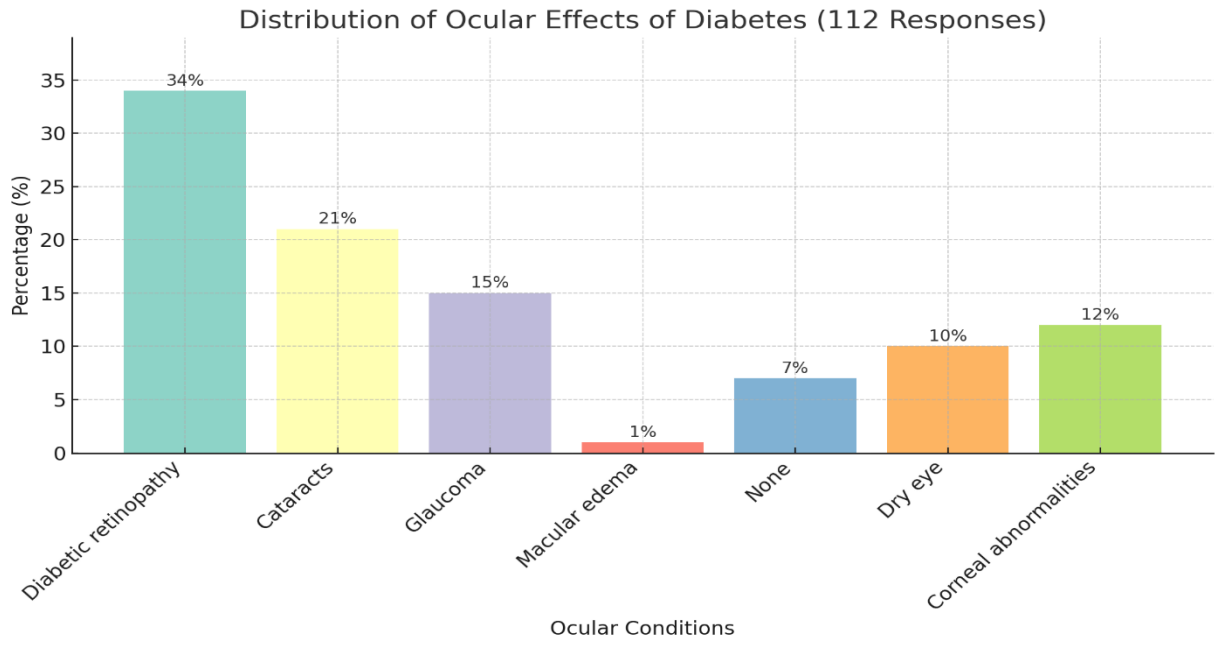
Summary	Responses	Percentage (%)
Blurred vision	41	36.6%
Eye pain	32	28.6%
Floaters/flashing lights	16	14.3%
Difficulty seeing at night	15	13.4%
Double vision	19	17.0%
Sudden loss of vision	21	18.8%
None	11	9.8%

The most reported ocular symptom was blurred vision (36.6%), a common issue in diabetic eye complications. Eye pain followed with (28.6%), suggesting discomfort is a frequent complaint. Other reported issues include sudden loss of vision (18.8%), double vision (17%), floaters or flashing lights (14.3%), difficulty seeing at night (13.4%). These results reflect a wide range of visual disturbances among individuals, most likely linked to diabetic eye-related issues such as DR, neuropathy, or cataracts.

Table 4.4 Ocular effects

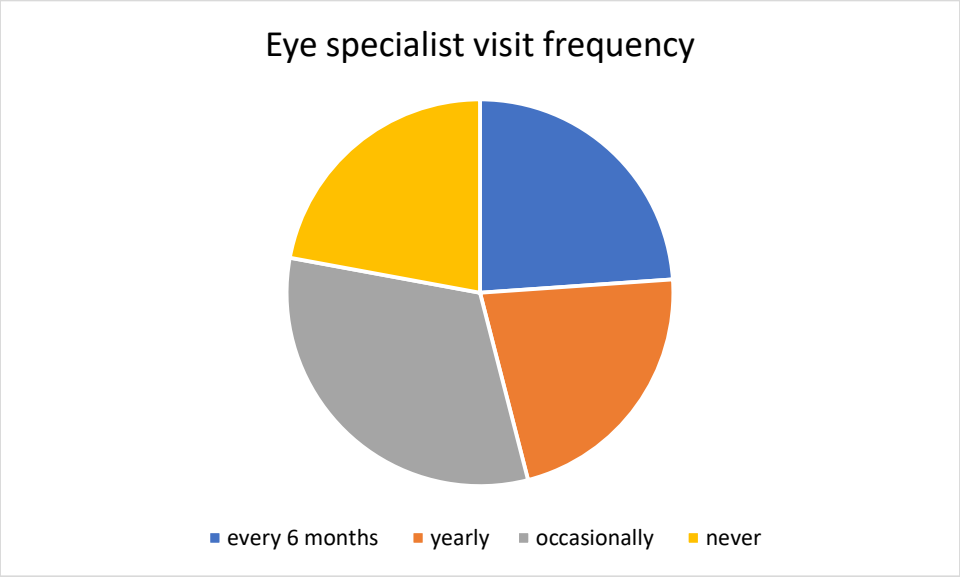
Condition	Frequency (%)	Frequency (No. of responses)
Diabetic retinopathy	34%	38
Cataracts	21%	24
Glaucoma	15%	17
Macular edema	1%	1
None	7%	8
Dry eye	10%	11
Corneal abnormalities	12%	13

Figure 4. 6 Distribution of diabetes ocular conditions



The bar chart illustrates the distribution of ocular conditions reported by patients with DM. DR is the most common, affecting 34% of respondents, followed by cataracts (21%) and glaucoma (15%). Less common conditions include corneal abnormalities (12%), dry eye (10%), and macular edema (1%). 7% of participants reported no ocular complications. This visual emphasizes the high prevalence of retinal and lens-related complications in diabetic individuals.

Figure 4.7 Eye specialist visit frequency



The chart above shows that while 46% of respondents visit an eye specialist regularly (every 6 months or yearly), the majority either go occasionally (31.9%) or never (22.1%), indicating a need for increased awareness on the importance of routine eye check-ups.This suggests that a large portion of respondents do not follow a regular schedule for eye check-ups, potentially missing early signs of complications.22.1% never visit an eye specialist, which is concerning and may indicate barriers such as lack of awareness, cost, or access to care. The similarity in percentages between those who never visit and those who visit yearly reflects a gap in preventive care that needs addressing.

5.0 CHAPTER FIVE: DISCUSSION

5.1 Introduction

In this chapter, the research findings are discussed in relation to or in contrast to other findings in the literature. The goals and objectives of the research served as the framework for this discussion. The objective of this study was to investigate the effects of type 2 diabetes on the structures of the eye and assess the knowledge of diabetic patients on the disorders in mining employees in Bindura and patients attending to Bindura hospital, Mashonaland central.

5.2 Demographic Overview

The study discovered that the majority of T2DM individuals (33.9%) were between the ages of 56 and 69, which is consistent with data showing that the risk and severity of problems connected to diabetes rise with age (Kirkman et al., 2012). The majority of women (56.3%) is in line with comparable research from sub-Saharan Africa that shows a greater incidence of diabetes in women, which is frequently linked to lifestyle choices and a lack of access to healthcare (Mogre et al., 2019).

These results are consistent with the International Diabetes Federation (IDF) report, which found that those over 50 are more likely to have the majority of diabetes-related problems, including ocular alterations (IDF, 2021). Given that more than 70% of people with diabetes are working, the employment status distribution indicates that the disease mostly affects productive age groups, which emphasizes the necessity for workplace-based health interventions.

5.3 Prevalence and Management of Type 2 Diabetes

Based on international trends, type 2 diabetes comprises 90–95% of the overall diabetic cases, and 86.6% of the participants were found to have the condition (UNHCR, 2019). The findings are supported by a study carried out by Alwazae et al. (2019) where it was established that oral hypoglycemic agents are the preferred treatment for type 2 diabetes, especially in resource-poor settings. Oral medication was the predominant mode of therapy (37.5%), followed closely by insulin therapy (26.8%).

The current findings show a trend toward moderately increasing insulin delivery when compared

to a study by Nyenwe et al. (2011) that concluded African diabetic patients used insulin less frequently. However, the comparatively decreased insulin utilization may still be due to patient resistance to injectable therapy, accessibility issues, or cost.

5.4 Comorbid Conditions and Systemic Risk

Of interest are the high hypertensive (39.8%) and hypercholesterolemic (22.1%) prevalence. Both have been known to elevate the rate of development of diabetic eye complications, especially macular edema and diabetic retinopathy (Cheung et al., 2010). The findings were consistent with that of Stratton et al. (2000) who demonstrated that high blood pressure has a significant effect in raising the risk of advancement of retinopathy for diabetic patients.

Further highlighting the necessity of integrated chronic illness care that incorporates routine ocular screening is the fact that the 12.4% prevalence of cardiovascular disease found in this study is comparable to the 10–20% reported by Morrish et al. (2001).

5.5 Ocular Symptoms: Patient-Reported Visual Complaints

The most prevalent symptoms were sudden loss of vision (18.8%), ocular discomfort (28.6%), and blurred vision (36.6%). Studies from Kenya and India have also found comparable symptoms, which are consistent with early indications of diabetic eye illness (Mwangi et al., 2017; Shukla et al., 2015). Our results closely matched those of Shukla et al., who found that 42% of diabetic individuals had impaired vision.

The multifactorial ocular effects of diabetes, such as retinal ischemia, early cataract development, and refractive alterations brought on by blood sugar variations, are also reflected in this broad range of symptoms.

5.6 Diagnosed Ocular Conditions and Disease Burden

The most frequent eye disease encountered was diabetic retinopathy (34%), followed by cataract (21%), and glaucoma (15%). The Wisconsin Epidemiologic Study of Diabetic Retinopathy

indicated that 28 to 40 percent of patients with type 2 diabetes were found to have retinopathy (Klein et al., 1984). This is in agreement with their study. In addition, retinopathy occurred in 35% of the subjects in a Ghanaian study by Amoaku et al. (2016), and it shows the very high prevalence of the disease in most populations.

Choudhary et al. (2012) identified cataracts in 20–30% of diabetic patients, and the 21% cataract prevalence is consistent with their findings. They attributed the increased risk to sorbitol accumulation and lens protein glycation brought on by persistent hyperglycemia.

Dry eye (10%), corneal abnormalities (12%), and macular edema (1%), which were less common but still significant, were probably underreported because they required more sophisticated diagnostic imaging, like OCT, which might not have been available at the time of the study.

5.7 Utilization of Eye Care Services

46% of the respondents visited eye specialists on a regular basis (every six months or yearly) against 31.9% who visited less frequently and 22.1% who never visited. This is a significant research finding. This is concerning trend, especially in view of the symptom prevalence, and concurs with evidence by Khandekar et al. (2008), who concluded that poor utilization of diabetic eye care in low-resource settings is caused by low awareness and access barriers. This difference is compared to a United Kingdom-based study where over 75% of diabetic patients were screened for retinopathy annually (Scanlon et al., 2008) and reflects differences in public health awareness and healthcare resources across low- and high-income nations.

5.8 Conclusion and Implications in Light of Comparative Studies

Finally, the findings in this chapter show that ocular complications are very common among Type 2 Diabetics, particularly in the elderly and middle-aged. The most common disorders, diabetic retinopathy, cataract, and glaucoma, agree with data from all over the globe, which show that type 2 diabetes pathology strikes ocular tissue indiscriminately across different populations.

But particularly for resource-poor countries like Zimbabwe, underutilization of eye care services and incidence of avoidable symptoms signal a significant gap in the treatment of diabetic eye care. The present study establishes the pressing need for public health programs, campaigns for education, and total care models that center on early detection and referral, in contrast to studies from Europe and Asia where routine screening rates are greater and ocular problems are detected earlier.

Ultimately, these results demonstrate that ocular effects should not be viewed as secondary consequences but rather as an essential part of overall diabetic treatment, and they further emphasize the significance of routine ocular evaluations as a fundamental part of diabetes management.

6.0 CHAPTER 6: CONCLUSION AND RECOMMENDATION

6.1 Conclusion

According to the results of the study, Type 2 Diabetes Mellitus (T2DM) significantly affects eye health and is a contributing factor to a number of visual issues that are both symptomatic and clinically diagnosed. A substantial burden of visual discomfort and dysfunction was suggested by the most frequently reported symptoms among diabetics, which included double vision, blurred vision, eye pain, and abrupt loss of vision. The discovered ocular diseases, which are generally acknowledged to be the primary causes of visual impairment among diabetic populations, were in line with these symptoms. These pathologies included diabetic retinopathy (34%), cataracts (21%), and glaucoma (15%).

Furthermore, the study demonstrated that a larger prevalence of ocular problems is highly correlated with advancing age, especially in the 56–69 age range. It was also discovered that the risk and severity of diabetic eye disorders were increased by the presence of comorbid conditions including hypertension and hypercholesterolemia. This emphasizes how intertwined systemic diseases are and how crucial it is to manage diabetes holistically and across multiple disciplines.

The low frequency of visits to eye specialists—just 46% of respondents regularly had eye exams—was one of the most important findings. This points to a potential delay in diagnosis and irreversible visual loss—a gap in health-seeking behavior, awareness, or access to care. This indicates a public health deficiency that requires immediate attention when compared to international best practices, where yearly diabetic eye exams are routine.

In conclusion, this research reinforces the reality that ocular complications are not just secondary outcomes but are central to the health burden posed by Type 2 Diabetes. Vision impairment severely affects the quality of life, independence, and productivity of individuals, especially those in the working-age population. Therefore, early detection through routine screening, patient education, and integrated diabetic care models is essential to prevent avoidable blindness and improve patient outcomes. Policymakers, healthcare providers, and public health practitioners must work collaboratively to raise awareness, improve access to eye care services, and implement national screening programs that prioritize the early identification and management of diabetic ocular complications.

6.2 Limitations

This research, although informative, does have a number of limitations that need to be highlighted. First, its cross-sectional nature restricts the potential to derive causality between Type 2 Diabetes and its subsequent ocular effects since the data were gathered at one point in time. The sample was moderately small and randomly from a particular geographic area, and this can influence the findings to be used for larger populations. Additionally, some of the data were self-reported, like symptoms and eye clinic visits, which may cause recall bias and be inaccurate. Underdiagnosis of some conditions, especially early ocular complications like macular edema or glaucoma, is probable because there was no advanced technology like optical coherence tomography or fundus photography. Furthermore, key variables like glycemic control (e.g., HbA1c) and other systemic or lifestyle risk factors were not controlled for in the analysis, reducing the scope of the risk factor analysis. These are limitations in pointing to the need for future studies involving larger more representative populations and longitudinal designs with longer clinical follow-up.

6.3 Delimitations

This study was intentionally delimited to focus specifically on individuals diagnosed with T2DM, excluding those with T1DM, gestational, or secondary forms of diabetes to maintain a clear and consistent scope. The research was also limited to participants attending selected healthcare facilities, meaning findings reflect individuals who already have some access to medical care, possibly excluding undiagnosed or less monitored cases in the general population. Only ocular complications related to diabetes were investigated, with no assessment of systemic complications or psychosocial impacts. Furthermore, the study centered on commonly observed ocular symptoms and conditions rather than conducting in-depth ophthalmologic evaluations, such as retinal imaging or visual acuity measurements, due to time, resource, and equipment constraints. These delimitations were necessary to keep the study focused, feasible, and aligned with available resources while still meeting the research objectives.

6.4 Recommendations

On the basis of the results of the present study, several key recommendations are evaluated to enhance prevention and care of ocular complications in patients with Type 2 Diabetes. Firstly, diabetic eye screening should be implemented and made available, especially in primary care settings, to allow prompt identification of conditions such as diabetic retinopathy and cataracts. Placing eye checks in universal diabetes treatment guidelines would improve coordinated care and prevent loss of vision. Another need is to improve patient education for early eye exams, correct glycemic control, and lifestyle changes since most of the patients in this study did not get early eye treatment despite having symptoms. They should also be trained to detect early signs of diabetic eye disease, particularly where there are pockets of lower resources where an ophthalmologist might not readily be present. Policymakers should also invest in diagnostic equipment and subsidized care programs in an attempt to stem costs. All these put together will facilitate early intervention, lower the impact of diabetic eye disease, and enhance the quality of life of individuals with Type 2 Diabetes.

Follow-up studies should use longitudinal design to better understand the progression of ocular complications with duration in Type 2 Diabetic patients. Larger and representative samples from various geographical and socioeconomic strata would enhance power in the generalizability of the results. It is also suggested that any subsequent study include objective clinical information like HbA1c level, duration of diabetes, and retinal photographs (e.g., OCT, fundus photography) to more accurately inform regarding the severity and control of disease. Patient awareness, availability of eye care services, and cultural belief in helping use ocular health services would be worthwhile for determining barriers to care. In addition, qualitative research based on interviewing or focus groups would give better insight into patient experience and health-seeking behavior in relation to diabetic eye well-being. These enhancements will help build a more robust evidence base to inform the development of effective interventions and health policies to prevent vision loss due to diabetes.

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Appendix

Questionnaire: Ocular Effects in Patients with Diabetes

Section A: Demographic Information

1. Age: _____

2. Gender: ☐ Male ☐ Female ☐ Other

3. Occupation: _____

4. Duration of diabetes (in years): _____

5. Type of diabetes: ☐ Type 1 ☐ Type 2 ☐ Gestational ☐ Unsure

Section B: Medical History

6. Are you currently on treatment for diabetes?
   ☐ Yes ☐ No

7. What type of treatment are you on?
   ☐ Oral medication ☐ Insulin ☐ Both ☐ Lifestyle changes only

8. How often do you check your blood sugar levels?
   ☐ Daily ☐ Weekly ☐ Monthly ☐ Rarely

9. Have you been diagnosed with any of the following? (Check all that apply)
   ☐ Hypertension ☐ High cholesterol ☐ Kidney disease ☐ Cardiovascular disease ☐ None

Section C: Ocular Symptoms and History

10. Have you experienced any of the following eye symptoms? (Check all that apply)
    ☐ Blurred vision ☐ Eye pain ☐ Floaters or flashing lights ☐ Difficulty seeing at night ☐ Double vision ☐ Sudden loss of vision ☐ None

11. Have you ever been diagnosed with any of the following eye conditions?
    ☐ Diabetic retinopathy ☐ Cataracts ☐ Glaucoma ☐ Macular edema ☐ Other (please specify): _____ ☐ None

12. How often do you visit an eye specialist (optometrist/ophthalmologist)?
    ☐ Every 6 months ☐ Yearly ☐ Occasionally ☐ Never

13. Have you ever had laser treatment or eye surgery due to diabetes?
    ☐ Yes ☐ No
    If yes, please specify: _____

Section D: Lifestyle and Awareness

14. Do you smoke or use tobacco products?
☐ Yes ☐ No

15. Do you use glasses or contact lenses?
☐ Yes ☐ No

16. Are you aware that diabetes can affect your eyes?
☐ Yes ☐ No

17. Have you received any diabetic eye health education?
☐ Yes ☐ No

18. How would you rate your current vision?
☐ Excellent ☐ Good ☐ Fair ☐ Poor ☐ Very Poor

19. Do you feel that diabetes has affected your quality of vision?
☐ Yes ☐ No
If yes, how? _____

Section E: Additional Comments

20. Is there anything else you'd like to share about your eye health or diabetes experience?
_____
_____

BINDURA UNIVERSITY OF SCIENCE EDUCATION

P. Bag 1020 Bindura,
Zimbabwe

Tel: +263 788443782

FACULTY OF SCIENCE AND ENGINEERING
DEPARTMENT OF OPTOMETRY

Date…16 April 2025……...

Dear Sir/Madam

RE: LETTER OF SUPPORT FOR TANYA CHAGARESANGO REG NUMBER B213375B RESEARCH PROJECT

I am writing to formally express my support for TANYA CHAGARESANGO, registration number **B213375B** undergraduate research project titled **The common effects of Type 2 diabetes on ocular functions in Mashonaland Central Province**, which will be conducted under my supervision as part of their academic requirements for the Bachelor of Honours in Optometry at Bindura University of Science Education.

This project aims to encourage and facilitate early diagnosis and treatment of diabetic eye disease to reduce the risk of vision loss. The research aligns with partial fulfilment of the prerequisites for the Bindura University of Science Education Bachelor of Honours in Optometry and demonstrates TANYA CHAGARESANGO'S commitment to advancing knowledge in Bachelor of Honours in Optometry.

As the supervisor, I confirm that:

- The project has been reviewed for academic rigor and feasibility.
- Ethical considerations have been addressed, and necessary approvals (e.g., ethics committee) will be obtained prior to data collection.
- TANYA CHAGARESANGO has demonstrated the skills, preparation, and dedication required to complete this project successfully.

I am confident that Tanya Chagaresango will execute the project with professionalism and integrity. I am available to provide ongoing guidance throughout the research process and will ensure adherence to institutional and ethical standards.

Should you require further information or clarification, please do not hesitate to contact me at claude2see@yahoo.com or +263772680401

- TANYA CHAGARESANGO has demonstrated the skills, preparation, and dedication required to complete this project successfully.

I am confident that Tanya Chagaresango will execute the project with professionalism and integrity. I am available to provide ongoing guidance throughout the research process and will ensure adherence to institutional and ethical standards.

Should you require further information or clarification, please do not hesitate to contact me at claude2see@yahoo.com or +263772680401

Thank you for considering this request.

Sincerely

Dr C.N Mtuwa

Optometry Department Chairperson and Supervisor
Faculty of Science and Engineering

Email: claude2see@yahoo.com

Signature……

BINDURA UNIVERSITY OF SCIENCE EDUCATION

P. Bag 1020 Bindura,
Zimbabwe

Tel: +263 788443782

FACULTY OF SCIENCE AND ENGINEERING
DEPARTMENT OF OPTOMETRY

Informed Consent Form

Project Title: The common effects of Type 2 diabetes on ocular effects in Mashonaland Central Province
Researcher: Tanya Chagaresango
Institution: Bindura University of Science and Engineering
Contact Information: tanyachagah@gmail.com or +263779926822

Purpose of the Study

You are invited to participate in a research study conducted by Tanya Chagaresango, an undergraduate student at Bindura University.This study aims to encourage and facilitate early diagnosis and treatment of diabetic eye disease, as well as to improve care for people with diabetes through encouraging integration and cooperation across the health system.

Study Procedures

If you agree to participate, you will be asked to complete a questionnaire that should take about 10-15 minutes. The survey includes multiple choice and short-answer questions about your opinions and experiences with type 2 diabetes.

Your participation is entirely voluntary, and you may skip any questions you do not wish to answer. The responses you provide will be kept **confidential and anonymous**, and the data will only be used for research purposes.

Voluntary Participation

Participation in this study is completely voluntary. You may withdraw at any time without any consequences or loss of benefits.

Confidentiality

All information collected will remain confidential and used only for the purposes of this study. Data will be stored securely and only accessible to the researchers. The results of the study may be published or presented, but your identity will not be revealed in any report or publication. Data will be anonymized and used solely for academic/research purposes.

Confidentiality

All information collected will remain confidential and used only for the purposes of this study. Data will be

stored securely and only accessible to the researchers. The results of the study may be published or presented, but your identity will not be revealed in any report or publication. Data will be anonymized and used solely for academic/research purposes.

Risks and Benefits

- **Risks:** There are minimal risks associated in participating in this study. Some survey questions may touch on personal or sensitive topics, which could cause mild emotional discomfort. However you are free to withdraw at anytime or skip any question. There is also a small breach on confidentiality, but strict data protection will be in place to minimize the risk.
- **Benefits:** it will contribute to a better understanding of the topic

Consent Statement

I have read and understood the above information. I have had the opportunity to ask questions and have received satisfactory answers. I voluntarily agree to participate in this study.

Participant's Name: _____
Signature: _____ **Date:** _____

Researcher's Name : _____
Signature: _____ **Date:** _____

BINDURA UNIVERSITY OF SCIENCE EDUCATION

P. Bag 1020 Bindura,
Zimbabwe

Tel: +263 788443782

FACULTY OF SCIENCE AND ENGINEERING
DEPARTMENT OF OPTOMETRY

Date…16 April 2025……

Dear Sir/Madam

RE: REQUEST FOR PERMISSION TO CONDUCT RESEARCH PROJECT AT YOUR COMPANY.

I am a part 4.2 Optometry student studying Bachelor of Science Honors Degree in Optometry (HBScOpt) at Bindura University of Science Education. It is a requirement that all university students must carry out research projects in partial fulfilment of the degree's requirements. I am hereby kindly requesting for access to your company, where I intend to conduct my research project. The title of my study is, **The common effects of Type 2 diabetes on ocular functions in Mashonaland Central province of Zimbabwe.**

The research study will assess the complications of Type 2 diabetes and its impact on ocular functions. Diabetes can cause a range of eye problems, including diabetic retinopathy, cataracts, and glaucoma. These conditions can lead to vision loss, blindness, and decreased quality of life. Early detection and prevention will lead to identification of early warning signs and prevent or delay onset of ocular complications thereby reducing healthcare costs such as medical expenses and improving workplace safety by reducing the risks of injuries and accidents, benefiting both employers and employees. This research will utilize a mixed-methods approach, combining quantitative data collection through surveys, questionnaires, medical records review and qualitative interviews with workers and safety managers.

I assure you that all information collected will be treated with the utmost confidentiality and used solely for academic purposes. I am committed to adhering to all ethical guidelines and regulations regarding data collection and usage.

Thank you for considering my request. I look forward to the possibility of collaborating with your organization on this important research project.

Yours sincerely

Thank you for considering my request. I look forward to the possibility of collaborating with your organization on this important research project.

Yours sincerely

Tanya Chagaresango

+263 779 926 822

Email: tanyachagah@gmail.com

Optometry Department Chairperson and Supervisor

Dr C N Mtuwa

Email: claude2see@yahoo.com

Signed.....