Optometry Unit, Department of Clinical Surgical Sciences, Faculty of Medical Sciences, St Augustine, the University of the West Indies

Title: A systematic review to analyse the vision specific and psychosocial impacts of low vision intervention on low vision patients with Diabetic Retinopathy.

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DEDICATION:

We dedicate this Systematic Review to the Optometry Students. We aim to develop a summarized review on the roles and effect of low vision interventions in the daily lives of diabetic patients that have been diagnosed with diabetic retinopathy. We hope that this review will supply a baseline of knowledge for any future research done in this area of study so as to guide those students or other researchers forward.

We finally dedicate this review to our father, lord and saviour, God, may he guide us forward with confidence and continue to provide us with wisdom and understanding.

ACKNOWLEDGEMENT:

We would like to acknowledge Dr Kingsley Ekemiri in his constant moral support and guidance. He has shown us great faith and confidence so we would like to say thank you and we look forward to your guidance in the future to come.

ABSTRACT:

Background: DR is among the leading causes of visual impairment globally and is ranked fifth as the most common cause of global blindness. DR affects 3 million people out of 1 billion vision-impaired individuals.

Aim:to do a systematic review to analyse the vision specific and psychosocial impacts of low vision intervention on low vision patients with Diabetic Retinopathy.

Method: AAppraise research studies, and synthesize findings qualitatively to formulate research questions and answer review objectives. Multiple study sources and databases were searched for the appropriate information relating to our review objectives. When searching for information the information was screened, analysed, and relevant data would be selected. The information would then be taken and used to answer the objectives outline and used in this study. The references of different studies would also be observed and studies that also match our criteria would also be observed and placed through this screening process to broaden the information that we have access to. All information would be analysed, and a table would be created to identify if there was a significant or if no significance.

Results: Fourteen (14) studies were found that made the review criteria. Based on the wide variety of information that was found, it can be observed that low vision intervention does have a significant vision specific and psychosocial impact on low vision diabetic retinopathy patients. One study [30] did find that there was no improvement in low vision patients.

Conclusion: Low vision is associated with reduced functional status and quality of life as persons are exposed to an increased risk for depression. It is therefore imperative for every citizen to play a role in the prevention, treatment and care of the disease to reduce its prevalence and impact as well as the diabetic low vision population to acquire and adhere to the use of low vision devices/aids

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LIST OF KEY ABBREVIATIONS:

QoL - Quality of Life

LV- Low Vision

DR- Diabetic Retinopathy

PDR- Proliferative Diabetic Retinopathy

NESTT- National Eye Survey of Trinidad and Tobago

LIST OF KEY DEFINITIONS:

Low Vision- impairment of visual functioning even after treatment and/or standard refractive correction, and has a visual acuity of less than 6/18 to light perception, or a visual field less than 10 degrees from the point of fixation, but who uses, or is potentially able to use, vision for the planning and/or execution of a task for which vision is essential

Diabetic Retinopathy - a diabetic complication that affects the eyes. It is caused by damage to the blood vessels in the retina whereby multiple complications can further arise in which visual impairment is the result if left untreated.

Proliferative Diabetic Retinopathy - the more advanced form of diabetic retinopathy. At this stage, the retina becomes deprived of oxygen due to vascular irregularities. As a result, new, fragile, abnormal and weaker blood vessels start to grow in the retina and into the vitreous which exposes the eye to major complications such as retinal detachment and maculopathies.

CHAPTER 1: INTRODUCTION

1.0 Introduction

Persons with Diabetes Mellitus are exposed to many complications and with regard to the eyes these complications can cost a person the ability to see clearly or not at all. Diabetes Type 1 and 2 can both be the cause of visual impairments. Cataract, Glaucoma and Diabetic Retinopathy are such visual impairments which can also lead to varying degrees of vision loss. Diabetes is a global health disease that is estimated to have an impact on 642 million adults by 2040 where a major of this number, (75%) are expected to come from low and middle income countries. When it comes to diabetic retinopathy it is expected to have an impact on 1 in 3 diabetic persons and it is one of the leading causes of blindness [1].

Diabetic Retinopathy (DR) is the abnormal change occurring in the retina and is the most serious form of eye disease that affects people diagnosed with diabetes mellitus that do not control or monitor it correctly. DR is the type of damage that the retina experiences caused by macrovascular and microvascular manifestations of Diabetes mellitus when there is uncontrolled blood sugar levels. DR affects the blood vessel network in the retina which leads to mild complications such as blurriness and distortions and severe complications such as severe vision loss [2]. These complications are brought about due to the deterioration of primary blood vessels; leaking of blood into the retina and blood flow blockages due to clots. The lack of oxygen supply known as ischemia due to vasoconstriction, formation of new blood vessels known as neovascularization due to compromised blood vessels, manifestations of atherosclerosis and medial calcification swelling [3].

DR is a progressive eye disease therefore the degree of control and monitoring of diabetes levels can reduce the progression of DR but lack thereof can lead to Proliferative Diabetic Retinopathy (PDR) which is an even more serious form of DR. Extensive haemorrhage, vision loss and retinal detachment; a subsequent result of scar tissue formation, are all strong possibilities of PDR. Diabetic Macular Oedema and Neovascular Glaucoma are other eye conditions that can be brought about due to DR.

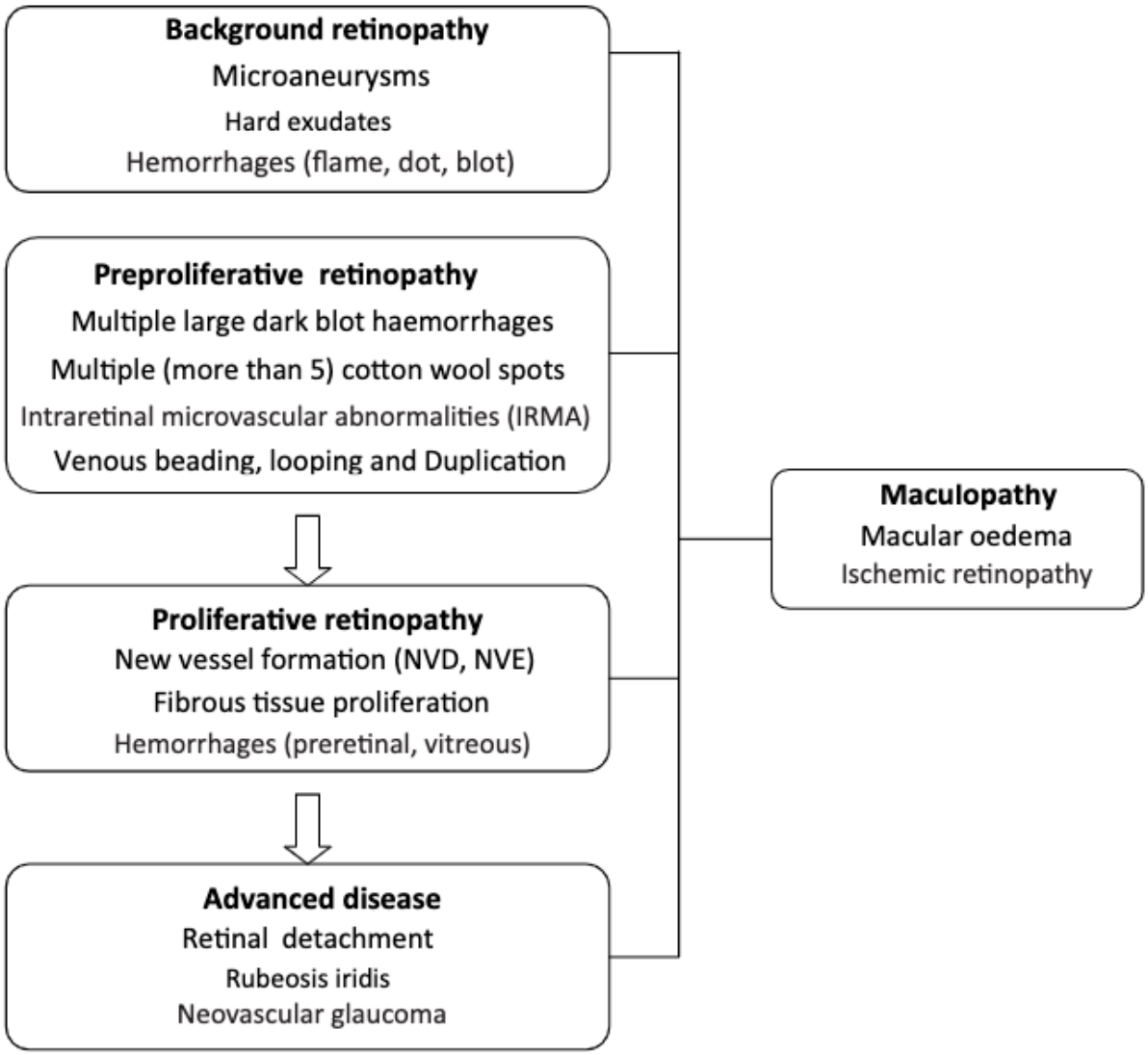


Diagram 1.0 above shows the stages of Diabetic Retinopathy and associated Maculopathy [4]

1.1 Background

DR is among the leading causes of visual impairment globally and is ranked fifth as the most common cause of global blindness. There are 2.2 billion people affected by visual impairment globally. This population can be split into 2 categories; vision-impairment and blindness. 1 billion are affected by vision impairment and 1.2 billion are affected by blindness. DR affects 3 million people out of 1 billion vision-impaired individuals. One sure way of mediating the increase of this population would be to implement early interventions [5].

The other 1.2 billion are affected by varying degrees of blindness, which can also be contributed to by DR. The prevalence of DR is especially seen in high-income countries in the ageing population i.e. 40 years and older, rather than in the lower to middle income countries [5].

Type 1 diabetics develop diabetic retinopathy after 20 years of diagnosis virtually 100% of the time and the years are even shorter for those who are irresponsible in seeking care and treatment [6]. Type 2 diabetics develop diabetic retinopathy at a much lower percentage compared to type 2: 40 to 60% expectation during their lifetime. The chance of developing PDR in both type 1 and type 2 are estimated to be 75% and 10% respectively and the percentages can increase when DR is coupled with other systemic diseases such as hypertension [7].

So how does Trinidad and Tobago (TnT) compare to some developed nations of the world?

According to the ‘International Agency for the Prevention of Blindness’ of Trinidad and Tobago, they reported that of the 107,700 people affected by diabetes in 2010 the number of new DR cases would be an estimate of 50 - 75,000 people in the few following years. Multiple research studies reported the prevalence rate of persons diagnosed with Diabetes in Trinidad and Tobago

was on average 14% [8]. To extrapolate 1 in every 6 men and 1 in every 8 women are affected by diabetes which means that 40% of people with type 1 diabetes and 20 % with type 2 diabetes will develop some form of diabetic retinopathy.

Two studies done in the United Kingdom (UK) took place over 9 and 10 years respectively. The first study mentions that the incidence of DR was found to be 28% in type 2 diabetes and 24% in type 1 diabetes while in the second study the prevalence of DR in patients who had type 2 diabetes were 28.3% and type 1 diabetes was 48.4%: a doubling in percentage compared to the first mentioned study [9]. These statistics showed that the UK had double the prevalence of DR compared to TnT.

Two studies in New Zealand (NZ) concluded that approximately 20–25 percent of people with diabetes have some form of DR [10] [11]. This result shows that NZ had a 1.5 to double the prevalence of DR compared to TnT.

According to the National Eye Institute a study done in the United States of America (USA) in 2019 concluded that between 40 to 45 % of Americans with diabetes have some form of DR. The Centers for Disease Control and Prevention of the USA reported 12,000 to 24,000 new cases of blindness each year due to diabetic retinopathy which made it the leading cause of vision loss among young adults, aged 20 to 24 years old. The same Center projected that by the year 2050, the older adults, 40 years and older, with DR will grow from the current 5 million individuals to about 16 million. When compared to TnT, the USA has a prevalence of DR that triples the TnT diabetic population.

Although there is an elevated risk of eye disease for all patients with diabetes, including diabetic retinopathy, preventive steps and prompt intervention can prevent or postpone subsequent vision loss. Systemic management of diabetes through combined control of glycemia, blood pressure, and serum lipid levels remains the most important method of diabetic prevention. Surgical and medical procedures, including photocoagulation, vitrectomy and intravitreal injection, can help maintain vision when detected. Also, Renin-angiotensin system blockade (RAS) and Fenofibrate under supervision of a team of physicians has been shown to reduce the (1)risk of diabetic macular edema, (2)the need for laser treatment, and (3)progression of retinopathy [12]. Anti-VEGF and Corticosteroids are medicines that can help slow and/or reduce the progression of DR. Another study used an 'intensified multifactorial approach' by using agents that targeted blood glucose, blood pressure and platelets levels as well as fats (lipids) with additional focus on patient lifestyle interventions such as exercise and diet. They found that multifactorial care is as efficient as continuous eye screenings/tests and is beneficial to other target organs of diabetic damage [13].

In this report DR will be correlating with low vision. So what is low vision? A person with low vision is someone who has impairment of visual functioning even after treatment and/or standard refractive correction, and has a visual acuity of less than 6/18 to light perception, or a visual field less than 10 degrees from the point of fixation, but who uses, or is potentially able to use, vision for the planning and/or execution of a task for which vision is essential as reported by WHO.

When it comes to DR patients, low-vision rehabilitation is the best way to deal with vision loss associated with medical or surgical procedures that fail or are contraindicated. Typical rehabilitation approaches include assessment of residual abilities and functional vision, training in their active use of vision, prescription and training in the use of low vision aids, instruction

and instructional services (orientation and mobility), assistance with everyday life tasks, driving, lighting changes, and therapy or emotional assistance. [15]. This systematic review aims to synthesize the literature of research relating to impaired vision secondary to DR and its associated rehabilitative aspects when current medical procedures were ineffective or only marginally successful for the patient.

1.2 Statement of Problem

The UWI Optometry clinic comes across many patients with diabetes and although the number of diabetic retinopathy cases is not significant we felt that there is a need to explore the QoL that low vision patients with diabetic retinopathies may be experiencing with LV interventions in a systematic review that can be made available to the optometry student body so as to better understand how these types of patients lives can be benefitted.

This systematic review was also done as a way to add more information to the current public database on the effects of interventions on low vision with diabetic origin by comparing studies done by countries on this topic around the world including any done In Trinidad and Tobago.

Diabetes is a stressful disease that has a plethora of implications such as visual impairment and blindness which can be seriously debilitating to the social, economic, physical and psychological functionings of a person. The small isles of Trinidad and Tobago are included amongst the countries with the most prevalent cases of diabetes and its numbers are only growing exponentially. The Ministry of Health of Trinidad and Tobago estimated that diabetes affects about 14.5% of our population with as much as 88% to 90% of diagnosed patients having Type 2 diabetes. Trinidad and Tobago has a high rate of diabetic complications and one such complication is Low Vision [16]. According to the National Eye Survey of Trinidad and Tobago (NESTT), there is a prevalence of 19.1% visual impairment due to diabetic retinopathy in adults over 40 years and with the diabetic population growing, this percentage will only increase over the years [17]. How does LV interventions affect patients' daily lives and to what degree are they effective?

We think this research is needed:

1. To understand why QoL is important for people with diabetes and low vision
2. To better understand how LV and DR affects patient’s QoL
3. To understand how patients judge their QoL over many methods of studies

4. To understand why some studies show that an increased amount of people with vision impairment with the need for low-vision services is anticipated to increase exponentially in the next 20 years. Therefore, we acknowledge that there is a critical need to assess models of low-vision rehabilitation likely to improve the QoL, and review the connection that improvement has on the daily performances of people living with diabetes as this population is not only afflicted with possible severe visual impairment and complications but also danger to their other bodily systems and organs if not treated early enough. [18]

When eye diseases are caused or contributed to by a person's systemic disease, the amount of care, maintenance and control can be exasperated when more treatment and management responsibilities are incurred by such systemic diseases i.e. a patient with diabetes is compounded with double responsibilities by adhering to their low vision interventions and the never-ending demands of diabetes care: exercising, blood glucose monitoring and meticulous eating. These factors can have some effects on their mental well-being even when either properly or improperly preserving their responsibilities. We want to understand the degree to which the low vision interventions effectively affect the quality of life of LV Pxs with DR.

This study helps us to understand what areas patients may be feeling some psychological and social distress, if any, and compare the QoL that they have with other nations . This study can potentially benefit those that may not see an importance to go to the clinic to get the necessary help they need because they may think they are a lost cause. It can also help those that previously attended their optometry clinics but have stopped going to appointments due to demotivation and thoughts of 'a waste of time' among other reasons. This study can also bring some necessary focused attention on this topic and possibly help our citizens become more aware of this

important matter that involves our visually impaired population and understand where we are at as a nation with regards to visual aids and its effects.

1.3 General Objective

To do a systematic review to analyse the vision specific and psychosocial impacts of low vision intervention on low vision patients with Diabetic Retinopathy.

1.4 Specific Objectives

1. To review the effect of low vision intervention on vision related quality of life on diabetic retinopathy patients (VR-QoL)
2. To review the effect of low vision services intervention on clinical measures of visual function in low vision diabetic retinopathy patients
3. To review the psychosocial impact of low vision intervention on low vision diabetic retinopathy patient
4. To review the effect of low vision services intervention on performance of activities of Daily living of low vision diabetic retinopathy patients (ADLs)

1.5 Significance of the study

Trinidad and Tobago has the capability to develop the necessary resources and services so desperately needed by the low vision population. Being a developing country, Trinidad has a plethora of implications posed to its visually impaired citizens in the medical sector particularly within the public domain. One such example is that the present public vision services do not

fulfil all objectives in order to help people with low vision to function independently with confidence and assimilate functionally into society.

Our present Low vision services include two major organisations: The UWI Optometry Low Vision Clinic and The Trinidad and Tobago Blind Welfare Association (TTBWA). Only the UWI Optometry Low Vision Clinic provides professional comprehensive care and interventions for low vision patients.

Type 2 diabetes and its complication has been on the rise in TnT which would have an impact on both the persons involved as well as public assistance that is associated with it because it places a financial strain on them when it comes to management and treatment. Diabetes can be prevented or delayed by lifestyle and diet changes, interventions of Pharmacology, early detection of diabetes for screening and early management as well as precursor lesion treatment. Implications of diabetes rise is an aging population, obesity rise, ethnicity such as african and asian populations and lifestyles that involve large sedentary periods. If these areas and treatment can be taken more seriously into account then it can make a difference in our world.

If people are able to control their diabetes it will in turn affect their progression of dibetic retinopathy and help their eyesight by preventing any retinal damage that would have resulted. People with diabetes need regular eye exams to protect their vision because it can cause diabetic retinopathy to develop as well as increases the risk of developing glaucoma and cataracts.

In diabetic retinopathy patients there is usually one in three diabetic people who have it and do not realize it because the early stages usually are symptom free for the patient that is why regular examinations of the eyes are important to detect these early stages and have the correct treatment done to prevent any further damages. Usually the patient would undergo a comprehensive dilated

eye exam to detect these changes. In the late stages of diabetic retinopathy usually there are new abnormal blood vessels that are made which are fragile and resulting in rupturing and bleeding that directly results in retinal detachment and in worst cases lead to blindness [19].

Low vision has a high prevalence affecting patients negatively which can expose them to fall into a negative state of mind. It can cause them to feel depressed and a burden on their family and society because they would have to rely on others because of the poor vision they would need help to do simple things like driving, walking, reading, etc.

Their motivation to work would also be low because they won't be able to find a job easily and in Trinidad and Tobago it isn't encouraged for these types of patients to find a job or further themselves but to rely on what little technical or manufacturing skills they have. Therefore, they would have to rely on the income of others to get their necessities. There is some hope for these patients at the low vision clinic at UWI optometry clinic where their eyes can be tested, and they can find the source of the problems and find ways around the problems where devices can come in. It all depends on the needs of the patient the optometrist can do their best to meet these needs with the use of low vision devices like the telescope, magnifying glass, walking canes, etc. But has it been effective?

This study helps us to understand what areas patients may be feeling some psychological and social distress, if any, and compare the QoL that they have with other nations . This study can potentially benefit those that may not see an importance to go to the clinic to get the necessary help they need because they may think they are a lost cause. It can also help those that previously attended their optometry clinics but have stopped going to appointments due to demotivation and thoughts of 'a waste of time' among other reasons. This study can also bring some necessary

focused attention on this topic and possibly help our citizens become more aware of this important matter that involves our visually impaired population and understand where we are at as a nation with regards to visual aids and its effects.

In the study [20] they found elderly people that have some vision loss usually report that they have poorer levels of functioning when it comes to symptoms of depression, activities in daily life and feelings of depression in comparison to general older patients and older patients with chronic conditions. However in this study they said that these people that have vision loss they say that they have more social support in all domains. Special levels of support in situations of problems which were higher among those who have low vision in comparison to the general population. In the SSL12-I or Social Support Scale Interaction the total scores were higher in the group of low vision persons even though there wasn't a significant difference when comparing them to the chronic disease patients like those who suffer from heart conditions and COPD/emphysema/asthma.

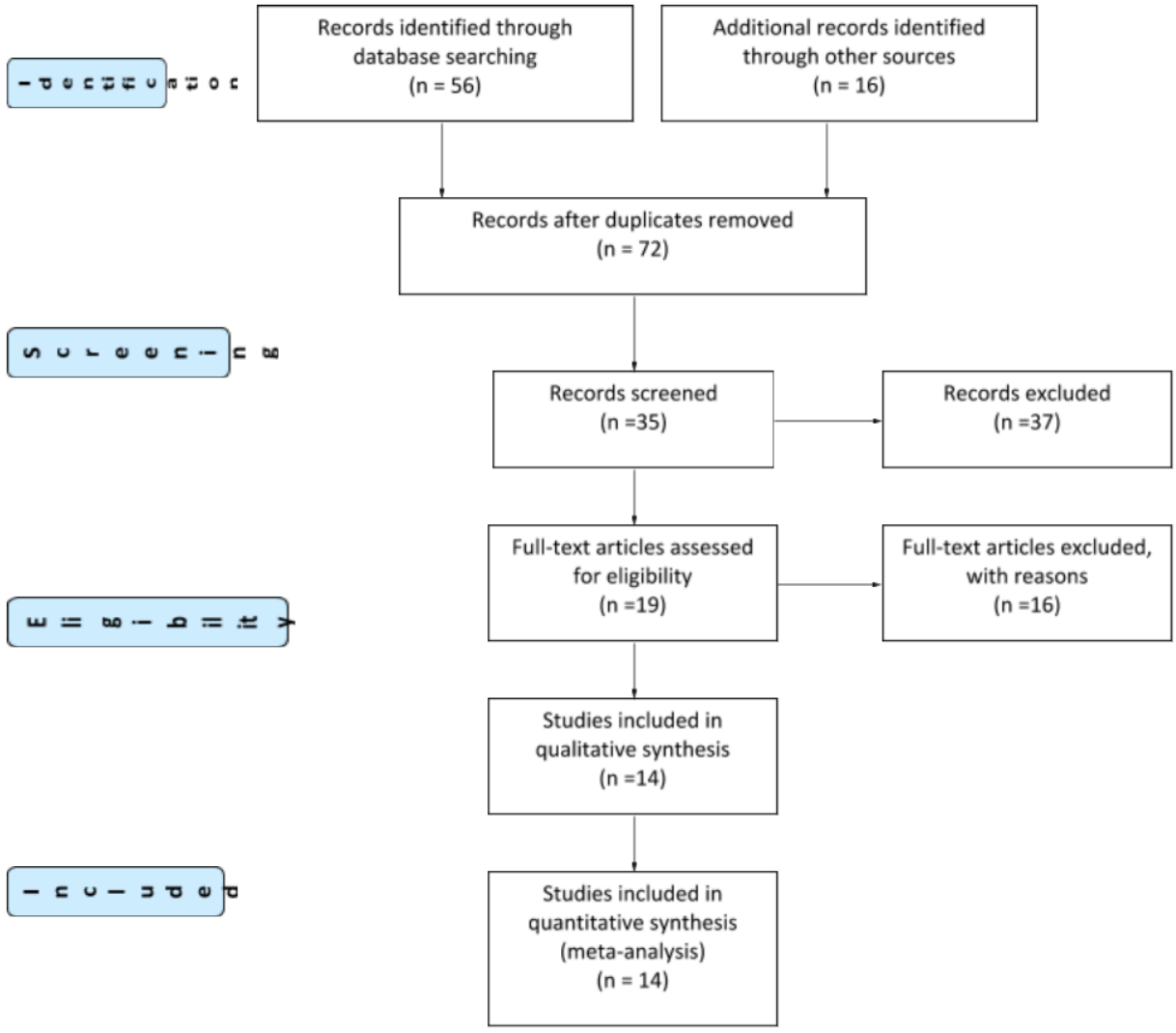
In a study [21] conducted, 43% of the patients who were looking for assistance with visual loss in Britain had clinically significant depressive symptoms. This number was compared to patients who have been diagnosed with cancer and are about to take part in chemotherapy. These types of patients who have clinically significant depression is 45%. When comparing this number to the number of patients with low vision clearly this group of people are under risk of depression. Even though these patients are receiving help for their low vision, 75% of these patients are a high risk group for depression and are not receiving any forms of treatment for it. This can suggest that depression of these patients are being overlooked during clinical exams.In Britain there are only 2 low vision services that regularly screened patients for depression.

These are the people who are getting help and using low vision devices, but what those who are not seeking low vision services? Are they in a better state mentally than these patients who are seeking low vision services?

CHAPTER 2: METHODOLOGY

2.1 Protocol

The protocol that was used is the PRISMA Flow diagram as shown below



Flow Diagram 1.0 showing PRISMA Flow Diagram

2.2 Criteria of selection

Population with condition of interest- all age participants but particularly those that are older adults

Intervention- questionnaire-AI, NEI-VFQ-25

Comparison or control- simple random sampling

Outcomes- vision specific quality of life, clinical measures on the vision specific quality of life, psychosocial quality of life, ADL impact on quality of life

Setting- clinical trials at Low Vision Clinics (LVC) kathmandu, LVC-india, LVC, Ophthalmology clinic-iran, LVC in baltimore america, john hopkins medical institutes baltimore america

Study designs- questionnaires and clinical tests, retrospective study, prospective, descriptive, cross sectional and electors.

2.3 Information source

When looking for information it is important to use reliable and credible sources of information as well as places that would have a wide variety of information to choose from. Google scholar was used because of these reasons. Then, we searched different keywords that would include diabetic retinopathy and low vision as part of the search. There were a variety of journals to look at but these keywords were kept in mind. Throughout all the websites the information that was used were taken from PubMed, IOVS, AJO, ResearchGate, NCBI, JAMANetwork, AAO and Wiley Online Library.

2.4 Search

The inclusion criteria for the search terms and study selection were low vision, diabetes, diabetic retinopathy, proliferative diabetic retinopathy, visual impairment, low vision interventions (inclusive of aids and devices), visual and psychosocial aspects . Also there was no limit to the publication year of any study reviewed. All searches were exclusively in english or sourced from english speaking countries.

The exclusion criteria for this review search was non-english sources and participants that did not have diabetic retinopathy or absence of a significant visual impairment. Studies on totally blind participants or primarily focuses on another systematic disease besides diabetes were excluded.

2.5 Data Selection

Data selection is important because we cannot use all the information that was found, otherwise using all that information would be quite tedious. The process that was undergone when carrying out this process was to first go on the google scholar search engine and utilize this platform to search the keywords that were necessary for our project such as low vision in diabetic retinopathy. This would also bring up a broad amount of data, so based on the objective the search would be adjusted a bit so if the search was on the effect of low vision intervention on vision related quality of life on diabetic retinopathy patients. Then if the title of the research is identified as information that is interesting then it would be selected and reviewed by checking the abstract first. Even though the keywords were searched on google scholar, the results did not always appear exactly as what we were looking for therefore we have to ensure that the study participants were actual low vision patients and that the study focused on diabetic patients primarily.

Then both my partner and myself would share the information with each other and we would analyse the research in depth. This is in an effort to reduce bias to a certain article. Once the information was determined to be useful for the study then the information was kept pinned and if the information didn't fit our inclusion criteria then it could not have been used.

2.6 Data Collection process

When different journals and research information was found, screened and identified as viable sources to use for this project, the information was analysed and relevant data selected. The information would then be taken and used to answer the objectives outline. When it comes to the vision specific objectives, information on visual acuity and vision related results as well as psychosocial and ADL related results would be used and analysed to identify if they experience positive or negative results. We would analyse the information and create a table to identify if there is a significant or if no significance was observed.

2.7 Data items

Data analysis would be important to help identify trends and determine what information was significant or not. Using these information to form objective statements that would determine if there is an impact to the patients at the low vision clinic which would be processed and analyzed using the Statistical Package for Social Scientist or SPSS program.

2.8 Risk of bias in individual studies

The risk of only using published data is evident and source unpublished data can be difficult since statistics have shown that only half of the data done on a research is published. However,

since data bases such as pubmed and google scholar were used this would help reduce this form of bias a bit since data research websites were used [22].

CHAPTER 3: RESULTS

3.0 Results

Table 1.0 showing of details from the selected studies in relation to the specific objectives

Study	Country study was done	# of patient	mean age	Study time period	Type of study	intervention category	mean BCVA
Naser Sadeghpur, et al, 2015	Iran	51 (diabetic patients)	57.35		random	Contrast sensitivity- CSV-1000	20/60 to </= 20/400
Robert Massof, et al, 2008	America	976 (114 diabetic patients)	19-90	15-20 years	retrospective	AI and rasch	0.7 logMAR
Zelia Zilda Lourenço de Camargo Bittencour, et al, 2011	brazil	155 (33.3 %)	12-88 years	collection period between 2004-2008	retrospective	Review	20/200-20/400

Sarika Gopalakrishnan, et al, 2017	India	100 (diabetic patients)	55..65+/-13.07 years	2015-2016	retrospective	Review	--
Gauri Shankar Shrestha, 2014	Nepal	38 (diabetic patients)	60-70	6 months	cross sectional	Questionnaire	0.73 logMAR
James S Wolffsohn, et al, 2000	America	150				custom 74 item questionnaire	
Joan A. Stelmack, et al, 2002	America	128 (17.6% of the 51 VICTORS patients and 15.6% of the 77 in BRC patients)	44-87 VICTORS 38-88 BRC			NEI-VFQ-25 interview style	0.54 logMAR VICTORS 1.00log MAR BRC

Rajendra Gyawali et al, 2012	Nepal	44 (14% diabetic)		1 year	prospective	NEI-VFQ-25 interview style	
Ingrid U Scott, et al, 1999	America	156 (11.5% of diabetic patient		1 year		interviews using 51 item field test version of the NEI-VFQ, SF-36, VF-14	
M Bernbaum, et al, 1988	America	29	not mentioned	1988	not mentioned	Rosenberg Self-Esteem Scale and the Diabetes Self-Reliance Test	not mentioned
Chinmay T Jani, et al, 2015	India	308	not mentioned	2015	not mentioned(abstract)	General Health Questionnaire -28 (GHQ 28)	20/70 to 20/200

Lawson R. Wulsin, et al, 1991	not mentioned	not mentioned	not mentioned	1991	Empirical and prospective	WOC emotion-focused summary score	20/40 to 20/200
Tatiana A. Kaminsky, et al, 2012	not mentioned	not mentioned		2012	Qualitative descriptive approach	semi-structured interviews, observation of participants' home environments and focus group discussions	not mentioned
Sarika Gopalakrishnan, et al, 2017	India	100	55.65 ± 13.07 years	2017	Retrospective chart review	LogMar chart readings	< 6/12

Table 1.2 showing the results of the selected studies reviewed

Study	VR-QOL

Naser Sadeghpur, et al, 2015	VA had significant improvement when a 527 ± 10 nm filter was used. When a 511 ± 10 and 527 ± 10 filter was used there was a significant improvement in the mean contrast sensitivity at 3 and 6 cycle/degree frequencies. There was not a significant effect when other filters were used for contrast sensitivity and visual acuity. There was a generally high patient satisfaction rate.
Robert Massof, et al, 2008	There was no significant statistical difference based on the Wilcoxon signed rank test analysis even though the probability for multiple comparison were adjusted, between control subjects and diabetic retinopathy patients in any of the four functional vision. Additional patients with diabetic retinopathy did not had a difference between the patients matched counterparts in their total visual ability and goal-level vision related functional ability.
Zelia Zilda Lourenço de Camargo Bittencour, et al, 2011	In this study there was vision rehabilitation therapy done which has an interdisciplinary team consultations whose main purpose is to help patients go through a mourning process for the vision impairment that they currently possess in an attempt to promote the enhancing of their skills for daily living and performing activities independently. The data found from the patient's medical records found that these low vision patients expressed difficulty in the early rehabilitation after their vision loss due to the challenges and lack of guidance they have. Vision rehabilitation is aimed at

	supporting them in the use of their prescribed low vision aids in their daily activities.
Sarika Gopalakrishnan, et al, 2017	The low vision device that was most prescribed was the half eye spectacles with 38.4%. There was significant statistical improvement in distance and near vision in the following pathologies such as diabetic retinopathy with disc pallor has an improvement of 4.4%, ischemic maculopathy with an improvement of 11.9%, and plaque of hard exudates with an improvement of 10.1%. Additionally, there was statistical improvement in all pathologies in near vision.
Gauri Shankar Shrestha, 2014	There were significantly higher visual disability scores for legibility of sentences (1.4 ± 0.4) and letters (1.2 ± 0.3) and the least was for clothing (0.7 ± 0.3). There was a significant correlation of the visual disability index between peripheral visual field and near visual acuity. There was also a significant correlation between contrast sensitivity with the total scores, and disability index.

James S Wolffsohn, et al, 2000	There was a high internal consistency in the LVQOL OF ($\alpha = 0.88$) as well as a good reliability of (0.72). In the population the average population of the LVQOL in the low vision patients was (60.9 ± 25.1) which was significantly lower when compared to the average score of the patients with normal vision (100.3 ± 20.8). With the intervention of visual rehabilitation there was an improvement of the LVQOL score of the low vision patient by an average of 6.8 ± 15.6 which was 17%.
Joan A. Stelmack, et al, 2002	item order by difficulty before rehabilitation In VICTORS patients agreed with item order for BRC patients. Similar visual ability scales were used by various patients with varied degrees of low vision. Distribution would be based on the pre-rehabilitation person, BRC patients would be more disabled than the VICTORS patients which would be predicted by observing the visual acuity. After rehabilitation, estimated item difficult for 4 out of the 34 items caused significant decrease in both VICTORS and BRC patients. The VICTORS and BRC programs had a significant increase in visual acuity when the rehabilitation programs were completed. This visual acuity increase is independent of the decrease in difficulty observed for the seven activities. The visual acuity average increase was 0.35 logit for the VICTORS and 0.5 logit for the BRC.

Rajendra Gyawali et al, 2012	The mean composite score was found to be (49.53 ± 14.10) and in the NEI-VFQ-25 the subscale score was significantly lower in the population of low vision patient when compared to the gender and aged matched normal vision population (89.90 ± 7.8). After low vision invention was conducted on patients, there was an improvement in a mean composite score of 5.74 ± 3.9 and improvement in 6 out of the twelve subscale. Additionally, in the objective measure of visual function, there was an improvement by 90.9% which is 40 out of the 44 patients at the first visit and 73.9% of patient rated the low vision invention as useful or very useful which was 17 out of the 23 follow up patients.
Ingrid U Scott, et al, 1999	There was improvement with low vision services in the subjective function status of the 150 patients and these patients gave it a "very useful" rating by 82 (53.9%) patients. The SF-36 reported that there was not a significant change after low vision intervention. There was an improvement in the VF-14 test which was 35.8 to 41.2 ($P < .001$). there is significant improvement in four categories in their NEI-VFQ subscale ($P < .001$) such as near vision activities, distance activities, and peripheral vision.
M Bernbaum, et al, 1988	Significant improvements in psychological profiles after introduction of rehabilitation methods

Chinmay T Jani, et al, 2015	Psychiatric counselling that is provided to visually impaired patients decreases the impact of the disease on their psychosocial aspect of health.
Lawson R. Wulsin, et al, 1991	Positive impact but further analyses and future prospective studies will help determine the importance of the primary and secondary effects of the variables of visual and psychosocial aspects.
Tatiana A. Kaminsky, et al, 2012	influence of both the physical and social environment along with psychological adaptation
Sarika Gopalakrishnan, et al, 2017	Visual rehabilitation prescription of low vision devices are successful in pathologies of DR
Ecosse L. Lamoureux, et al, 2007	Significant improvements in overall QoL and 2 specific areas of daily living in people with low vision were determined to be present

Table 1.1 and 1.2 [31], [32], [33], [34], [35], [36] and [37]

CHAPTER 4: DISCUSSION

4.0 Discussion

The aim is to do a systematic review to analyse the vision specific and psychosocial impacts of low vision intervention on low vision patients with Diabetic Retinopathy. Fourteen studies met the criteria and they were analysed. There was a large amount of evidence that points toward low vision intervention having a significant visual and psychosocial impact on low vision diabetic retinopathy patients. One study was found that was against the aim.

There have been many types of analytical procedures used to evaluate the effectiveness of patient responses to a medley of low vision interventions and training methods as well as other aspects affecting the quality of life after the interventions are put in place.

We observed in some studies that there was a contrast in results of improvement in the overall score on a vision-related QoL in participants/patients who received low-vision rehabilitation. There were clear improvements while others recorded none what-so-ever. We noticed that this was due to changes in the statuses of the participants' visual function such as contrast sensitivity and visual acuity.

One such study had participants that experienced visual deterioration for 12 months whereas in another study the participants had no observations of visual deterioration. Both studies used the same method of analysis; a Rasch analysis to evaluate patient-centered outcome measures by evaluating health outcomes which improves precision of the study results. Only a few studies have implemented the use of Rasch analysis to correctly determine the effects of low-vision rehabilitation. By using Rasch-transformed IVI scores, some studies showed findings that low-

vision rehabilitation services significantly improve participation in daily living and QoL in people with diabetic induced low vision.

Visual acuity is very important for the patient to do their daily task where as other studies tried to look at it from a broader point of view by looking at their perception on how vision intervention affects their lifestyle.

The reliability of the studies may vary in strength. Some studies would have a higher reliability than others. The latter studies would be a bit less reliable because they did not include patients that were only diabetic retinopathy but other forms of disease that can cause low vision.

From the second table of results it can see that a lot of the studies presented positive results when patients are provided with low vision services and intervention. These tests had various study types such as random, prospective, cross-sectional, empirical, qualitative descriptive approach, Rasch analysis, retrospective and retrospective chart review. There are also different inventions that were used such as Rosenberg Self-Esteem Scale and the Diabetes Self-Reliance Test, General Health Questionnaire -28 (GHQ 28), WOC emotion-focused summary score, semi-structured interviews, observation of participants and focus group discussions,IVI score, VCM1, as well as, various questionnaires like the NEI-VFQ-25 interviews, custom made questionnaires.

With all these different types of test, it will detect different areas that can be missed in another type of test. This will focus on the problem holistically when looking at all the information.

All these studies combined had an age range from 12-90 which reached a broad amount of ages.

Looking at this second table there are also some studies that didn't show improvements after low vision intervention which was a retrospective study using the AI and Rasch analysis intervention. It also had a large number of participants of 976 with an age group of 19-90. In other studies that had positive results they implemented similar type study, intervention and age range. This test uses 114 diabetic retinopathy patients out of the 976 patients. This is a very reliable test since these characteristics therefore it is very interesting to note that for some patients these low vision interventions may not be able to improve everyone's lifestyle.

When looking at both tables a lot of information was taken from America but the studies were taken in a variety of places such as Nepal, India, Australia, Iran, brazil. These countries are from different parts of the world with different types of economies which can cover a variety of people that can be found in a country such as ours.

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According to a paper on 'Psychosocial Correlates of Mild Visual Loss' any debilitating eye disease, with it comes relatively negative complications. One of such complications is the psychosocial aspects which directly correlates to an individuals' enthusiasm and involvement in daily activities. The first empirical study to find clinically significant relationships between measurements of visual acuity and measures of psychosocial functioning determined that mild to moderate impairment of visual performance broadly affected several aspects of psychosocial functioning.

Another study displayed some differing results in the effects of diabetic retinopathy. An excerpt from this prospective, cross-sectional study evaluated the ways in which limitations of daily activities brought on by the visual symptoms of diabetic retinopathy affected the psychological functioning of their low vision participants. The authors determined that the visual symptoms of diabetic retinopathy themselves did not particularly impact the psychological functioning in the participants. However, the effects of visual symptoms on daily activities that inconvenienced the participants by limiting social, mobility, activity restrictions result in their emotional distress [23].

So in what ways do the psychosocial impact of low vision intervention on low vision diabetic retinopathy patients? It is shown in many studies that a significant improvement in psychological profiles are present though various analytical methods after respective low vision intervention programs are used. This suggests that rehabilitation programs are of a clinical benefit early in the course of vision loss associated with diabetic retinopathy.

One study expressed that the psychological impacts of vision loss due to diabetic retinopathy are worsened by the absence of not only low vision interventions but diabetes self-management skills as well.

Other analytic tests specific to diabetes such as the Rosenberg Self-Esteem Scale and the Diabetes Self-Reliance Test proved that there are lower levels of performance which affect the psychosocial aspect of low vision patients while the Rand Mental Health Index, the Zung Self-Rating Depression Scale and the Minnesota Multiphasic Personality Inventory suggested that diabetics with stable visual impairment were moderately compensated and showed improvements in their psychosocial lifestyles [24].

One interesting intervention that we have seldom come across in our searches is the aspect of psychiatric counselling for the visually impaired and its relative importance to physical interventions such as low vision devices. In a study done in Gujarat, India, 308 participants divided in 3 groups for comparison on their psychosocial improvements. All groups included diabetics but in the first group there were no retinopathy, the second had diabetic retinopathy and in the last group proliferative diabetic retinopathy was present. This study provided new light to the substantial electronic database on different types of intervention available for low vision. Psychiatric counselling has shown to decrease the impact of diabetic retinopathy on the psychosocial aspect of health. This study makes the point that including psychiatric counselling is quite necessary in decreasing the psychosocial hardships along with other methods to control diabetes [23].

Do low vision interventions effectively create a better QoL? Is there a change to the performance in the daily lives of diabetic low vision patients with retinopathies? To what degree are these interventions effective and areas do they effect?

Acquiring low vision at a stage where life is happening such as careers, jobs and leisure that makes up one's daily activities can present some serious restrictions. The highest restriction was reported for the work, leisure, consumer and social interaction as well as mobility domains were higher when compared with factors of emotional reaction to visual loss, personal and household care [25]

A study with the aim of exploring the perceived environmental barriers and support to daily performances for low vision patients due to diabetic retinopathy and the adaptive strategies used by these patients to improve their individual-to-environment situations, indicated that the social and physical environments are both essential in the rehabilitation of patients with low vision caused by diabetic retinopathy.

There are 3 factors that are considered to achieve the best rehabilitation of people with low vision due to diabetic retinopathy: such factors of focus are the influence of the physical environment, social environment and psychological adaptation. Low vision aids such as telescopes, magnifiers and CCTVs accompanied by training can help to improve diabetic low vision patients interactions within their environment which positively impacts all 3 factors.

Adaptation to vision loss can be arduous for those with diabetic retinopathy as the vision loss comes later on in life and is complicated due to the fact that diabetes is a systemic disease that ultimately affects many organs and systems in the body.

They observed that the psychological adaptation to vision loss in daily life can be characterized by cycles of grieving and acceptance. This cycle makes it difficult for these patients to be ready for rehabilitation and continue to participate. There were 4 themes that continuously came from the study's data analysis: “It’s a complicated life” and “The world isn’t accessible” but with interventions in place these statements were heard: "Making it work” and “Learning to be blind” which suggest improvements.

The study also mentioned that alternative approaches to rehabilitation such as continuous periodic intervention if needed and the inclusion of peers in the rehabilitation process may help patients increase their daily performance [26].

A study done in australia in 2007, examined the effectiveness of low vision interventions on the QoL of 194 diabetic low vision patients as well as the effect on their participation in daily living. These participants were 60 years and above and from this study 90% of the participants were estimated to have residual vision, which did benefit from low-vision rehabilitation programs [27].

The impact of low vision due to diabetic retinopathies correlates on the progression of the diseases and the remedial effect of low vision devices can decrease depending on it’s severity as this occurrence was encountered in a study evaluating low vision rehabilitation in mild to severe visual impairment. Patients' prescribed distance and near low vision devices from their respective Low Vision Clinics (LVC) were analyzed and there were visual benefits observed. There is great improvement in daily activities as the use of low vision devices supply relief and opportunity to interact with others and their environment [28].

CHAPTER 5

5.0 Limitation

Some studies required a payment or subscription to the research website to view the full article or pdf which deterred our efforts in acquiring the full version of the study of interest. There was not a wide area of study that specifically correlated diabetes and low vision which made for a small number of accessible data.

5.1 Recommendation

Acquiring funding for future data collection will be the best course of action as there are many studies available for access via payment methods.

5.2 Conclusion

Low vision is associated with reduced functional status and quality of life as persons are exposed to an increased risk for depression. Increasing restrictions on available sight such as in visual field loss and blurry vision is associated with decreasing quality of life. Improvements in both functional status and quality of life occur after low-vision service delivery.

Diabetes is a worldwide health disease that has been estimated to have an impact on 642 million adults by 2040 where a majority of this number, about 75%, are expected to come from low and middle income countries. When it comes to diabetic retinopathy it is expected to have an impact on 1 in 3 diabetic persons and it is one of the leading causes of visual impairment and blindness [29].

Diabetes has an enormous physical, mental and economic toll on the patients, their family and friends that provide help, and the community at large. It is therefore imperative for every citizen to play a role in the prevention, treatment and care of the disease to reduce its prevalence and impact as well as the diabetic low vision population to acquire and adhere to the use of low vision devices/aids .

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