UNIVERSITY OF KWAZULU-NATAL

Title

Impact of low vision on quality of life of patients with low vision visiting the low vision center of the Eastern Regional Hospital, Ghana

By

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A thesis submitted to the School of Health Science, University of KwaZulu-Natal, in fulfillment of the requirements for the degree of Master of Optometry

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Preface and Declaration

Preface

As an optometrist, I have had as part of my professional responsibilities, the opportunity of managing low vision patients. I have observed the general outlook of patients with low vision who report to the clinic as well as their quality of life. I have always wondered why these patients appear to have low quality of life and seem to be bitter about life. This observation motivated this study to determine how low vision impacts the quality of life of these patients who visit the low vision clinic of the Eastern Regional Hospital of Ghana, to determine the specific life challenges the condition poses to them and how the severity of vision loss relates to the degree of impact on quality of life so as to have a better understanding of the situation and to provide appropriate recommendations in order to ensure a more holistic approach to managing such patients.

Declaration

I, Beatrice Adamptey (OD), declare that this work has been originally done by me under the supervision of Prof. Kovin Naidoo and Ms. Pirindhavellie Govender and has not previously been submitted to UKZN or another tertiary institution for purposes of obtaining a degree or any other academic qualification.

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Signature

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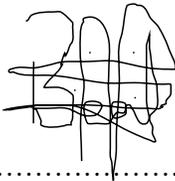
Dedication

I dedicate this work to all the patients who voluntarily participated in this study. My greatest appreciation goes to all the optometrists, ophthalmic nurses and the low vision specialists who work tirelessly in the center to assist these patients use their remaining vision to achieve their daily goals. The staff of the center assisted me immensely during the data collection process and to them I dedicate this work.

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List of acronyms

NEI VFQ-25	National Eye Institute Visual Function Questionnaire - 25
WHO	World Health Organization
QOL	Quality of life
IQR	Interquartile range

Abstract

Introduction: Low vision impacts quality of life and more so when the vision loss is severe. Persons living with low vision have reduced functionality and psychosocial well-being with the potential for high dependence on others in carrying out everyday activities. Decreased quality of life and psychosocial well-being affect both the individual and the community economically as the productive labour force is affected. Low vision may also increase morbidity and mortality. Although the relationship between low vision and quality of life has been extensively studied in other parts of the world, with documented evidence of the adverse effect of low vision on a person's quality of life, very little has been done in Ghana to understand the specific setbacks and challenges low vision brings to the patients in spite of the fact that there are such patients living in the country for which reason a center has been set up to manage and treat them. Understanding specific vision and functional challenges is important in ensuring management that is tailored to the needs of patients with low vision. This study aims to investigate the impact of low vision on quality of life, and as well to establish the relationship between severity of vision loss and level of impact on quality of life of subjects with low vision visiting the low vision center of the Eastern Regional Hospital in Ghana.

Method: A descriptive case control study involving 41 cases and 41 controls was conducted. The cases were stratified into three categories of low vision namely moderate, severe and profound. The National Eye Institute Visual Function Questionnaire (NEI VFQ-25) which consists of twenty five questions was used in the collection of data. Descriptive statistics and logistic regression analysis were conducted to determine associations between various variables.

Results: Case subjects had statistically significantly lower quality of life compared to control subjects (cases, median=46.09, IQR= 30.84-66.00, n=41), (controls, median= 98.09, IQR=94.94-100.00-, n=41), $p<0.001$). The functional and psychosocial subscales (driving, near and distance activities, social function and mental health) produced the lowest quality of life scores. There was, however, no statistically significant difference in the ocular pain and discomfort subscale between cases and controls ((cases; median= 87.50, IQR= 71.88-100), (controls; median= 87.50, IQR= 87.50-100), $p=0.098$). Regression analysis showed no significant relationship between demographic profile and quality of life. Cases with profound low vision were 0.49 (95% CI= 0.46-0.71) times less likely to have good quality of life compared to subjects with normal vision. Quality of life worsened with decreasing vision

Conclusion: Quality of life is impacted by low vision especially in areas of functionality and psychosocial well-being. The degree of impact of low vision on quality of life is influenced by the

severity of vision loss. Incorporation of social support services counseling and rehabilitation protocols that focus on improving functionality may be a step in the right direction in assisting persons with low vision adapt to their vision loss and improve their quality of life.

CHAPTER 1. Introduction

1.1 Background

The health of a group of people is of great importance as healthy people are critical for the development of the group, community or nation (1,2). In recent years, however, various nations have been presented with serious health challenges such as HIV/AIDS and Ebola that have led to loss of human resources with huge economic implications, and have threatened the very existence of some communities and nations (3,4). Low vision is one of the visual health-related conditions that affects an individual's quality of life (5,6). Low vision is said to exist if the vision, "best corrected with regular lenses in the better eye is worse than 6/18 but better than light perception or if the maximum diameter of the visual field in the eye with the larger field is less than 10° from the point of fixation" but the individual is able to make use of his remaining vision to plan and carry out his/her tasks (7,8). The categories of low vision are outlined in Table 1.

Table 1. Classification of low vision (8)

Category	Definition of low vision as specified by best corrected visual acuity in the better eye (in Snellen notation)	Classification of low vision category
0	6/6 – 6/18	Normal vision
1	<6/18-6/60	Moderate low vision
2	<6/60-3/60	Severe low vision
3	<3/60-1/60	Profound low vision
4	<1/60- PL	Near total blindness
5	NPL (no light perception)	Total blindness

The World Health Organization (WHO) defines quality of life as "the individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns" (9). " The concept of quality of life is wide and complex and is affected by the person's physical health, psychological state, level of independence, social relationships, personal beliefs and their relationship to salient features of their environment" (9).

The burden of low vision and its prevalence is on the increase (10) and has become an important public health issue especially in developing countries (11,12). There are 284 million people worldwide with visual impairment of which two hundred and forty five (245) million are said to have low vision and 39 million are blinded (13,14). Global and regional estimates of low vision prevalence is "0.7%, 0.3% in developed countries, 1.4% in sub-Saharan Africa and 0.7% in Ghana" (15). A study on low vision conducted in the Wenchi district in the central region of Ghana in 1994 found the "prevalence of low vision among those over 30 years to be 2%" (16). The prevalence of low vision is said to increase for each decade after the age of 60, regardless of race or ethnicity, with 25% of all people over the age of 75 experiencing low vision (17). This figure is expected to increase by twice if nothing is done to remedy the situation by 2020 (18). For persons over 40 years of age, current global estimates indicate that 1 in every 28 people experiences some form of low vision due to age-related vision diseases (18).

Low vision adversely impacts quality of life (19,20). Studies conducted in different countries on the impact of low vision on the quality of life have found it to be associated with a higher depression rate, high rate of falls and fracture, especially among the elderly (21–24), higher mortality rate (25) and high rate of dependency in carrying out activities of daily living (26). There was a strong correlation between low vision and emotional distress among persons with low vision (27). Low vision has also been found to be a major disabling condition affecting functionality and emotional aspects of the lives of the residential occupants (28).

Low vision could pose a challenge to one's capacity to perform regular or everyday tasks which may include but not limited to reading, getting out of and into bed or the house and picking out one's own clothes (29). In 2008 low vision was described as the "third most common chronic condition for which people need assistance or help to carry out their daily activities" (29). Less involvement in social activities further impacts functionality and emotional wellbeing (30-31). While a lack of involvement in social activities among patients with low vision affects emotional wellbeing, anxiety and depression could result in decreased activity (32).

Low vision affects the prospect of employment, its sustenance and maintenance as well as efficiency even on the job (33). In a study involving 10,340 working individuals, persons with low vision indicated that they had less job satisfaction, less productivity at the workplace, and much less opportunities for career development and advancement, less recognition and being under paid for work done (31,33).

The economic burden resulting from low vision cannot be underestimated (2,14,34,35). In Australia, the economic burden of low vision for the population older than 40 years, was $38.2 billion per annum (36). Global loss of productivity due to low vision was estimated at US$ 42 billion in 2000 (37). This is likely to increase to US$ 110 billion per year by the year 2020 if nothing is done to reduce the prevalence of low vision (37).

While the presence of low vision may affect quality of life, the severity of vision loss rather than the mere presence of low vision is considered as a better predictor of the level of impact of low vision on quality of quality of life (38,39). In a study among residential dwellers, subjects with severe low vision were found to experience greater reduction in their overall quality of life as compared to subjects without any form of visual disability or those with mild unilateral vision loss (28, 40). In a similar study among patients with diabetic eye disease or retinopathy, severity of the retinopathy was associated with the level of impact on quality of life (41).

In Ghana there was a study in 1994 (16) on the impact of low vision on quality of life but no study has been done to determine the relationship between severity of low vision and the level of impact on quality of life of persons with low vision as has been in Europe and America (42).

This study therefore investigated the impact of low vision on quality of life of patients with low vision visiting the Low Vision Center of the Eastern Regional Hospital of Ghana, and the relationship between severity of low vision and quality of life. The Eastern Regional Hospital Low Vision Center is the only low vision center in Ghana where all low vision referrals are managed. This research study is significant as it can provide new and useful insights to the nature of problems low vision poses to patients. A better understanding of the specific challenges patients with low vision in Ghana grapple would direct management and inform future studies that provide solutions specific to the needs of these patients in Ghana.

1.2 Research Questions, Aim and Objectives

1.2.1 Research Questions

The specific research questions for the study were:
   i.   Was there a difference in the quality of life score between subjects with low vision and subjects with normal vision?
   ii.   Did the severity of the low vision relate to the level of impact on quality of life?
   iii. What was the influence of demographic profiles on the quality of life of the studied subjects?

1.2.2 Aim

The aim of the study was to determine the impact of low vision on the quality of life of patients with low vision visiting the Low Vision Center of the Eastern Regional Hospital in Ghana, and the relationship between severity of low vision and impact on quality of life.

1.2.3 Objectives

The specific objectives of the study were:

1.   To determine the difference in quality of life scores between case and control subjects
2.   To determine the relationship between quality of life and severity of low vision.
3.   To determine the effect of demographic characteristics on the quality of life

1.3 Conceptual frame work

The conceptual framework (Figure 1) for this study looked at the factors affecting the quality of life of patients with low vision. These factors included: activities involving near and distance vision, general health, general vision, ocular pain, colour vision, peripheral vision, driving and psychosocial issues (social function, mental health, role difficulty and dependency.
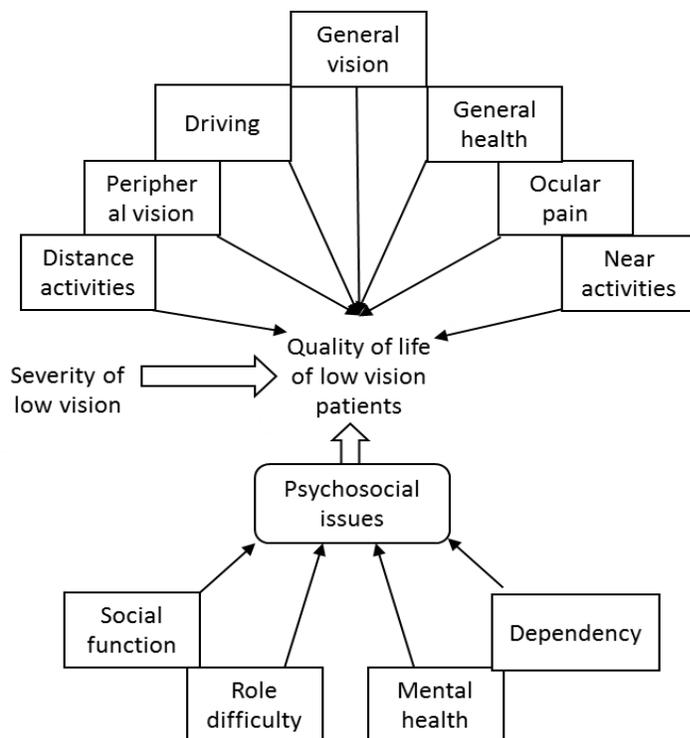
Figure 1. Conceptual framework

Study limitation

This is not a population-based study and that those presenting at the hospital could be more motivated than others.

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CHAPTER 2. Methodology and Research Design

2.1 Introduction

This chapter explores the research methodology and design of the study, the processes and methods used to achieve the study objectives.

2.2 Study Design.

The study followed a case-control descriptive design in which cases were defined as subjects with low vision and controls were age-gender matched patients with normal vision presenting at the low vision center of the Eastern Regional Hospital.

2.3 Study Setting

The study was conducted in the Low Vision Center of the Eastern Regional Hospital in Ghana, West Africa. This low vision center is the main referral center for all low vision cases in Ghana. It has a low vision specialist, an optometrist and an ophthalmologist who manage all the referred cases. Ghana is a constitutional democracy divided into ten administrative regions. It is the world's 45th and Africa's 11th most inhabited nation with a population of approximately 27 million as of 2014 (1). The main occupation of the majority of the populace in this region is farming.

2.4 Subjects

The study included all clinically diagnosed patients with low vision who visited the Eastern Regional Hospital's low vision center from December 1, 2015 to March 31, 2016. These patients consented to be part of this study. These individuals were selected because they were able to provide objective information regarding the impact of low vision on their life. A control group of patients without low vision were also included in the study to deduce if the reduction in quality of life of subjects with low vision is actually attributable to the low vision or other extraneous factors.

2.5 Sampling

2.5.1 Sample size

There were two groups to be compared in this study. These two groups were cases (subjects with low vision) and controls (subjects with normal vision). Measurement of interest was continuous. Cases and controls were set and the main outcome measure was a composite score calculated using NEI VFQ-25 form (Appendices 1, 3). Power of the test was 0.8 (the least reasonable power of a hypothesis test).

Observations were not paired. The Alpha value or significance was set at 0.05 for a two tailed test. From the literature, a large difference was expected of at least 20 points on the composite score (2). Median scores were compared and confidence was set at 95%. The total minimum sample size to effectively compare each section of the NEI VFQ-25 form therefore was 82 [(36*2) + 10%].

2.5.2 Sampling technique

A list of all diagnosed subjects with low vision was obtained from the patient records available at the low vision center. These patients with low vision were then stratified into moderate low vision, severe low vision and profound low vision using the WHO definition of low vision (3). Simple random sampling was used to select 15 subjects with moderate low vision, 13 subjects with severe low vision and 13 subjects with profound low vision. Convenience sampling was used to select 41 age-gender matched subjects with normal vision as the control group. These patients with normal vision also attended the low vision center of the Eastern Regional Hospital for other eye non-vision threatening issues other than low vision.
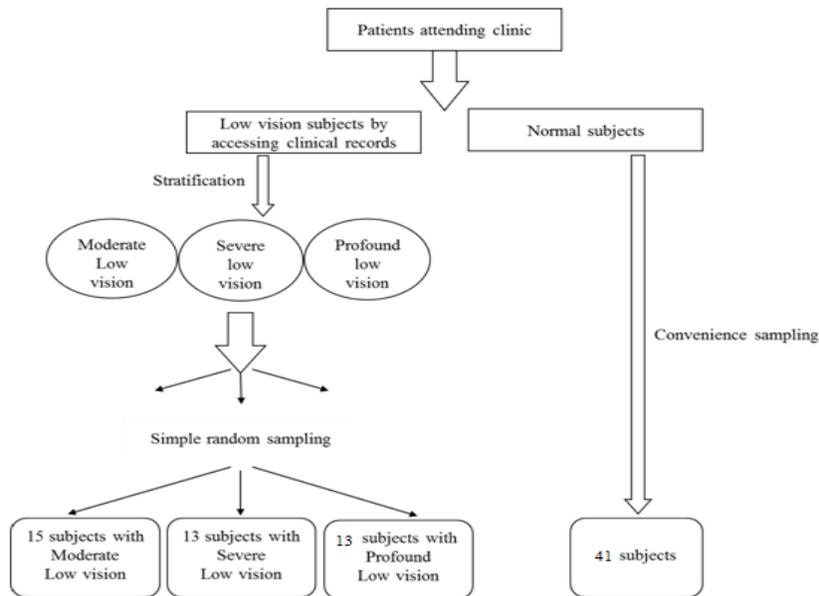
Figure 1. Sampling of cases and control

2.6 Data Collection Tools

Data on the quality of life of the subjects was collected using the NEI VFQ-25 questionnaire (Appendix 1). Demographic profile such as age, gender education and employment as well as the profile of the subjects was collected the biographical portion of Appendix 1.

The NEI VFQ-25 is an abridged form of the of the NEI VFQ-37 questionnaire. It is a validated tool used in assessing quality of life in low vision as well as in a variety of other ocular diseases (2,4–6).

2.7 Data collection process

The scope, aim, objectives, benefits and risks of the research were explained to the patients, and provided in an information document for the patients. The information document and consent form, drafted in accordance with the ethical requirements stipulated by the Biomedical Research Ethics committee of the University of KwaZulu-Natal and the Ghana Health Service (Appendices 4, 5, 6) were signed by consenting subjects before data collection. Demographic information including age, gender, educational level and employment status were obtained from patients. The NEI VFQ-25 questionnaire was used without any amendment in this research after pretesting and validating its use among the sampled subjects.

2.8 Data Analysis

The NEI VFQ-25 is a shorter version of the 51-item vision function questionnaire (Appendix 1) and explores vision-targeted health-related quality of life. It comprises of 12 subscales (appendix 2) which are each scored between zero and hundred, with a higher score indicating better quality of life (Appendix 3)

The statistical package for social science (SPSS) software, version 23.0, Chicago IL, was employed in the analysis of the data. Descriptive statistic was conducted to assess demographic characteristics of subjects studied. Data was entered in and analyzed with SPSS. Non-parametric analysis including Mann-Whitney U and Kruskal-Wallis test were conducted to compare the quality of life of cases and controls. Statistical significance was set at $p < 0.05$.

2.9 Data Management

The data was entered in SPSS. The hard copies were stored in secured cabinets with the principal investigator being the sole person with access to it. The electronic copy was stored on a password protected computer. The data collection forms will be kept for a maximum of five years in a locked cupboard, after which it will be discarded.

2.10 References

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CHAPTER 3 Manuscript One

This chapter addresses the first objective which sought to compare the quality of life of cases and controls and is presented as a manuscript on: vision specific and psychosocial impact of low vision on quality of life of patients with low vision at the Low Vision Center of the Eastern Regional Hospital, Ghana. The manuscript is written in the format for publication in the African Vision and Eye Health journal. The manuscript reference number 401 (Appendix 7), has been accepted for publication subject to review.

Vision specific and psychosocial impact of low vision among patients at the Low Vision Center of the Eastern Regional Hospital in Ghana

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Abstract.

Purpose: Low vision is said to adversely impact the psychosocial and vision specific quality of life of patients living with low vision. The vision specific functions and psychosocial well-being effects of low have not been extensively studied in Ghana. This study therefore investigated the impact of low vision on quality of life of low vision patients visiting the low vision center of the Eastern Regional Hospital of Ghana.

Methodology: A descriptive case-control study compared the quality of life of 41 subjects with low vision (cases) and 41 subjects with normal vision (controls) from the Low Vision Center of the Eastern Regional Hospital of Ghana using the National Eye Institute Visual Function Questionnaire (NEI VFQ-25) as the data collection tool. Descriptive statistics were conducted to assess patients' demographic and clinical characteristics using SPSS version 23, Chicago IL. To investigate association between patients' demographics and quality of life, logistic regression analysis was done. Comparison analysis using Mann-Whitney U test that assessed differences in median between quality of life scores for cases and controls were done.

Results: The sample comprised of 27 male and 14 female case and 16 males and 25 females control subjects. There was a statistically significant difference in the quality of life scores of subjects with low vision compared to control subjects, (composite score of cases (median= 46.09, Interquartile range [IQR]: 30.80-66.00, n=41), control (median= 98.09, IQR: 94.90-100.00, n=41)), $p<0.001$. All the quality of life subscales, except the ocular pain and discomfort subscale (p=0.098) showed statistically significant correlation with low vision. The driving subscale was the most affected (median= 8.33, IQR: 8.33-41.67, n=41, $p<0.001$.

Conclusion: Low vision significantly impacts the quality of life of patients with low vision especially in the areas of functionality and psychosocial health. Interventions that address the functional and psychosocial issues of persons with low vision are necessary and may be elucidated with further in-depth qualitative research on the quality of life of patients with low vision in Ghana.

Introduction

Low vision is defined as a visual impairment in which the "best corrected vision with corrective lenses in the better eye is worse than a visual acuity of 6/18 but better than light perception or the maximum diameter of the visual field in the eye with the larger field is less than 10° from fixation"(1). Its increasing prevalence has raised public health concern (2,3). Approximately 284 million people have visual impairment worldwide of which 39 million are blind and 245 million have low vision (3,5). The prevalence of low vision in developed countries is estimated at 0.3%, lower than both the global estimate of 0.7% and the sub-Saharan Africa estimate of 1.4% (5). The prevalence of low vision for each decade after 60 years increase irrespective of race or ethnicity (6). Approximately 25% of all people over the age of 75years do experience some form of low vision (6). With a population of about twenty million in 2000, Ghana was estimated to have between 200,000 and 600,000 persons who were visually impaired (7). For person in the central region of Ghana who are over 30 years of age, the prevalence of low vision was estimated to be 2% in 1994 (8).

Quality of life, which refers to an individual's perception of his or her position in life in relation to the cultural beliefs and value systems in which she or he lives and relative to his or her goals, expectations, standards and concerns (9), is impacted by low vision (10). Low vision is associated with psychosocial and functional problems (11–13). It has also also been associated with increasing mortality, decreasing mobility and risk of falls (14–16). The global and regional economic implication due to low vision cannot be underestimated (17,18). Globally, in 2000, there was an annual economic loss of productivity of US$ 42 billion due to low vision and this figure is expected to increase to US$ 110 billion per year by the year 2020 should prevalence of low vision continue to increase (17, 19). Low vision leads to loss of productivity due to reduced workforce participation as most low vision subjects are either unemployed or are unable to perform maximally due to their visual disability (19) The possibility of gainful employment is adversely impacted by low vision as well (20,21). Low vision is considered to be one of the main disabling visual that creates the need for high dependency and affects one's ability to carry out every day activities of life (22,23). This study aims to investigate the vision specific and psychosocial implications of low vision among patients with low vision visiting the Eastern Regional low vision center in Ghana.

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Methodology

This was a descriptive case-control study examined forty one (41) subjects with low vision (cases) and forty one (41) subjects with normal vision (control) who presented at the Low Vision Center of the Eastern Regional Hospital of Ghana. The main outcome measure was a composite score calculated through the use of National Eye Institute visual function questionnaire (NEI VFQ-25) (24). The NEI VFQ-25 has been used in numerous studies as a very reliable and valid tool for assessing quality of life in low vision (25,26). Based on a power of 0.8, unpaired observations, significance set at 0.05, and an expected difference of at least 20 points on the composite score, the minimum sample size to effectively compare each section of the NEI VFQ-25 questionnaire was 82 [(36*2) + 10%].

This study received ethics approval from the Biomedical Research Ethics Committee of the University of KwaZulu-Natal and the ethics committee of the Ghana Health Service, Eastern Region Branch, Ghana and approval from the Eastern Regional Hospital. Informed consent was obtained from research participants before the commencement of the study.

A list of all patients diagnosed with low vision was obtained from the patient records available at the Low Vision Center of the Eastern Regional Hospital. Forty-one patients with low vision were selected using simple random sample. Their low vision status was confirmed with a preliminary examination by a low vision specialist. To establish that the quality of life scores among the subjects with low vision was actually due to the low vision, a control group of 41 age- gender matched subjects with normal vision who visited the Low Vision Centre of the Eastern Regional Hospital were recruited and studied. Grading of scores for each of the NEI VFQ-25 subscales was guided by the literature (24). The NEI VFQ-25 questionnaire was used without any modification; however, it was pre-tested on subjects and was found to be reliable with a Cronbach's alpha coefficient of 0.98. Data was entered into the Statistical Package for Social Sciences (SPSS) and analysed using SPSS version 23, Chicago, IL. Descriptive statistics were conducted to determine the socio-demographic and clinical characteristics of subjects. Non-parametric analysis was conducted since the data was not normally distributed. The Mann-Whitney U test was used to compare quality of life scores between cases and control. Statistical significance was set at $p<0.05$. Multivariate analysis was conducted to investigate associations between quality of life and the demographic variables

Results

The sample comprised of 41 cases and 41 controls. Of the cases, there were 27 (65.85%) males and 14 (34.15%) females. There were 16 (39.02%) males and 25 (60.98%) females in the control group.   The age range of the sample was from 17 to 80 years. The median age of cases (35.50, IQR: 62.00-21.00) and controls (36.50, IQR: 50.00-28.00) were similar.

Table 1. Demographic profile of studied subjects (n=82)

	Frequency (n)	**Percentage (%)**	**Frequency (n)**	**Percentage (%)**
	Cases (n=41)		**Controls (n=41)**	
Age (years) distribution				
<40	21	51.22	25	60,98
40-60	7	17,07	12	29,27
>60	13	31,71	4	9,75
Gender distribution				
Male	27	65,85	16	39,02
Female	14	34,41	25	60,98
Employment				
Unemployed	21	51,22	4	9,76
Government Employee	4	9,76	19	46,34
Self Employed	10	24,39	15	36,59
Retired	6	14,63	3	7,32
Income				
None	6	14,63	1	2,44
Low Income (<GH₵1000)	22	53,66	11	26,83
Middle Income (GH₵ 1000-5000)	9	21,95	10	23,39
High Income (GH₵ >**5000**)	4	9,76	19	46,34
Education				
Uneducated	6	14,63	5	12,20
Basic	5	12,20	5	12,20
Secondary	16	39,02	10	24,39
Tertiary	14	34,15	21	▶ 51,22
Marital Status				

Single	18	43,90	17	41.46
Married	18	43,90	20	48,78
Divorced	0	0,00	1	2,44
Widowed	5	12,20	3	7,32

The proportion of unemployed patients with low vision compared to subjects with normal vision was significantly high with 51.22% and 12.20% respectively with Fisher's exact test showing a significant p-value <0.001. There was also a high proportion of government employed patients with normal vision than patients with low vision with 46.34% and 9.70% respectively, with Fisher exact test showing a significant p-value <0.001 as well. The proportion of patients with low earning income status was significantly higher among patients with low vision compared to normal vision patients 53.66% and 26.83% respectively, Fishers exact test yielded significant p-value (p=0.040). There was no significant difference in the educational and marital status of cases and controls (p= 0.423 and 0.657) respectively.

Table 2 Causes of low vision among cases (n=41)

Cause	Frequency (n)	Percentage (%)
Cataract	8	19,51
Uncorrectable refractive error	8	19,51
Glaucoma	6	14,63
Maculopathy	5	12,20
Cornea Opacity	3	7,32
Nystagmus and albinism	3	7,32
Amblyopia	2	4,87
Keratoconus	1	2,44
Multiple cause	2	4,87
Retinopathies	2	4,87
Retinitis Pigmentosa	1	2,44
Total	41	100,00

Cataract (19.51%) and refractive error (19.51%) were the most prevailing causes of low vision among case subjects (Table 2). Glaucoma (14.63%) was the second commonest condition among the cases. Other

less frequent conditions that resulted in low vision were corneal opacity, amblyopia, keratoconus, retinitis pigmentosa, retinopathies, nystagmus and albinism.

Table 3 Comparison of NEI VFQ-25 scores of cases (n=41) with controls (n=41), significance set at p<0.05

QOL subscales	QOL scores for Cases (median and IQR)		QOL scores for Controls (median and IQR)		*p*-value
	Median	**IQR**	**Median**	**IQR**	
Driving*†	8,33	8,30-41,70	100,00	100,00-100,00	P< 0,001
Dependency*	33,33	25,00-50,00	100,00	100,00-100,00	P< 0,001
Distance activities†	35,42	16,70- 58.80	100,00	100,00-100,00	P< 0,001
Mental health*	37,50	25,00-50.00	100,00	93,80- 100,00	P< 0,001
General vision†	40,00	20,00-60.00	100,00	80,00- 100,00	P< 0,001
Near activities†	50,00	16,7- 66,70	100,00	100,00-100,00	P< 0,001
Social function*	50,00	37,50- 78,10	100,00	100,00-100,00	P< 0,001
Role difficulty*	50,00	25,0- 62.50	100,00	100,00-100,00	P< 0,001
Colour vision†	50,00	25,00-100,00	100,00	100,00-100,00	P< 0,001
Peripheral vision†	50,00	25,0- 100,00	100,00	100,00-100,00	P< 0.001
General health	75,00	50,00-75,00	100,00	100,00-100,00	P< 0,001
Ocular pain*	87,50	71,9-100,00	87,50	87,50- 100,00	0,098
Composite score	**46,09**	**30,80-66,00**	**98,09**	**94,90-100,00**	**P< 0,001**

* Psychosocial subscales; †vision specific subscale

Quality of life (QOL) for the cases and controls was determined using the median due to the fact that the data was not normally distributed (Table 3). The median composite score of quality of life on the NEI VFQ-25 questionnaire for cases was 46.09 (IQR: 30.84 -66.00) while that of controls was 98.09 (IQR: 94.00 100.00)).   The QOL subscale mostly affected was driving (median 8.33, IQR: 8.30-41.70) with dependency (median 33.33, IQR: 25.00-50.00) and distance activities (median 35.42, IQR: 16.70-58.80) as the second and third most affected subscales respectively. There was no significant difference between cases and controls on the ocular pain and discomfort subscale (p=0.098).

Discussion

The median age (median = 38.50, IQR=18.00-61.00)) at which the cases developed low vision was quite similar to that in other developing countries (27) which is more frequently at an early age compared to developed countries (28). This could be due to the high life expectancy in developed countries as a result of better healthcare, adequate health facilities and the ability and willingness of people in developed countries to access healthcare in contrast to developing countries with inadequate healthcare providers and facilities, combined with a high rate of poverty, making healthcare inaccessible and unaffordable (29,30).

Unemployment rate was relatively higher among cases than controls (Table 1). The proportion of unemployed patients with low vision compared to subjects with normal vision was significantly high (51.22% vs. 12.20%) respectively Fisher's exact p-value <0.001. Most case subjects who had employment were self-employed with low income returns. The employment situation of case subjects is consistent with that of the study by Wolffe and Spungin (31) who reported that most patients with low vision either lose their jobs and/or are forced to employ themselves because they are unable to carry out their responsibilities at their workplace anymore. Similar unemployment rate for the visually impaired and low vision have been reported in Britain (32) and in Australia (33). A study on employment issues facing patients with low vision in Australia indicated that almost 60% of respondents were unemployed not by their choice, people with low vision were found to be four times unlikely to be employed and almost 25% of respondents faced employment-related discrimination (33). If visually impaired patients have difficulties with respect to employment, then patients with low vision will have more difficulties due to the barrier to functioning within certain roles as a result of their vision impairment. One can infer from the findings of this study and those cited above that, subjects with low vision apparently have similar challenges in the area of employment irrespective of geographical location. Among the many reasons for the high unemployment rate and unwillingness on the part of employers to take on persons with low vision include non-performance on the job due to the limitations placed on subjects with low vision by their visual condition, inability of employers to discipline due to possible lawsuits, limited awareness on how to deal with people with disabilities and their general attitude towards employment (34–36).

Causes of Low Vision

This study found the leading causes of low vision to be cataract and refractive error, both with approximately twenty percent (20%) frequency. This finding was slightly different from global and Africa-specific data where cataracts predominate over uncorrected refractive error (37,38). The equal frequency of cataracts and refractive error could possibly only be attributed to this study sample. Cataract and refractive error continue to be the leading causes of blindness in developing countries due to limited availability of eye care services, increasing poverty rate which makes accessibility to cataract surgeries and the purchase of corrective lenses almost impossible to the majority of the people (39). The lack of adequate health care personnel (40) to provide vision care contributes to the development of low vision from avoidable and sometimes preventable causes. Glaucoma was the second commonest condition responsible for low vision among the case subjects probably due to the fact that Ghana has been identified as the country with the second highest prevalence of glaucoma globally, with about 700,000 of the population diagnosed with glaucoma (41,42)

Vision related aspects of quality of life

In this study, cases presented with much lower quality of life scores in comparison with the control group with the median composite score for cases of 46.09 (IQR: 30.80-66.00), and 98.09 (IQR: 94.90-100.00) for controls. Except for the ocular pain and discomfort subscale (p=0.098), cases had statistically significant lower scores on all the NEI VFQ-25 subscales (table 3), indicative of the negative impact of low vision on quality of life. Vision specific, functionality and psychosocial aspects of quality of life were the most affected. Vision specific subscales that were impacted included driving, colour vision, distance and near vision/activities, colour vision and general vision. The case subjects in this study recorded very low scores on the driving subscale compared to control subjects (table 3), in agreement with the study in Nepal (43). Driving has implications for quality of life where research has shown that cessation of driving is associated with depression, less social interaction and limits job opportunities (44–46). Unlike subjects with low vision in developed countries who are privileged to have sophisticated low vision aids such as the visual field expanders and bioptic telescopes to enable them drive, low vision subjects in this study did not have access to such aids. This probably explains why most of the cases either completely stopped driving or barely drove. Though the subjects in the study by Fonda et al. (44) were elderly patients than those in this current study, low vision appears to produce similar effects on driving. This could be due to the fact that driving is a visually demanding task (47) and the quality of vision required to execute the driving task is the same irrespective of age.

Psychosocial aspects of quality of life

Low vision was found to be an important factor impacting psychosocial health. Psychosocial subsclaes on the NEI VFQ-25 questionnaire were social function, role difficulty, mental health and dependency. In 2012, Omar et al. (48) discussed that even mild low vision was significantly associated with reduced mental health (48). In this study, mental health was the most affected aspect on the QOL subscale after driving, dependency and distance activities (table 3). Strong correlation between low vision and emotional distress (49–53) have been found to exist. The psychological implications of low vision indicates the need for mental health assessment or psychological intervention in low vision assessment (12,53). In Ghana however, access to such services are limited.

Low vision affected the functional ability of cases in this study (median=8.33 IQR: 8.30-41.70). Difficulty participating in social functions such as visiting friends and in carrying out activities of daily living characterized the experience of the cases. This finding is consistent with other studies (15,23,54,55). Berger et al.(6) and Warren (23) reported from their studies that low vision was the third most common chronic condition for which people required some form of assistance in carrying out activities of daily living. Berger and Porell (13) reported that, decreased near vision is positively associated with reduction in activities of daily living. Low vision could also place limitation on distance and near vision ability (56–58). The impact of low vision on distance vision was found in our study to be greater than near vision contrary to similar studies in Nigeria (57) and Tanzania (59). One possible reason could be due to the overall age distribution of the cohort in this study being a younger age category whereby people are predominantly occupied in activities that require distance vision being more utilized. Although low vision affects the different quality of life subscales independently, there is an interrelation among these subscales of the NEI VFQ-25. Cessation of driving has been found to negatively affect mental health by causing depression (60), peripheral and colour vision loss affect driving (47),

Conclusions and Recommendations

The interrelationship among the different components of the NEI VFQ-25 demands an interdisciplinary approach in the management of the patient with low vision. The need for training low vision patients is vital not only to enable them to adapt to their new situation but to make use of their residual vision in their daily living in improving their quality of life. A multi-disciplinary team consisting of optometrists, low vision specialists, orientation and mobility therapists and psychologists working with low vision patients will enable them to psychologically handle the situation and its limitations, to facilitate access

and fulfill activities of daily living. Furthermore, a community or social worker can also assist families in becoming aware of the impending limitations of the patient with low vision and thereby allow family members to take a more compassionate approach in dealing with the patient with low vision. It is critical that the overall acceptability of patients with low vision by communities as well as governments is addressed. This will include creating awareness in communities regarding low vision and the fact that with appropriate interventions patients with low vision can be active and productive. Furthermore government services need to be aligned to the needs of the low vision patients, a major challenge in developing and poor countries.

This study provides insight into the implication of low vision on quality of life of patients with low vision in Ghana. There is however, the need for further research on interventions, the relation between severity and/or duration of low vision and level of impact on quality of life. A randomized control study will be very useful in providing greater insight into these issues.

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CHAPTER 4 – Manuscript 2

Manuscript two addresses the second objective of investigating the relationship between severity of low vision and level of impact on quality of life.

The relationship between the severity of low vision and quality of life

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Abstract

Introduction: Low vision is a significant eye health condition that impacts the quality of life of affected individuals. The severity of low vision is considered to be a more significant determinant of the level of impact of low vision on quality of life than just the mere presence of the condition. This study therefore sought to assess the relationship between severity of low vision and impact on quality of life of subjects with low vision from the Eastern Regional Low Vision Center, Ghana.

Methodology: A total of eighty two subjects were recruited from the Eastern Regional Low Vision Center with 41 subjects having been diagnosed with low vision (case) and 41 subjects with normal vision (control) by the low vision specialist. The cases were then stratified into moderate, severe and profound low vision based on the best corrected visual acuity in the better eye according to the classification of low vision set out by the World Health Organization. Descriptive statistics were applied to determine the visual acuity presentations of cases and control. Correlation and logistic regression analysis were also conducted to assess the relationship between severity of low vision and quality of life.

Results: The median composite score of quality of life on the NEI VFQ-25 questionnaire for case subjects was 46.09 (Interquartile range [IQR]: 30.84-66.00) while that of controls subjects was 98.09 (IQR: 94.94-100.00). A statistically significant negative correlation existed between severity of low vision and quality of life (rho=0.908, p<0.001). Logistic regression analysis found that subjects with profound low vision were 0.49 times less likely to have good quality of life in relation to subjects with normal vision (95% CI= 0.46- 0.71).

Conclusion: There is a significant relationship between severity of low vision and the level of impact on quality of life. Profound vision loss resulted in greater reductions in quality of life.

Introduction

The impact of low vision on quality of life is well documented in both developing and developed countries (1–7). The instrumental role of visual function in ensuring optimal function and social well being have probably influenced the many studies in quality of life in low vision (8–10).

Recent studies (11–14) have sought to explore the relationship between confounding factors such as duration of low vision, cause of low vision and the severity of the low vision on the level of impact on quality of life, which may contribute greatly to the quality of life of low vision patients than just the mere presence of low vision. Although literature has very limited data on the relationship between severity of low vision and level of impact on quality of life, and scarcely any such data in Ghana, other studies have explored the relationship between severity of vision impairment and quality of life (14, 15), severity of diabetic retinopathy and quality of life (13, 16), severity of visual field loss in patients with glaucoma and quality of life (17).

The level of severity of impaired distance and near visual acuity was greatly associated with poorer quality of life among elderly residential dwelling individuals (18). In a study that compared quality of life with vision loss due to diabetic retinopathy and loss of vision due to age-related macular degeneration, the level of impact on quality of life was related more to the severity of the vision loss rather than the cause of vision loss (19). The "Los Angeles Latino eye study" found severity of diabetic retinopathy to be significantly associated with poor quality of life (13). Thus the severity of low vision determines to a large extent the level of impact on quality of life. The severity of the low vision may warrant different rehabilitation services and may affect management and treatment. Therefore, research that investigates the impact of the severity of low vision on quality of life of patients with low vision is necessary. The stratification of subjects with low vision into moderate, severe and profound was based on the best-corrected visual acuity in the better eye in accordance with the WHO classification of low vision (table 1) (20).

Table 1. Classification of low vision (20)

Category	Definition of low vision as specified by best corrected visual acuity in the better eye (in Snellen notation)	Classification of low vision category
0	6/6 – 6/18	Normal vision
1	<6/18-6/60	Moderate low vision
2	<6/60-3/60	Severe low vision
3	<3/60-1/60	Profound low vision
4	<1/60- PL	Near total blindness
5	NPL (no light perception)	Total blindness

The information gathered from this study could inform decision making of clinicians regarding commencement of rehabilitation and monitoring the response of patients to treatment or rehabilitation. This study aims to investigate the relationship between severity of low vision and the level of impact on quality of life of patients with low vision visiting the low vision center of the Eastern Regional Hospital, Ghana.

Methodology

A total of 41 subjects with low vision (cases) and 41 age and gender matched subjects with normal vision (controls) were recruited from the outpatient Low Vision Center of the Eastern Regional Hospital. The minimum required sample size based on a power of 0.8, set at a significance of 0.05 was 82 [(36*2) + 10%]. The National Eye Institute Visual Function Questionnaire (NEI VFQ-25) served as the measuring tool. It was pretested for reliability with a Cronbach's alpha coefficient of 0.98.

Permission to conduct the study was obtained from the Eastern Regional Hospital in Ghana and ethical clearances were awarded by the Ghana Health Service Ethics Committee, and the Biomedical Research Ethics Committee of the University of KwaZulu-Natal.

Preliminary examinations that established visual acuity using the LogMAR acuity chart, low vision status and cause of low vision were conducted by optometrists, low vision specialist and an ophthalmologist. Low vision was "said to be present when the best-corrected visual acuity in the better eye with corrective lenses was worse than 6/18 but better than light perception" (21). These cases were then stratified into

moderate, severe and profound levels of low vision according to the WHO classification (table 1) (20). The procedure for the recruitment of study subjects is diagrammatically presented in figure 1.
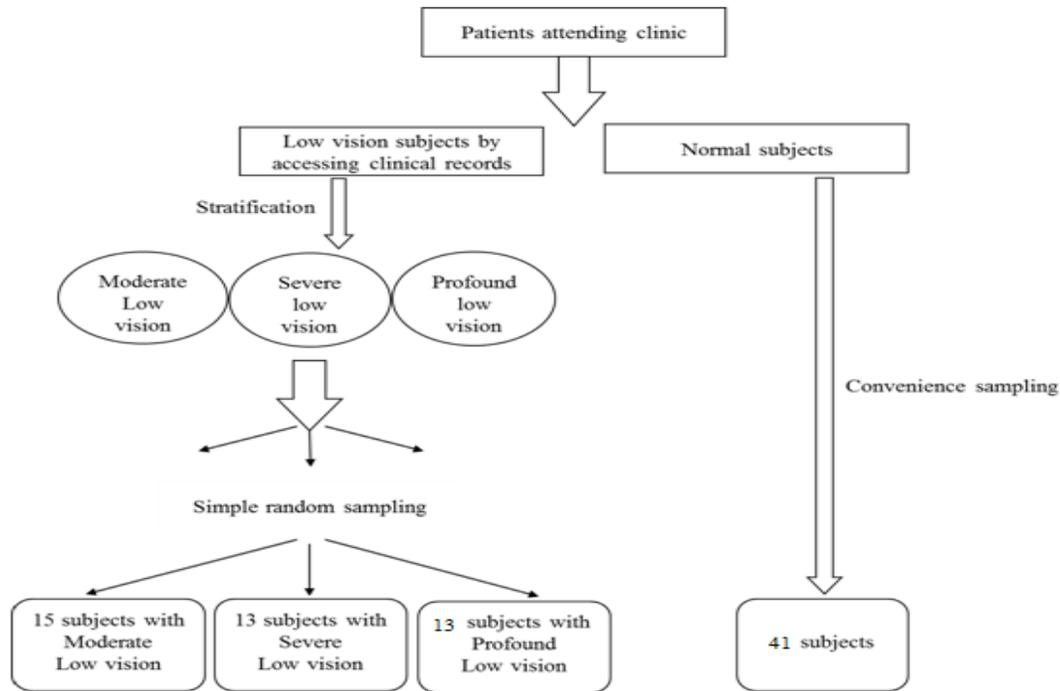
Figure 1. Sampling of studied subjects

An in-hospital interview was conducted to gather information on demographics. The NEI VFQ-25 questionnaire was administered to consenting subjects after they had had an understanding of the study and its purpose and consented to enroll as research subjects (appendix 6). The NEI VFQ-25 is a validated and reliable questionnaire that is used in assessing quality of life over a wide range of eye conditions and in various languages (22–25). In computing the total scores for each subscale in the NEI VFQ-25 questionnaire (Appendices 2 and 3), the proposed scoring algorithm by the developers of the tool was used (26,27). The responses generated from the NEI VFQ-25 questionnaire were transformed and recoded (appendix 2). Scoring on the NEI VFQ-25 quality of life scale was a two-step process. In the first step, the original numeric values from the survey were re-coded following the scoring rules outlined in appendix 3. All items were scored so that a high score represents better functioning. Each item was then converted to a 0 to 100 scale (appendix 3) so that the lowest and highest possible

Scores were set at zero (0) and 100 points, respectively. In this format scores represent the achieved percentage of the total possible score, e.g. a score of 70 represents 70% of the highest possible score. In step 2, items within each sub-scale were averaged together to create the 12 sub-scale scores. The total composite score for each subject was obtained by calculating the average of the averages from all the eleven subscales of the NEI VFQ-25 (Appendices 2 and 3).

Data analysis

Descriptive statistics was used to determine the distribution of the best corrected visual acuity for both cases and controls. Non-parametric data analysis was conducted due to non-linearity of the data and small sample size. Correlation analysis was done to investigate the relationship between the various categories of the cases and quality of life. Partial correlation coefficients were calculated to determine those correlations while adjusting for age and gender and other demographic factors. To compare scores between the groups (moderate, severe and profound low vision), a Kruskal Wallis analysis was conducted. Logistic regression analysis was finally applied to determine the association between severity of low vision and impact on quality of life. The Statistical Package for Social Sciences (SPSS), Chicago IL, version 23 was used for data analysis.

Results

A total of eighty two subjects, forty-one with low vision (cases) and forty one (41) subjects with normal vision (controls)) were studied. There were 27 males (65.85%) and 14 females (34.15%) among the case subjects and 16 male (39.02 %) and 25 female (60.98%) control subjects. The median composite score of quality of life on the NEI VFQ-25 questionnaire for case subjects was 46.09 (IQR: 66.00-30.84) while that of controls subjects was 98.09 (IQR: 94.94-100.00). The median age of cases was 35.50 (IQR: 21.00-62.00) while that of the control was 36.50 (IQR: 28.00-50.00)

Table 2. Distribution and categorization of best corrected visual acuity among cases and control (n=82)

Best corrected visual acuity (LogMAR)	Frequency (n)	Percentage (%)	Category of low vision
0,00-0,50	41	50,00	Normal/near normal vision
<0,50-1,00	15	18.30	Moderate low vision
<1,00-1,30	13	15,90	Severe low vision
<1.30-1.77	13	15.90	Profound low vision
total	82	100,00	

Best corrected visual acuity is the vision in the better eye after correction with regular lenses. The LogMAR visual acuity notation was used.

There was a statistically significant inversely proportional correlation between severity of low vision and quality of life subscales except for ocular pain subscale, (tables 3 and table 4).

Table 3 Correlation between severity of low vision and quality of life subscales (n=82)

QOL subscale	Severity of low vision Correlation coefficient	p-value
General health	-0,68**	P<0,001
General vision	-0,93**	P<0,001
Ocular pain and discomfort	-0.31**	0.578
Near activity	-0,91**	P<0,001
Distance activity	-0,92**	P<0,001
Social function	-0,91**	P<0,001
Mental health	-0,89**	P<0,001
Role difficulty	-0,90**	P<0,001
Dependency	-0,90**	P<0,001
Driving difficulty	-0,89**	P<0,001
Peripheral vision	-0,79**	P<0,001
Colour vision	-0,79**	P<0,001
Composite score	-0,92**	P<0,001
*significant at p<0.05 (2-tailed), ** significant at p<0.01 (2-tailed)		

All subscales except ocular pain and discomfort subscale on the NEI-VFQ-25 questionnaire showed statistically significant correlations, p<0.001 with quality of life subscales being inversely proportional to severity of low vision (table 3)

Table 4. Correlation between severity of low vision and quality of life subscales after controlling for demographic factors (n=82)

QOL subscale (bold)	Severity of low vision Correlation coefficient	p-value
General health	-0,48	P< 0,001
General vision	-0,87	P< 0,001
Ocular pain and discomfort	-0.26	0.230
Near activity	-0,91	P< 0,001
Distance activity	-0,87	P< 0,001
Social function	-0,91	P< 0,001
Mental health	-0,86	P< 0,001
Role difficulty	-0,77	P< 0,001
Dependency	-0,88	P< 0,001
Driving difficulty	-0,88	P< 0,001
Peripheral vision	-0,79	P< 0,001
Colour vision	-0,78	P< 0,001
Composite score	-0,95	P< 0,001

All subscales on the NEI-VFQ-25 questionnaire showed statistically significant correlations, p< 0.001 except for ocular pain and discomfort subscale p=0.230 with quality of life subscales being inversely proportional to severity of low vision.

Multinomial logistic regression analysis was performed to assess the impact of severity of low vision on quality of life. The model contained one independent variable (composite score) and four categories of the dependent variable (normal vision, moderate low vision, severe low vision, profound low vision) with normal vision as the reference category. The model was statistically significant X^2(3, n=(82)=68.56, p<0.001). The odd ratios (OR) indicate that respondents with moderate, severe and profound low vision were less likely to report an increase in quality of life than those with normal vision. The likelihood of those with profound low vision reporting an increase in quality of life scores were least likely (OR= 0.49 times), followed by severe low vision (0.62) and moderate low vision (0.73)[table 5]

Table 5. Logistic regression analysis between severity of low vision and quality of life (N=82)

Severity of low vision	OR	95% CI	p-value
Normal vision	Ref	ref	ref
Moderate low vision	0,73	0,651-0,894	P< 0,001
Severe low vision	0,62	0,583-0,817	P< 0,001
Profound low vision	0,49	0,459-0,709	P< 0,001

Discussion

Demographics profile, visual acuity and quality of life of cases and control

This study investigated the relationship between quality of life and severity of low vision to determine if there were differences in the quality of life at the various levels of severity of low vision. The proportion of male case subjects to female case subjects in this study was greater (ratio: 2:1). This could be due to the less utilization and cultural, economic and social barriers to accessibility of eye care services by females (28) especially in developing countries such as Ghana. This data is similar to studies conducted in Nigeria (29) in which the ratio of male to female with low vision was 1.9:1. Further investigations into the determinants of low vision service utilization and access among females in developing countries could provide insight into understanding the gender distribution in low vision clinics.

Subjects with low vision had lower quality of life on the NEI VFQ-25 questionnaire compared to subjects with normal vision. The median composite score of quality of life for case subjects was 46.09 (IQR: 30.80-66.00) while that of control subjects was 98.09 (IQR: 94.90-100.00). The visual acuity presentation among the cases ranged from 0.60 (LogMar acuity notation) to 1.70

Severity of low vision and quality of life

Correlation analysis showed a statistically significant negative correlation between quality of life subscales and severity of low vision (tables 3, 4). This implied that, quality of life findings among the studied subjects decreased with worsening visual acuity (r=0.95, p<0.001). This negative correlation between quality of life and visual acuity is consistent with results from other studies that investigated the impact of visual acuity on quality of life in patients with type 2 diabetes (13). The regression analysis model (p<0.001) revealed a negative association between quality of life and visual acuity with those with (profound low vision) having the least quality of life score. A study among 535 Caucasians had similar findings (13) as Clark et al (31), except that, the study found no statistically significant association between the ocular pain subscale and changes in visual acuity (31,32). The statistically insignificant

correlation between severity of low vision and ocular pain and discomfort subscale could be due to many factors which may include but not limited to, social support that alleviate pain (33), religious believes that enable people to endure suffering, pain and discomfort (34) thus making the experience of pain and discomfort a less contributing factor to reduced quality of life among patients with low vision. Besides, most causes of low vision do not have ocular pain as an associated factor. The role of religion in helping persons with disability could be an important factor among the cases considering that Ghana is a very religious country (35–37).

The strongest association after controlling for age and gender (table 4) was found between quality of life and social function (rho=0.91, p<0.001) and near activity (rho=0.91, p<0.001), followed by driving (rho= 0.88, p<0.001), dependency (rho=0.88, p<0.001), distance activity (rho=0.933, p<0.001) and mental health (rho=0.912, p<0.001). These findings were expected as literature suggests that optimal vision is essential for functionality (38) and to engage in social activities (9,39,18). The inability to carry out every day activities and to be socially active could also have a depressive or psychological implication therefore reducing mental health and creating a situation of dependency (5,40,41) especially in Ghana, where persons with low vision are not privileged to have easy access to assistive low vision devices (42–44).

Logistic regression analysis of quality of life and severity of low vision showed that persons with severe and moderate low vision were 0.62 times (95% CI: 0.583-0.817, p=0.000) and 0.73 times (95% CI: 0.651-0.894) less likely to have good quality of life respectively compared to persons with normal vision and persons with profound low vision were least likely (0.49 times) to have good quality of life (95% CI: 0.459- 0.709, *p*=0.000) compared to persons with normal vision. This finding implies that, severity of the low vision has an accompanying impact on quality of life and probably not just the mere presence of low vision. This evidence is supported by a study that compared the "utility values of diabetic retinopathy and age-related macular degeneration" (19) and found the impact on quality of life to be associated with the degree of impairment rather than the cause of low vision.

Another study conducted in Ibadan, Nigeria, (8) supports the finding that quality of life is impacted by severity of low vision. The study found that forty-one percent (41.4%) of patients who were blind had poor quality of life compared with 13 (8.6%) with low vision and three (2.4%) with near normal vision. A similar study conducted in Korea (15) that compared the quality of life with severity of visual impairment also found quality of life to decrease with increasing visual impairment relative to normal vision subjects and concluded that even mild visual impairment significantly caused a deterioration in quality of life, thus calling for timely and appropriate intervention.

The findings from this study have implications for the management of low vision, the type of intervention and when management is to be initiated. The strong negative correlation between distant activities (rho=0.87, p<0.001), social function (rho=0.91, p<0.001), near activities (rho=0.91, p<0.001), driving (rho= 0.88, p<0.001), dependency (rho=88, p<0.001) mental health (rho=0.86, p<0.001) and severity of low vision indicates the areas that are critical in management and treatment of subjects with low vision. Treatment regimen and management must focus on improving the patient with low vision's ability to function independently or with less assistance with respect to carrying out daily activities such as attending social functions, interacting with people, ability to read or see well enough at both near and distance (45–47). While assistive devices and management that improve social function may improve mental health, the incorporation of counseling or psychological interventions in management may also be relevant (48)

Conclusion:

This case control study showed that, not only does low vision impact the quality of life of persons but the severity of vision loss has a significant implication for the level of impact on quality of life. Treatment and management routines would have to focus on functionality and mental health. Persons with low vision should be psychologically prepared and equipped socially to adequately face the challenge of decreasing vision through occupational and psychological therapies

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CHAPTER 5: General synthesis

5.1 Introduction

This study explored the impact of low vision on quality of life, and the relationship between severity of low vision and level of impact on quality of life. The study involved 41 clinically proven patients with low vision (cases) and 41 clinically proven subjects with normal vision (control) aged between 17 years and 78 years from the Low Vision Center of the Eastern Regional Hospital, Ghana.

5.1.1 Demographics and quality of life

There was a 51.22% rate of unemployment among the cases and those who worked were primarily self employed (24.39%). This result reflects the general employment situation of persons with low vision worldwide (1–3). In Australia, 58% of persons with low vision are unemployed as a result of visual difficulty compared to the 14% unemployment rate among persons with normal vision (2). The likelihood of persons with low vision remaining unemployed or not finding a job in Australia was four times higher relative to the unemployed individuals with normal vision, that is unemployed persons with low vision who want a job are four times more likely to be unemployed compared to the general population. Persons with low vision still face the challenge of discrimination in relation to employment in Australia (2,4). Similar findings of unemployment rates for visually impaired persons have been found in Britain (5,6).

5.1.2 Causes of low vision

Among the case subjects in this study, cataract (19.51%) and refractive error (19.51%) were the leading causes of low vision (Table 2 of manuscript 1). Glaucoma ranked second among the most common cause of low vision. This finding correlates with those of other studies where the leading cause of low vision was found to be cataract and uncorrected refractive error (7,8). However, in developed countries, age related macular degeneration has been found to be the leading cause of low vision (9,10). Cataract and refractive error, as leading cause of low vision among the cases is a reflection of what is happening in the entire Sub Saharan sub-region of Africa. This could be due to limited availability of eye care services, limited human resources to address the condition (11), increasing poverty rate which makes accessibility to cataract surgeries and the purchase of corrective lenses almost impossible to the majority of the people. Low vision is thus developed from causes that otherwise could have been prevented (11,12). Glaucoma was the second leading cause of low vision among the case subjects and this could be expected as Ghana has the second highest global prevalence of glaucoma with about 700,000 of the population diagnosed with glaucoma (13,14).

5.1.3 Low vision and quality of life

The quality of life scores were lower for the cases compared to the control group except for the ocular pain and discomfort subscale, with the lowest quality of life scores for cases being on the driving subscale, dependency, distance activity, mental health, general vision and social function (table 3 manuscript 1). This outcome was similar to the study on the quality of patients with low vision in Nepal (15). However, there was no statistically significant difference in the score on the ocular pain subscale of the NEI VFQ- for patients with low vision and patients with normal vision. Like the results of this study, low vision has also been found to impact the quality of life with respect to functionality and psychosocial well being (16,17). Inability to function normally creates dependency and the need to rely heavily on others for assistance (18–20).

5.1.4 Severity of low vision and quality of life

While low vision impacts the quality of life, the severity of vision loss may be a better determinant of the level of impact on quality of life. Severity of low vision could influence the level of impact of low vision on quality of life in a manner that may warrant different management protocols (21,22). Severity of low vision correlated negatively but significantly with all the subscales of the NEI VFQ-25 subscales (p<0.001) except ocular pain and discomfort subscale. Severity of low vision had the strongest correlation with factors that involved functionality (driving, near and distance vision, social activity, and dependency) and psychosocial well-being. The inversely proportional correlation between severity of low vision and impact on quality of life as found in this study was similar to that among residential care dwellers (23) in which severity of low vision impacted mostly distance and near activities, mobility, social activity, psychological distress, adaptation and coping, and social activities.

Logistic regression analysis conducted showed that persons with severe and moderate low vision were 0.62 times (95% CI: 0.58-0.82, p<0.001) and 0.73 times (95% CI: 0.65-0.89) less likely to have good quality of life respectively relative to persons with normal vision and persons with profound low vision were least likely (0.49 times) to have good quality of life (95% CI: 0.46–0.71, *p*<0.001) compared to persons with normal vision. This implied that, as the visual acuity got worse or low vision got worse (visual acuity value in logMar notation increased), the quality of life as measured by the NEI VFQ-25 questionnaire decreased. The results from this study correlates with that obtained in the Los Angeles Latino Eye Study Group using a similar NEI VFQ-25 questionnaire as the measuring tool (24) . It was found from the Los Angeles Latino Eye study that, even mild or moderate low vision affected quality of life. The decreased quality of life produced a resultant increase in dependency, lower mental health and greater difficulty in performing activities of daily living such as driving. It was also found, after following

the subjects in the Latino eye study for 4 years that a two line decrease in visual acuity resulted in a 5-point decrease in the composite score of the subscales of the NEI VFQ-25 scale (25), thus this Latino Eye study showed that the severity of the low vision determines to a greater degree the impact on quality of life. A similar correlation was found in the Blue Mountain study in Australia (26).

5.2 Conclusion

Low vision impacts the quality of life of persons affected and more so when the vision loss is profound. Loss of vision affects patients with low vision profoundly in functionality and psychological well-being. While it is important to assess the relationship between low vision and quality of life, it is equally important to study the relationship between the severity of low vision and quality of life that may significantly determine the degree of impact than just the presence of low vision.

5.3 Recommendations

On the basis of the outcome of this study, it is recommended that:

- Low vision assessment and rehabilitation must focus on improving functionality.
- Psychological well-being among patients with low vision ought be assessed and counseling be incorporated in low vision assessment in Ghana
- Government policies need to take into consideration employment of persons with low vision
- Public awareness campaigns and the increase in social services for persons living with low vision may help reduce the negative impact on their quality of life.
- A randomized controlled study investigating the impact of low vision on quality of life may give more insight into the subject of low vision in Ghana.

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APPENDICES

Appendix 1. *Research Questionnaire*

"Biographical Data

Date……………………………………………. Location ……………………………….. Facility

……………………………………………

Age ……………………………………………….. SEX ………………………………………. NUMBER

…………………..

Employment

1. What is the main occupation or activity from which you earn income during the past one year?
    a. Unemployed
    b. Self-employed
    c. Government employee

2. If unemployed, where you formally employed/ lost your job due to poor vision?
    a. Yes
    b. No, have never being employed

3. How much do you earn from all sources of income at the end of the month?

    a. Salary

    b. Self-generated income

    c. Remittances

    d. Others

4. What is your current level of education?
    a. Tertiary.

b. Secondary.

c. Basic school.

d. Uneducated.

5. What is your current marital status?

a. Single

b. Married

c. Divorced

d. Widowed

Clinical Data:

Distance and near visual acuities.

1. RE: D ……………… N…………………………..

LE: D……………… N…………………

2. Cause of Low Vision:

National Eye Institute Visual Functioning Questionnaire (NEI-VFQ 25)

PART 1 - GENERAL HEALTH AND VISION

1. In general, would you say your overall health is*:

1	2	3	4	5
Excellent	Very Good	Good	Fair	Poor

2. At the present time, would you say your eyesight using both eyes

(with glasses or contact lenses, if you wear them) is excellent, good,

fair, poor, or very poor or are you completely blind?

1	2	3	4	5	6
Excellent	Good	Fair	Poor	Very Poor	Completely

					Blind

3.How much of the time do you worry about your eyesight?

1	2	3	4	5
None of the time	A little of the time	Some of the time	Most of the time	All of the time

4. How much pain or discomfort have you had in and around your eyes

(for example, burning, itching, or aching)? Would you say it is:

1	2	3	4	5
None	mild	moderate	severe	Very severe

PART 2 - DIFFICULTY WITH ACTIVITIES

The next questions are about how much difficulty, if any, you have doing certain activities wearing your glasses or contact lenses if you use them for that activity.

5. How much difficulty do you have reading ordinary print in newspapers? Would you say you have:

1	2	3	4	5	6
No difficulty at all	A little difficulty	moderate	Extreme difficulty	Stopped doing this because of your eyesight	Stopped doing this for other reasons or not interested in doing this

6.How much difficulty do you have doing work or hobbies that require you to see well up close, such as cooking, sewing, fixing things around the house, or using hand tools? Would you say:

1	2	3	4	5	6
No difficulty at all	A little difficulty	moderate	Extreme difficulty	Stopped doing this because of	Stopped doing this for other

				your eyesight	reasons or not interested in doing this

7. Because of your eyesight, how much difficulty do you have finding something on a crowded shelf?

1	2	3	4	5	6
No difficulty at all	A little difficulty	moderate	Extreme difficulty	Stopped doing this because of your eyesight	Stopped doing this for other reasons or not interested in doing this

8. How much difficulty do you have reading street signs or the names of stores?

1	2	3	4	5	6
No difficulty at all	A little difficulty	moderate	Extreme difficulty	Stopped doing this because of your eyesight	Stopped doing this for other reasons or not interested in doing this

9. Because of your eyesight, how much difficulty do you have going down steps, stairs, or curbs in dim light or at night?

1	2	3	4	5	6
No difficulty at all	A little difficulty	moderate	Extreme difficulty	Stopped doing this because of your eyesight	Stopped doing this for other reasons or not interested in doing this

10. Because of your eyesight, how much difficulty do you have noticing objects off to the side while you are walking along?

1	2	3	4	5	6
No difficulty at all	A little difficulty	moderate	Extreme difficulty	Stopped doing this because of your eyesight	Stopped doing this for other reasons or not interested in doing this

11. Because of your eyesight, how much difficulty do you have seeing how people react to things you say?

1	2	3	4	5	6
No difficulty at all	A little difficulty	moderate	Extreme difficulty	Stopped doing this because of your eyesight	Stopped doing this for other reasons or not interested in doing this

12. Because of your eyesight, how much difficulty do you have picking out and matching your own clothes?

1	2	3	4	5	6
No difficulty at all	A little difficulty	moderate	Extreme difficulty	Stopped doing this because of your eyesight	Stopped doing this for other reasons or not interested in doing this

13. Because of your eyesight, how much difficulty do you have visiting with people in their homes, at parties, or in restaurants?

1	2	3	4	5	6
No difficulty at all	A little difficulty	moderate	Extreme difficulty	Stopped doing this because of your eyesight	Stopped doing this for other reasons or not interested in doing this

14. Because of your eyesight, how much difficulty do you have going out to see movies, plays, or sports events?

1	2	3	4	5	6
No difficulty at all	A little difficulty	moderate	Extreme difficulty	Stopped doing this because of your eyesight	Stopped doing this for other reasons or not interested in doing this

15. Now, I'd like to ask about driving a car. Are you currently driving, at least once in a while?

Yes .... 1 *Skip To Q 15c*

No...................... 2

15a. IF NO, ASK: Have you never driven a car or have you given up driving?

Never drove ...... 1 *Skip To Part 3, Q 17*

Gave up............. 2

15b. IF GAVE UP DRIVING: Was that mainly because of your eyesight, mainly for some other reason, or because of both your eyesight and other reasons?*)*

Mainly eyesight .... 1 *Skip To Part 3, Q 17*

Mainly other reasons .... 2 *Skip To Part 3, Q 17*

Both eyesight and other reasons ... 3 *Skip To Part 3, Q 17*

15c. IF CURRENTLY DRIVING: How much difficulty do you have driving during the daytime in familiar places? Would you say you have:

1	2	3	4
No difficulty at all	A little difficulty	Moderate difficulty	Extreme difficulty

16a. How much difficulty do you have driving at night? Would you say you have:

1	2	3	4	5	6
No difficulty at all	A little difficulty	moderate	Extreme difficulty	Stopped doing this because of your eyesight	Stopped doing this for other reasons or not interested in doing this

16b. How much difficulty do you have driving in difficult conditions, such as in bad weather, during rush hour, on the freeway, or in city traffic? Would you say you have:

1	2	3	4	5	6
No difficulty at all	A little difficulty	moderate	Extreme difficulty	Stopped doing this because of your eyesight	Stopped doing this for other reasons or not interested in doing this

PART 3: RESPONSES TO VISION PROBLEMS

The next questions are about how things you do may be affected by your vision. For each one, I'd like you to tell me if this is true for you all, most, some, a little, or none of the time.

1	2	3	4	5
All of the time	Most of the time	Some of the time	A little of the time	None of the time

17. Do you accomplish less than you would like because of your vision?

1	2	3	4	5

18. Are you limited in how long you can work or do other activities because of your vision?

1	2	3	4	5

19. How much does pain or discomfort in or around your eyes, for example, burning, itching, or aching, keep you from doing what you'd like to be doing? Would you say:

1	2	3	4	5

For each of the following statements, please tell me if it is definitely true,

mostly true, mostly false, or definitely false for you or you are not sure.

(Circle One On Each Line)

Definitely Mostly Not Mostly Definitely

True True Sure False False

20. I stay home most of the time because of my eyesight.....

1	2	3	4	5
Definitely true	Mostly true	Mostly false	Definitely false	Not sure

21. I feel frustrated a lot of the time because of my eyesight...............................

1	2	3	4	5
Definitely true	Mostly true	Mostly false	Definitely false	Not sure

22. I have much less control over what I do, because of my eyesight. ....

1	2	3	4	5
Definitely true	Mostly true	Mostly false	Definitely false	Not sure

23. Because of my eyesight, I have to rely too much on what other people tell me. .

1	2	3	4	5
Definitely true	Mostly true	Mostly false	Definitely false	Not sure

24. I need a lot of help from others because of my eyesight................................

1	2	3	4	5
Definitely true	Mostly true	Mostly false	Definitely false	Not sure

25. I worry about doing things that will embarrass myself or others, because of my

eyesight"................................

1	2	3	4	5
Definitely true	Mostly true	Mostly false	Definitely false	Not sure

Appendix 2. *Generation of the items on the NEI VFQ-25 Sub-Scales*

scale	Number of items	Items to be averaged
General Health	1	1
General vision	1	2
Ocular pain	2	4, 19
Near activities	3	5, 6, 7
Distance activities	3	8, 9, 14
Vision specific: Social functioning Mental health Role difficulties Dependency	 2 4 2 3	 11, 13 3, 21, 22, 25 17, 18 20, 23, 24
Driving	3	15c, 16, 16a
Color vision	1	12
Peripheral vision	1	10

Appendix 3. *Scoring key: recoding of items 2*	3	4	5	
Definitely true	Mostly true	Mostly false	Definitely false	Not sure

Appendix 2. *Generation of the items on the NEI VFQ-25 Sub-Scales*

scale	Number of items	Items to be averaged
General Health	1	1
General vision	1	2
Ocular pain	2	4, 19
Near activities	3	5, 6, 7
Distance activities	3	8, 9, 14
Vision specific:		
Social functioning	2	11, 13
Mental health	4	3, 21, 22, 25
Role difficulties	2	17, 18
Dependency	3	20, 23, 24
Driving	3	15c, 16, 16a
Color vision	1	12
Peripheral vision	1	10

Appendix 3. *Scoring key: recoding of items*

Item Numbers	Change original response category (a)	To recoded value of:
1,3,4,15c(b)	1	100
	2	75
	3	50
	4	25
	5	0
2	1	100
	2	80
	3	60
	4	40
	5	20
	6	0
5,6,7,8,9,10,11,12,13,14,16,16a A3,A4,A5,A6,A7,A8,A9(c)	1	100
	2	75
	3	50
	4	25
	5	0
	6	*
17,18,19,20,21,22,23,24,25, A11a,A11b,A12,A13	1	0
	2	25
	3	50
	4	75
	5	100
A1,A2	0 to 10	0 to 100

Appendix 4. Ethical clearance

UNIVERSITY OF KWAZULU-NATAL ™
INYUVESI YAKWAZULU-NATALI

16 October 2015

Dr B Adamptey (214584189)
Department of Optometry
School of Health Sciences
adampteybeatrice@ymail.com

Dear Dr Adamptey

Protocol: The impact of low vision on the quality of life of low vision patients visiting the low vision centre of the Eastern regional hospital Ghana.
Degree: MSc Optometry
BREC reference number: BE393/15

EXPEDITED APPLICATION

A sub-committee of the Biomedical Research Ethics Committee has considered and noted your application received on 01 September 2015.

The conditions have been met and the study is given full ethics approval.

This approval is valid for one year from **16 October 2015.** To ensure uninterrupted approval of this study beyond the approval expiry date, an application for recertification must be submitted to BREC on the appropriate BREC form 2-3 months before the expiry date.

Any amendments to this study, unless urgently required to ensure safety of participants, must be approved by BREC prior to implementation.

Your acceptance of this approval denotes your compliance with South African National Research Ethics Guidelines (2015), South African National Good Clinical Practice Guidelines (2006) (if applicable) and with UKZN BREC ethics requirements as contained in the UKZN BREC Terms of Reference and Standard Operating Procedures, all available at http://research.ukzn.ac.za/Research-Ethics/Biomedical-Research-Ethics.aspx.

BREC is registered with the South African National Health Research Ethics Council (REC-290408-009). BREC has US Office for Human Research Protections (OHRP) Federal-wide Assurance (FWA 678).

The sub-committee's decision will be **RATIFIED** by a full Committee at its meeting taking place on **10 November 2015.**

We wish you well with this study. We would appreciate receiving copies of all publications arising out of this study.

Yours sincerely

Professor J Tsoka-Gwegweni
Chair: Biomedical Research Ethics Committee

cc supervisor: naidook6@ukzn.ac.za
cc postgrad: nenep1@ukzn.ac.za

Appendix 5. Permission letters from the Ghana Health Service and Eastern Regional Hospital.

In case of the reply the number and the date of this letter should be quoted.

My Ref. No. ERHD/898

You're Ref. No. ....

REGIONAL HEALTH ADMIN.
GHANA HEALTH SERVICE
EASTERN REGION
P.O. BOX 175
KOFORIDUA. ER. GHANA

13th April, 2015
Tele: 081-23341
Fax: 081-23351
E-mail: rdhs.er@ghsmail.org

PROFESSOR KOVIN NAIDOO
UNIVERSITY OF KWAZULU NATAL
SOUTH AFRICA

RE: PERMISSION TO USE THE LOW VISION CENTER OF THE EASTERN REGIONAL HOSPITAL FOR A RESEARCH STUDY

Permission has been granted to Dr. Beatrice Adamptey, a Masters Student of the University of Kwazulu Natal South Africa, Student number 214584189 to conduct research at the Low Vision Center of the Eastern Regional Hospital.

The research will benefit patients in the low vision and the valuable information will be provided for stakeholders.

Thank you.
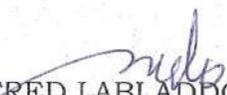
DR. WILFRED LABI ADDO
AG. REG. DIR. OF HEALTH SERVICES
EASTERN REGION

REGIONAL HOSPITAL
P. O. BOX 201
KOFORIDUA

9TH APRIL, 2015

My Ref. No RHK/GF-59
Your Ref. No.

TEL. # 03420-23011 FAX # 0342025294
Email: reghspkof@yahoo.com.

GHANA HEALTH SERVICE
Your Health - Our Concern

PROFESSIOR KOVIN NAIDOO
UNIVERSITY OF KWAZULU NATAL
SOUTH AFRICA

RE: PERMISSION TO USE THE LOW VISION CENTER OF THE EASTERN REGIONAL HOSPITAL FOR A RESEARCH STUDY

Dr. Beatrice Adamptey, a masters student of the University of Kwazulu Natal South Africa, Student number 214584189 has requested for permission to use our facility for research.

Dr. Adamptey did her Internship in this hospital in 2012 and 2013, also considering the benefits of the research to the patients in the form of low vision aids and the valuable information it will provide for stakeholders, including the efficiency of the services provided to low vision patients; I grant her permission to conduct the research in this facility.

Thank you.

Yours faithfully,

DR. ANIM BOAMAH
HOSPITAL DIRECTOR

DR. KWAME ANIM-BOAMAH
MEDICAL DIRECTOR
REGIONAL HOSPITAL
KOFORIDUA

Cc:

REGIONAL DIRECTOR OF HEALTH SERVICES
EASTERN REGIONAL DIRECTORATE
GHANA HEALTH SERVICE
KOFORIDUA

Appendix 6. Information document and consent form for patients
Informed consent Document

PROJECT TITLE: the impact of low vision and low vision devices on the quality of life of low vision patients visiting the low vision centers of the Eastern Regional Hospital, Ghana .

INTRODUCTION

You are invited to join a research study to investigate the impact of low vision and low vision devices on the quality of life. Please take whatever time you need to discuss the study with your family and friends, or anyone else you wish to. The decision to join, or not to join, is up to you. In this research study, we are investigating and evaluating the efficiency and availability of low vision devices to you. We will also assess how the devices and the low vision condition have positively or negatively impacted your life.

WHAT IS INVOLVED IN THE STUDY?

If you decide to participate you will be asked to fill out some questionnaires and further eye examination if the need arises. This will take you thirty minutes to complete the questionnaire.

RISKS

This study is risk free except for the financial demand of transporting yourself to the low vision center. There may also be other risks that we cannot predict.

BENEFITS

It is reasonable to expect the following benefits from this research: catering services. However, we can't guarantee that you will personally experience benefits from participating in this study. Others may benefit in the future from the information we find in this study.

CONFIDENTIALITY

All information gather from you would be kept strictly confidential. Your name would also not be required on the questionnaire or in the interview so that you remain anonymous. The data stored on a computer would require a password for assess so that no unauthorized person would have access to it while the hard copy would be kept in locked cabinets that only the principal investigator will have access to.

YOUR RIGHTS AS A RESEARCH PARTICIPANT?

 Participation in this study is voluntary. You have the right not to participate at all or to leave the study at any time. Deciding not to participate or choosing to leave the study will not result in any penalty or loss of benefits to which you are entitled, and it will not harm your relationship with the research team.

CONTACTS FOR QUESTIONS OR PROBLEMS OR INFORMATION?

Call Dr**. Beatrice Adamptey** (OD), +233(0)2449911998, +233(0)208768564 or email adampteybeatrice@ymail.com OR **Prof. Kovin Naidoo** OD, MPH, PhD, FAAO, FBCO(Hon) Global Programs Director; Public Health Division Chairperson: International Agency for the Prevention of Blindness (Africa), 172 Umbilo Road Durban, South Africa, 4000 Tel: +27 31 2023811 Fax: +27 86 6381322 Mob/Cell: +27 83 7774293 Skype: kovin Web: www.brienholdenvision.org. if you have questions about the study, any problems, unexpected physical or psychological discomforts, any injuries, or think that something unusual or unexpected is happening.

Consent of Subject (or Legally Authorized Representative) Signature of Subject or Representative Date

_____

Upon signing, the subject or the legally authorized representative will receive a copy of this form, and the original will be held in the subject's research record.

Appendix 7. Document from AVEH acknowledging submission of manuscript

Dear Dr. Beatrice Adamptey,

It is a sincere pleasure to inform you that your article is presently in unassigned at 'AVEH, African Vision and Eye Health'. The manuscript I am referring to is 'Vision Specific and Psychosocial Impact of Low Vision Among Patients At The Low Vision Center of The Eastern Regional hospital, Ghana' with the manuscript reference number 401.

Please find attached all the licensing forms that require your completion. (The forms need to be signed and witnessed) Could you kindly complete and email it back to me no later than 24-05-2017.

If you need any assistance, kindly contact me.

Kind regards,

Tanien Botes: AOSIS Submissions and Review

Phone +27 21 975 2602 Ext: 506

Fax 086 1000 381

Office hours: 08:00-16:30 (UCT +2:00) Mondays – Fridays

Email: submissions@avehjournal.org

_____

African Vision and Eye Health, previously known as The South African Optometrist

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