UNICAF UNIVERSITY.

MASTERS IN HEALTH CARE MANAGEMENT.

EVALUATION OF NEWBORN SCREENING PRACTICE AND INTERVENTION FOR OCULAR DISORDERS AMONG UNDER-FIVE CHILDREN AT MZUZU CENTRAL HOSPITAL, MALAWI.

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16 APRIL 2022

A RESEARCH THESIS SUBMITTED IN PARTIAL FUFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTER OF SCIENCE IN HEALTH CARE MANAGEMENT

DECLARATION

This thesis is my original work and has not been presented elsewhere for any academic award. Every effort has been made to appreciate and recognize the contributions made by others towards this work.

Precious Emmanuel Chisale. **Date**

SUPERVISOR

I confirm that the work reported in this thesis was carried out by the candidate under my supervision as university supervisor.

Signature: ……..

Professor Marios Kantaris. UNICAF University. Date:

DEDICATION

I dedicate this work to my family, particularly my beloved mother; a queen in my world, whose efforts continue manifesting till today. I also dedicate this work to my fiancé Mary Ngabinu who has continuously supported my efforts depriving herself of quality family time. To myself, for not succumbing to the pressure of extracurricular activities while walking in this academic journey.

ACKNOWLEDGEMENT

Special acknowledgement goes to my supervisor, Professor Mario Kantaris for providing guidance and supervision of this work. Special mention also goes to my friend Thokozani Mzumara who has time and again assisted in proofreading this work. Specifically I acknowledge the efforts of Dr. J Afonne who has always been my mentor and inspiration. Above all I thank God for everything He has been to me. **To Him alone be the Glory.**

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ABSTRACT

The purpose of this study was to assess new born screening activities for eye diseases and intervention strategies for children under the age of five at Mzuzu central hospital eye department. This cross section study utilized secondary data from Mzuzu central hospital eye department. 400 children with various eye disorders, aged five years and below were included in this study. We used linear regression analysis to evaluate association and prediction between time of intervention and outcome as well presented prevalence of ocular disorders at, Mzuzu central hospital. The prevalence of ocular disease was 49.6% for conditions considered serious and sight threatening. 50.4% of the cases were minor and had no impact on vision. We also found that the age group with most cases was 0-1 years (49.5%) old followed by 2-3years (25.5%) and 4-5 years (25%) respectively. Eye care practices at MCH positively contributed 73% of cases having desirable outcomes

while 10% had developed amblyopia as a complication. We found that time, (negative correlation coefficient of -0.364 and P<0.005); was a good predictor of outcome as compared to type (-0.425 (P<0.005), of intervention given. However they both contributed to the prognosis of the condition after treatment. **Conclusion**. The study found that there are no screening mechanisms put in place for eye care service delivery to under-five children at Mzuzu central hospital. Hence having mechanism put in place is key to identifying and treating conditions in early stages before they significantly affect vision.

Key words:

Outcome, Eye care, prognosis, early intervention, eye care, time of intervention. And Prevalence.

CHAPTER 1: INTRODUCTION

1.0 Background.

Screening and assessing functionality of organs in newborns is the search for diseases in newborns before signs and symptoms appear. (Alfadhel M, Al Saif S and Al Zaben A. 2016). According to WHO, screening newborns for up to one year is beneficial and enables timely identification and intervention to prevent associated morbidity and mortality. (WHO 2018.) It is observed that most conditions responsible for child motility and infant morbidities ensue in the first 28 days to one year of life and this is an important determinant of the child's survival. (Alfadhel M et al 2017). Globally screening protocols and programs have been established over the years that include different disorders. (Mohammed S 2017). However, establishment and implementation of these programs is dependent on resources and healthcare infrastructure. (Kawaza et al 2020). The number of screened disorders also differ in various settings with some incorporating one condition while others reach up to 50 disorders. (Alfadhel M et al 2017). For example in china initially, 2 disorders; congenital hypothyroidism and phenylketonuria were considered for screening, before expanding to include other disorders that also affect infants. (Mohamed et al *202*0). For example screening protocol for newborns in low-middle income countries as of 2019 included one or two conditions only. In USA, the recommended uniform screening panel which is responsible for identifying and revising the screening program for various conditions that are life threatening continuously recognizes disorders that affect infants and make recommendations for inclusion on the screening tool. (US Department of Health and Human Services 2019). In Africa, the screening for newborns is limited and only includes conditions that are deemed most consequential.

Congenital eye abnormalities are one of the serious causes of preventable child disabilities. (WHO 2020). Some eye abnormalities also give a clue of a life threatening condition. (Goyal et al 2018). Physiologically, children are born with immature visual system and require stimulus from both distance and near objects to develop normally (Wallace DK et al 2018). Failure of the system to mature can lead to amblyopia which cannot be corrected after age 10. (Coats et al 2020). Hence early recognition and treatment of eye diseases is crucial and prevents permanent visual loss and impairment in infants. (Wallace DK et al 2018). Some eye diseases such as cataract, congenital

glaucoma, corneal opacities, and hereditary retinal dystrophies, lesions of optic nerve and retinopathy of prematurity cause blindness or severe visual impairment. (WHO 2020). Additionally, visual loss due to diseases such as retinoblastoma and lipid storage diseases may signal a serious and life threatening disease (Rogers GL and Jordan CO 2013).

A lot of morbidities and poor quality of life are associated with visual impairment esp. for both the guardians and the impaired individual. (WHO 2020).Vision disorders represent one of the most disabling and handicapping conditions in children (Adhikari et al 2015).Screening for ocular conditions is an important part of medical care of children because some eye abnormalities have irreversible vision loss if left untreated in the first few months of life. (Coats DK, Paysse EA, Torchia MM 2020). The global estimate of blindness is about 1.4 million and two-thirds of these live in developing countries. (WHO 2020).The causes of blindness vary according to region and socioeconomic condition. (Gilbert C, and Muhit M. 2008).

The quality of care given to under-five children ensures that all potential conditions are captured or identified before they reach the advanced stages. (Kawaza et al 2020). As observed by Kelly et al (2021), the world is more concerned about the survival of the child and there is less effort on monitoring development of the child within the first years of life especially in low in -come countries. Screening newborns for various conditions has the potential to prevent severe disabilities through early diagnosis and treatment. (Kelly et al 2021). As the child is growing certain conditions manifest themselves late which if screened would be caught earlier. Monitoring the life of the child as he/she is developing is crucial to achieving quality of adjusted life afterwards. However, in developing countries like Malawi; the overlook on the possibility of onset of disabling conditions sabotages the whole essence of improving the quality of life of the child. (Kawaza et al 2021). The practice of screening children for various conditions before they are fully developed has helped identify serious conditions that would otherwise affect the quality of life of the child as well as their immediate care givers. (Kelly et al 2017). Most of these conditions can be caught at an early stage if there are mechanisms for screening and assessing the organ functionality of child. (D. Marsden et al (2021). The health and development of the infants

depends on the care given as well as the ability of the system to identify and catch conditions early. (D. Marsden et al (2021). In Malawi visual impairment (24.2%) was the second common type of disability in children after hearing loss (24.9%) as of 2018. (NSO 2018).The majority of these disability cases were caused by diseases/illness (49%) and birth injuries/ congenital (40%). (NSO 2018).

However there is little if any at all that's been done collectively to screen/examine these infants for ocular conditions that can affect their visual development and quality of life thereafter. Despite a number of policies and tools that have been developed recently in most healthcare facilities across the country, none has focused on screening infants for potentially debilitating and blinding conditions. (Hearadson 2021,). Devising, adopting and improving the care giving protocol is central to achieving quality and meaningful under-five child survival rate and quality of life of the child. (Donahue SP, Nixon CN 2016). WHO (2020) reiterates that millions of child death and disability could be avoided if more resources were invested to address the needs of infants. Over 78% of children who develop disabilities are from developing countries esp. the sub-Saharan region, Malawi inclusive. (Smith et al 2017). Screening and assessing vision functionality is critical to preventing disabilities and can point to conditions that are life threatening. (Ma et al 2018). It is with this conviction that this study is undertaken to assess eye care practices and interventions in infants born at Mzuzu central hospital.

1.2 Statement of the problem.

According to the Malawi Neonatal care guidelines achieving a further reduction of neonatal mortality rate from 27 per 1000 live births, significant gaps in infection control practices must be addressed. (NSO 2018). In the last 16 years, the rate of decline has stagnated around 27 deaths to 1000 live births, which may be associated with the critical gaps in case management of sick newborns and infection control. (Kawaza et al 2020). Furthermore, the situation is exacerbated by immediate discharges of infants (two days after birth) before the infant is assessed and screened for other equally serious conditions. (Haraldsdottir I et al 2021). Complexities in key areas of child care such as neonatal jaundice, hearing loss, visual loss demonstrate the need for thorough screening and testing to fill up gaps of infant care. (Kkawaza et al 2020). Newborn screening (NBS) allows prompt identification and management of disorders with early onset and serious,

life threatening consequences, including many inborn errors of metabolism. (D. Marsden et al 2020). Within the first 6 months of life, most organs in the child are still developing and mature at different times. This period is very critical as such, any disturbance to the normal development can lead to long term morbidities and disabilities to the child. (D. Marsden et al 2020).

Much as screening for ocular disorders is done in Malawi, it has not been embedded into the general preventive child health care screening system.(NSO 2018).The vision screening program has not changed since its implementation and there are no guidelines for vision screening. There are no known methods for quality monitoring, imposed by the government and no information is collected concerning the vision screening program. (NSO 2018) There has been no research conducted into the clinical or cost-effectiveness of vision screening in Malawi. Furthermore, Mzuzu Central Hospital is the only tertiary hospital in the Northern region of Malawi and serves 6 District Hospitals and numerous health centers. The hospital has moderate level of neonatal deaths at country level than other districts as well as there is a vision center that provides support to the main stream hospital through various vision care activities. However it is not known if screening of vital organs esp. the eyes is done to rule out possibility of any conditions that would lead to death or disability in the child and if follow up mechanisms are put in place until when the child reaches five years of age.

1.3 Justification

Screening for organ functionality in infants will help identify conditions in their early stages that will be attended to before they can significantly impact on the child's life. It can also reveal conditions that are prevalent in that particular region/ facility and hence explain possible causes for such prevalence. The information from the study will guide and bring several experts from medical, eye, Lab and nursing professional together to collectively screen and assess organ functionality of infants for possible interventions. Additionally, developing and understanding routine newborn care practices in the hospital and home environment will inform the designing and prioritizing of interventions for newborn survival. Therefore, the information from the study would be very useful to inform the Malawi government in addressing specific newborn care gaps particularly in eye care services.

1.4 Main Objective.

To assess newborn screening activities for eye diseases and intervention strategies for children under the age of five at Mzuzu central hospital eye department.

1.4.1 Specific Objective.

To identify common ocular disorders in children under the age of five years seen at Mzuzu central hospital from 2019-2021.

To identify eye care practices and services given to children under the age of five years at Mzuzu central hospital.

To assess the impact of time and age on the outcome after intervention.

1.5 Research Questions

1. What are some eye care practices and services being given to under-five children at Mzuzu central hospital?

2. What is the prevalence of ocular disorders in under-five children visiting Mzuzu central hospital?

3. What is the effect of time and type of intervention given on the prognosis of treated cases?

Limitations

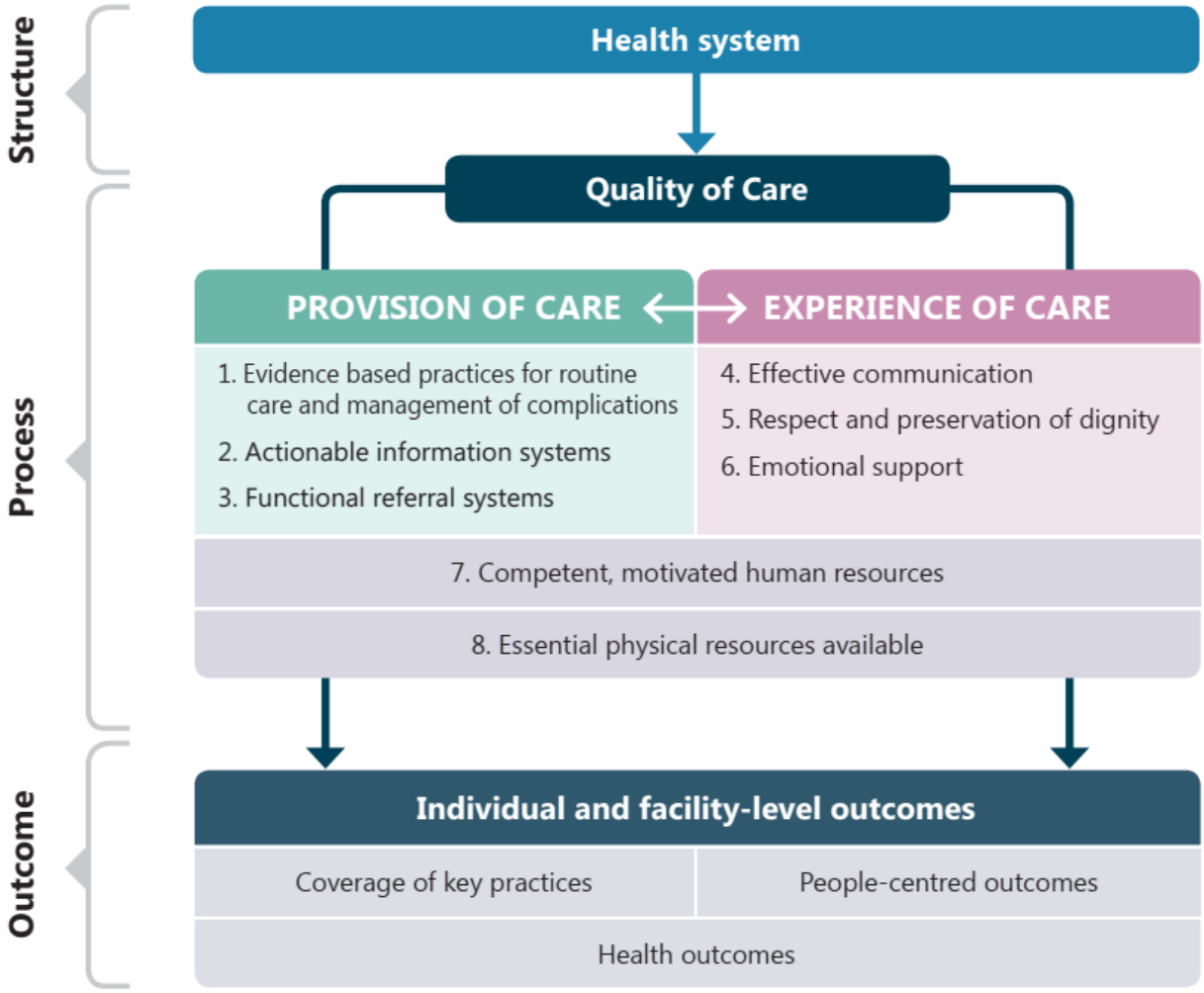
The study was limited by time and scarcity of readily available secondary data on infant screening. It was also limited by lack of resources both in terms of funding. As a result of limited time and resources the study was conducted with the available funds and within the shortest period possible so that it was manageable.

1.6 Conceptual frame work

Quality of care models have been prepared to guide health care managers and providers to improve quality of health services rendered to newborns. These models have guided in developing a quality of care frame work that identifies domains targeted to assess, improve and monitor care in health facilities within the domain of the health system. The domains of care within the frame work focus on key aspects of providing care in health facilities. Hence it useful to drive and influence newborn screening to improve infant

quality of life as well as identify key areas affecting survival of children. The framework of eight domains of quality of care for newborns in facilities increases the likelihood that the desired individual and facility outcomes will be achieved. The health system approach provides the structure for quality improvement in the two linked dimensions of provision and experience of care. Provision of care includes use of evidence-based practices for routine and emergency care, information systems in which recordkeeping allows review and auditing and functioning systems for referral between different levels of care. (Tuncalp Ö et al 2015). The below framework has been adapted from the (WHO 2015) and will be used in this study. This framework can be used to assess the characteristics or dimensions of quality of care in various sectors of the health system, from the perspectives of service users, service providers and managers. On the basis of this framework and in line with the organizational mandate, six Strategic areas of work were identified for improving the quality newborn care. These six areas were used as the basis for a systematic, evidence-based approach to preparing Guidelines, standards of care, effective interventions, indicators of quality of care and research and capacity-building for improving the quality of maternal and newborn care

Fig. 1. WHO framework for the quality of maternal and newborn health care



2.0 CHAPTER TWO: LITERATURE REVIEW

2.1 Global situation of newborn screening practices for various disorders.

Globally it is estimated that congenital anomalies are responsible for considerable number of still birth deaths and disabilities in children. (Therrel et al 2015). About 15-20% of congenital abnormalities, account for blindness and severe visual impairment in children worldwide respectively. (Gilbert C and Foster A. 2020). Several studies done in India, China and United States have reported significant impact of congenital abnormalities on children's development. (Callaway et al 2016; Li LH et al 2013 and Vinekar et. 2015). Basic neonatal and infant eye screening has significant benefits and is being done in the developed countries. (Goya p et al 2018). Currently eye screening reaches about one-third of world's new born population. (Therrel et al 2020). The number of disorders considered for screening depends on resources plus regional priorities of prevalent conditions. (Therrel et al 2020). For example it estimated that globally, 400,000 babies are born with sickle cell disease and 75% of these are in the sub-Saharan Africa. (Piel et al 2013). About 80% of these die before 5years of age. Grosse et al (2011). Therrell Jr et al (2020) during the pan African workshop on newborn screening reported that among the disorders deliberated for inclusion on newborn screening was Sickle cell disease SCD, implementation of which has led to early diagnosis and management of the diseases. The outcome of the screening was improved survival rate of these patients. (Shook and ware 2018). Similar assertions were made by WHO in 2010 at its 63rd assembly when it addressed its member states to address concerns of limited resources dedicated to prevention and management of birth defects through introduction of newborn screening programs. (WHO 2020). Similar studies from UK, and Sweden indicated screening for newborns was able to detect up to 47% and 75% of congenital cataract that would need surgery. (García Aguado J 2016).

As of 2016, Vision screening program had begun in Malawi esp. in the southern region under provision decided upon by pediatric ophthalmologists with the direct funding of ministry of health. (Paolo et al 2019). However no proper guidelines, and/or protocol have been developed to be included in the primary prevention health guidelines. (World Bank data 2018). This is a setback as screening has proven to identify conditions early and has enabled early intervention for serious life and sight threatening conditions.

2.2 Prevalence of screened eye abnormalities in infants.

The incidence of infant ocular abnormalities varies, however studies by Vinekar et al 2015 and Lie et al 2017 have reported high incidence of retinal hemorrhages in health full term patients. In a similar study by Erum Shhid et al (2018) on frequency of ocular abnormalities in infants at a tertiary hospital, which enrolled 377 infants ranging from day 1 to less than a year. It was discovered that acquired ocular disease occurred in 61% of infants and congenital diseases accounted for 39%. The most common condition was conjunctivitis. This study illustrates the need for screening, however it did not elicit significant outcomes that could warrant adoption of NBS and again the sample size adopted may have been smaller and involved full term births. Comparably the study by Delin Liu et al (2021) which screened 23,861 newborns (pre-tem and full term) using digital imaging in Ningbo, China, found that ocular abnormalities were in 27% of cases. The most common in full term babies was retinal hemorrhages and was in 18% of the case. The study also found retinoblastoma, and congenital cataract in 6 and 4 % of the cases. Method of delivery had significant impact on incidence of neonatal retinal hemorrhages. Additionally 21% of all preterm births had observable retinopathy of maturity, which signified preterm birth as a risk factor. (Delin Liu et al 2021).

Furthermore, the reported incidence of fundus hemorrhages in infants has varied widely among studies, with rates ranging from 2 to 50%. (Goyal P, et al 2018). As RI Chee and RVP Chan (2018) allude, institutional sampling bias affects the rate of fundus hemorrhages as vaginal delivery, in particular with the use of instrumentation (e.g. forceps or vacuum), is associated with a higher risk of infant fundus hemorrhages. For example in the study by Vinekar A et al 2015, it was found that when the rate of vaginal delivery was low, at 3.1%, the incidence of fundus hemorrhages also dropped to 2.4%. However, when the hemorrhages persist for a longer duration, they cause long-term visual impairment. (Campbell et al 2015). Additionally Lie et al (2013) also postulated that early visual limitation may limit normal optical development, potentially resulting in visual disturbances such as anisometropia and amblyopia later in life. Supporting this is Garcia Aguado J (2016) who reported the prevalence of amblyopia in infancy and in preschool kids globally is 3 %. Additionally, Gregersen's (2016) study reported the prevalence of ocular disorders in infants as being uncommon, yet with potential to cause vision loss and

even death in cases of retinoblastoma. Cases of congenital cataract, Glaucoma and retinoblastoma have been estimated at 1.7 (per 10.000 live births), Gregersen PA et al (2016), 1.6 and 6.6 globally per 100,000 live births respectively. (Sheeladevi S et al 2016).

2.3 **Methods of screening and care practices for ocular disorders**

Various eye screening tests exist. However the accuracy and validity of the results depends on the sensitivity of the tests to detect and differentiate the abnormality. (Jonas 2017). For example in one study, which used red reflex test to screen newborns for ocular abnormalities, the result was low detection for cataract and retinoblastoma. (Jonas 2017; Sheeladevi S et al 216). It was concluded that the test has low sensitivity to detect retinoblastoma, however it still remains relevant to identify the condition warranting further fundus examination. (Jonas 2017). As Jonas reports, age is a significant influencer of screening for children. The reason being infants may present with less ability to complete the screening test. This has been the reason most vision screening tests have focused on children above 3 years old. (US Preventive Services Task Force 2016). Similarly, the study by Hull 2017 compared the accuracy of screening tests used alone and in combination to detect strabismus in children. It was discovered that combination of tests was able to elicit desirable results. Hence combining fundus examination methods with red reflex, digital imaging system gives accurate results. Another important concept advocated by various authors is use of fundus image screening on a more targeted scale especially use of telemedicine for retinopathy of prematurity (ROP) screening, and other conditions affecting the fundus .(Patel SN et al 2015 Julien et al 2021and)

2.4 Challenges to implementation of screening

While critical to improving survival, NBS implementation is particularly challenging in low-income, high-burden settings such as those in Africa (Kato et al. 2018.). Thus, although NBS is cost-effective as a health program, its sustainable implementation in Africa is difficult. (Alfadhel M et al 2017). The American Academy of Pediatrics on newborn screening, (2008) reported that newborn screening is affected by economic, political and cultural considerations. In developing countries, the slow development of the program has been due to lack of understanding by individuals, family and societal. (Saadallah AA, Rashed MS. (2007). Another challenge affecting newborn screening is out of hospital births which, is at 80% in Pakistan, 61% India and 62% Philippines etc. (Therrell Jr BL

2014). Hence children born outside the hospital do not have access to hospital facilities and are prone to challenges should the child face congenital or acquired new borne diseases.(Padilla CD 2008) Padilla CD, Therrell Jr BL 2012.

3.0 CHAPTER THREE: METHODOLOGY

3.1 Introduction

This section presents the methodology which was adopted in this study. It is divided into subsections, which include; the study design, study setting and population, sample size calculation, data collection methods, data analysis, ethical considerations, limitations of the study and dissemination of this research findings.

3.2 Study design

The study was a quantitative cross-sectional retrospective design.

3.3 Study population and setting

The study was conducted at Mzuzu central hospital, the only tertiary hospital in the northern region which has a well-equipped eye department with state of the art equipment and specialists. It serves as a referral hospital for 6 district hospitals and more than 40 primary health facilities. (NSO 2018). The eye department comprises ophthalmologists, optometrists, ophthalmic clinical officers, optometry technicians, ophthalmic nurses and general nurses. Work is organized in such a way that the primary contact person is the optometrist and ophthalmic clinical officer before booking for an ophthalmologist is done. For referred cases and consultations from various wards, depending on severity, the consultation may be handled by an optometrist and/or in conjunction with an ophthalmologist.

The study analyzed data for under five children with various eye conditions, obtained from Mzuzu central hospital eye department database for the period of three years from January 2019 to December 2021.

3.4 Inclusion criteria

All cases for various eye conditions for children between ages 0 to 5 years treated at Mzuzu central hospital in the years 2019-2021.

3.5 Data collection and analysis

The sampling of data and choice of secondary data is dependent on the set objectives of this current study. Sample will be systematically selected.

3.6 Dependent and Independent variables.

The independent variables in this study comprised of age of child, type of eye disorders at Mzuzu central under-five, time of diagnosis and intervention, clinical process and type of intervention. The dependent variables are prognosis after treatment, desirable outcomes, and reduced disability.

3.7 Data analysis tools

Data from Mzuzu central hospital health information system and eye department was managed and organized into meaningful form for analysis. Results were analyzed by means of descriptive statistics (frequencies, percentages and means with standard deviations). Associations, correlations and predictions were measured using chi square and linear regression Pearson correlations using Statistical Package Social Science (SPSS) software version 20.0. The $p < 0.05$ with confidence interval at 95% was considered statistically significant. The results were presented using frequency tables, histograms and bar graphs.

3.8 Ethical consideration

The permission to conduct this study using data from Mzuzu central hospital will be obtained from the research Directorate of Mzuzu Central Hospital. There is no conflict of interest.

4.0 CHAPTER FOUR: DATA ANALYSIS AND RESULTS

4.1 Demographic data of the population

The study evaluated 400 cases of under-five children who were treated for various eye conditions at Mzuzu central hospital for a period of 3 years. Out of these cases, 198 were for children within one year of age representing 49.5% of the study population. About 44 (11%) cases were for children aged 2 years, while 59 (14.8%) cases were for children aged 3 years. Lastly 41 (10.20%) and 58(14.5%) cases were for children aged 4 and 5 years respectively. The mean age of the children was 2.29 years (+-1.6 years SD). There were 199 male and 201 female cases.

4.2 prevalence of Ocular disorder and age group

The age group with majority of cases was between 0-1 years with Ophthalmia Neonatorum as the most common followed by nasal lacrimal duct obstruction, congenital cataract and congenital glaucoma respectively. The prevalence of conditions that can impair vision and/cause loss of sight and life were also studied keenly. There was a total of 58 cases of congenital cataract, 48 cases of congenital glaucoma, 16 cases of retinoblastoma, 19 cases of strabismus, 27 cases of orbital cellulitis and 19 cases of retinopathy of prematurity. The table below illustrates the distribution of ocular disorders among the different age groups for the period of 2019-2021.

Table 1. Distribution of ocular disease according to age group.

Age group * ocular disorder Cross-tabulation

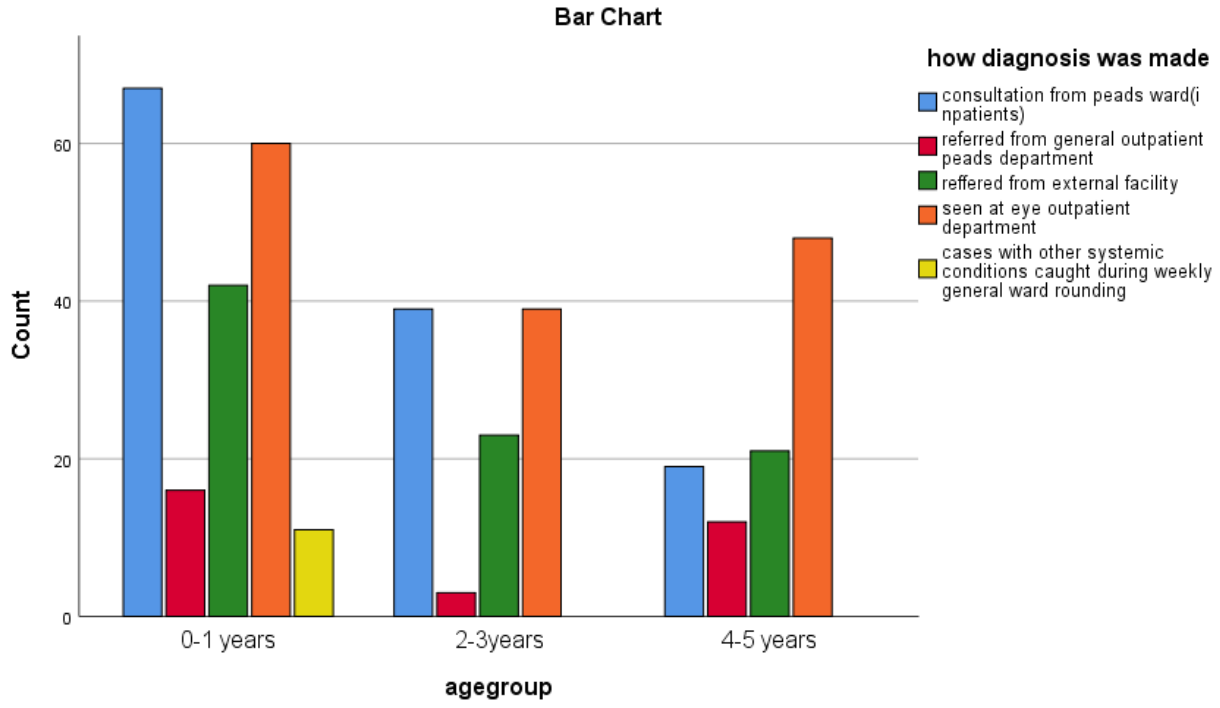
Count

		ocular disorder											Total
		congenital cataract	congenital glaucoma	Retinoblastoma	Ophthalmia Neonatorum	Strabismus	retinopathy of prematurity	High myopia	Orbital Cellulitis	Nasal Lacrimal duct obstruction	Malaria retinopathy	refractive error	
Age-Group	0-1 years	28	19	3	90	5	9	0	6	36	0	0	196
	2-3years	15	19	9	0	5	5	5	11	16	11	8	104
	4-5 years	15	10	4	0	9	5	8	10	0	7	32	100
Total		58	48	16	90	19	19	13	27	52	18	40	400

4.3 Distribution of age group and places where diagnosis was made

We also evaluated how the cases were diagnosed and places where diagnosis took place. Out of 400 cases, 125 were diagnosed from consultations made by peads ward for in patients. Of these only 67 were within 1 year of age. 31 cases were referred from general out peads OPD, while 86 cases were from external facility. 198 cases were seen while within 1 year old representing 49.5% of all cases.

Figure 1. Distribution of places diagnosis was made.



Another key factor was how and where the diagnosis was made. They highest number of cases were diagnosed and treated in the eye department. However a significant number was also from consultation in the pediatric wards. A total of 204 cases were seen when the child was at least 2 years of age.

4.4 Type Intervention

We found that type of care given to under-five children was age specific and depended on the type of disorder. All cases that required medical attention were treated within the facility. All cases requiring pediatric specialist care were sent to Kamuzu or Queen Elizabeth central hospitals because our facility does not have specialist pediatric

ophthalmologist. We found that 133 cases were referred to KCH/QUECH, of which 79 were 2 years or older.

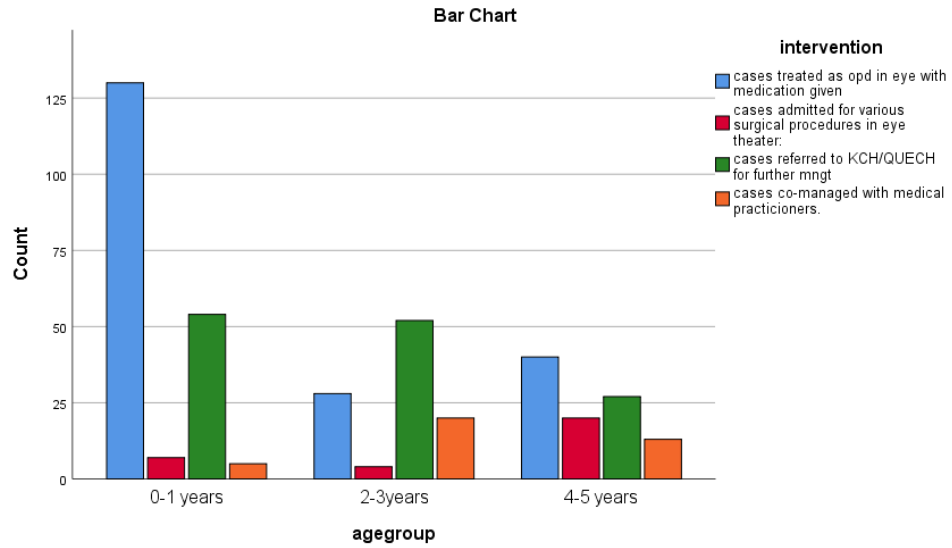
Table 2. Various types of interventions given

agegroup * intervention Crosstabulation

Count

		Intervention				
		cases treated as opd in eye with medication given	cases admitted for various surgical procedures in eye theater:	cases referred to KCH/QUECH for further mngt	Cases co-managed with medical practicioners.	Total
Agegroup	0-1 years	130	7	54	5	196
	2-3years	28	4	52	20	104
	4-5 years	40	20	27	13	100
Total		198	31	133	38	400

Figure 2. Type of intervention.



4.5 Time of intervention and outcome.

We observed that there were 184 cases with desirable visual outcome when the child received intervention within one year of age. Similarly, the cases of poor visual outcome especially Amblyopia, that received intervention after one year begun to increase and were significant from age 3 to five years.

We run Chi square to test if the differences observed in the groups were statistically significant. There were significant differences between groups as indicated by the Pearson chi square test (157.90) (P<0.00) with a p value of less than 0.05.

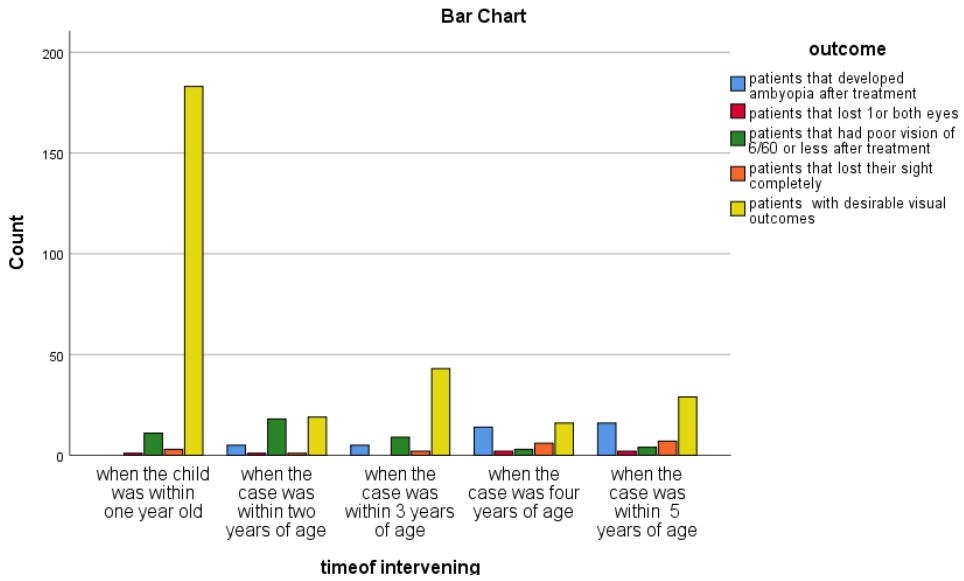


Figure 3 showing distribution of case prognosis at different time's intervention was given.

4.6 Outcome and Age Group.

We also evaluated the outcomes after interventions were given to peads in various age groups. There was a total of 40 cases that developed amblyopia after treatment and these were between 2 and 5 years of age. 6 children that lost one or both eyes, due to retinoblastoma, 4 of which were aged between 4-5 years. There was a total of 291 cases with desirable outcomes for all age groups. A Chi square analysis of the differences observed in the groups was statistically significant. There were significant differences between groups as indicated by the Pearson chi square test (140.586) (P<0.00) with a p value of less than 0.05. There was a weak negative correlation coefficient of -.475 between outcome and age group.

Table 3. Illustration of outcome and age group.

Crosstab

		Outcome patients that developed amblyopia after treatment	patients that lost 1or both eyes	patients that had poor vision of 6/60 or less after treatment	patients that lost their sight completely	patients with desirable visual outcomes	Total
Agegroup	0-1 years	0	1	9	4	184	198
	2-3years	10	1	28	3	62	102
	4-5 years	30	4	8	13	45	100
Total		40	6	45	20	291	400

4.7 PREDICTORS OF OUTCOME AFTER INTERVENTION

A linear regression analysis was performed to explore factors that would predict the outcome after intervention. We included; Type and Time of intervention as significant predictors of the outcome. However, Time was a better predictor than type. As Time for intervention increased (the older the child became) the poorer the outcome after intervention with a negative correlation coefficient of -0.364 and P<0.005. Tables below illustrate the regression model.

4.7.1Time of intervention and outcome.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.419[a]	.176	.173	1.193

a. Predictors: (Constant), time of intervening

b. Dependent Variable: outcome

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	120.597	1	120.597	84.729	.000[b]
	Residual	566.481	398	1.423		
	Total	687.077	399			

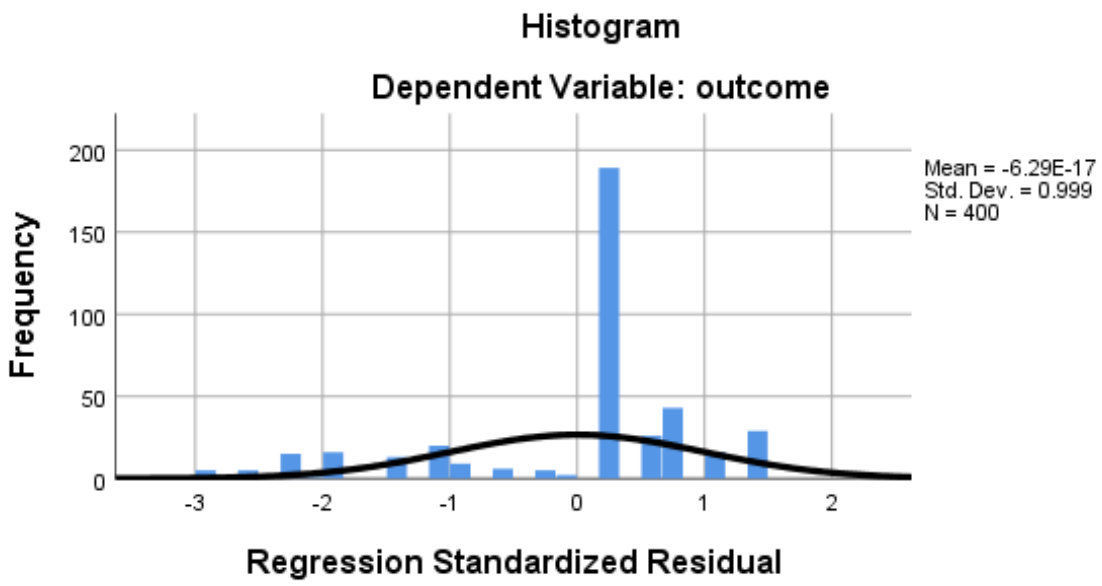
a. Dependent Variable: outcome

b. Predictors: (Constant), time of intervening

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B	
		B	Std. Error	Beta	T	Sig.	Lower Bound	Upper Bound
1	(Constant)	5.118	.109		47.132	.000	4.904	5.331
	Time of intervening	-.364	.040	-.419	-9.205	.000	-.442	-.286

a. Dependent Variable: outcome



4.7.2 Type of intervention and outcome.

There was a negative linear correlation between type of intervention and the prognosis. With Pearson correlation coefficient of -0.425 (P<0.005). Type of intervention was a weaker predictor of the outcome after intervention as compared to time.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.356[a]	.127	.125	1.228

a. Predictors: (Constant), type of intervention

b. Dependent Variable: outcome

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	87.154	1	87.154	57.820	.000[b]
	Residual	599.923	398	1.507		

Total	687.077	399				

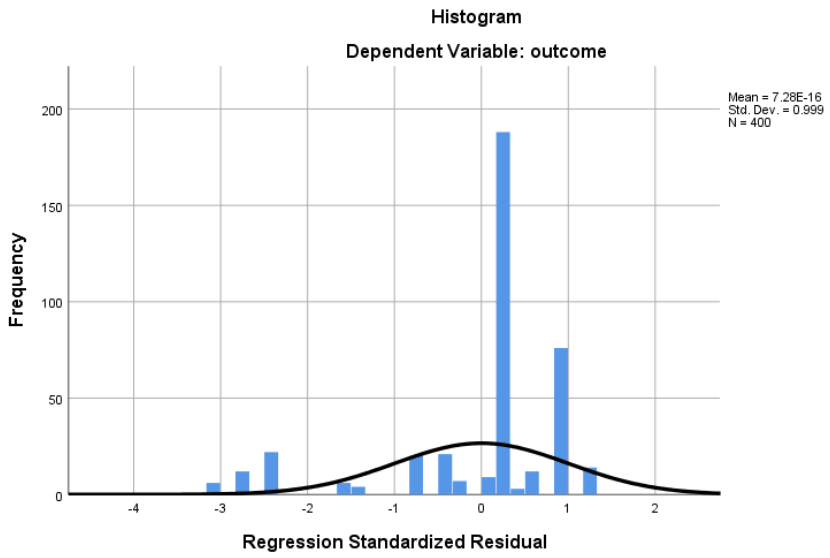
a. Dependent Variable: outcome

b. Predictors: (Constant), type of intervention

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B	
	B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
(Constant)	5.144	.129		39.919	.000	4.891	5.397
Type of intervention	-.425	.056	-.356	-7.604	.000	-.535	-.315

a. Dependent Variable: outcome



5.0 CHAPTER FIVE DISCUSSION.

In this study we found that there was a total of 14.5 % congenital cataract cases, 12% for congenital glaucoma, 4 % for retinoblastoma, 4.8% for strabismus, 4.8% for retinopathy of prematurity, 3.3 % for high myopia and 6.8 % was for orbital cellulitis. The rest of the cases accounted for 50.4% of the cases. 49.6% of the cases were considered serious and had significant impact on vision and some life. Similar observations were made in the study by Delin Liu et al (2021) who found that congenital cataract and Retinoblastoma were present in 4 and 6% of cases of all screened children. There were 4.8% cases of retinopathy of prematurity in our study, a finding lower than that of Delin Liu et al 2021, who found 21% of ROP in all cases. The lower numbers in our study may be due to small sample chosen and we did not consider how the child was born unlike in the study by Delin et al (2021) where most ROP cases were from preterm babies and was considered the main risk for ROP. Similar findings were also observed in studies by Li L-H et al (2013,) who found that 107 cases were sight threatening and including retinoblastoma, ROP and macular hemorrhages. Furthermore, N Nsiangani et al (2021) found that out of the 13197 screened children, 5% had strabismus, 2% had Glaucoma 2% Refractive error 27% and conjunctivitis 56 % constituting the majority. Additionally, our study looked at the trend of ocular disorders for up to 5 years, no wonder the prevalence of ocular disorders has diversified as some conditions manifest their symptoms when the child is 2 years or older.

Our study found that within the 3 years being studied, the age group with the most cases was 0-1 years (49.5%) followed by 2-3 years (25.5%) and then 4-5 years. (25%). Several factors could be attributed to why those within one year of age were most prevalent. We see that majority of the cases in this age group came from peads departments where consultations for eye specialist were made. The children may have been admitted for other conditions on top of the eye condition and it was easy to ask for specialist care as part of routine co management care within the hospital or it could be due to closer attention mothers pay to children under age one than they do with older children for any

sickness. However it is worth of note that children at least 2 years or more constituted majority in this study having most ocular disorders. Other studies have made similar observations, however those that screened new-born found retinal hemorrhages as the major ocular disorder and reported significant visual impairment later in life when the hemorrhages were on the macula. (Li L-H, et al 2013.)

Overall we discovered that there are good practices of patient care esp. for eye care services in under-five patients. This study observed that cases came from various points, however the eye department had the highest of the cases as compared to the others. Consultations from the pediatric in patient wards came second. Most of these cases came in as a secondary observation by the physician. However, the results show that there is no standardized program which looks into under-five care except through exiting channels for every patient right from birth up to when the child is one year old. The results also indicate fragmentation of the process that's being followed for eye care services in under-five eye children. Particularly we found that there is no protocol or guideline for screening infants after birth esp. for ocular disorders. This is evidenced by the way various diagnoses and treatments were made and administered. There are so many loopholes for missing the child once they leave the hospital after birth. Similar observations were made by various studies (Solebo AL. (2019, Gacia J 2016, Vinekar A et al 2015) indicating that having a tool to identify ocular disorders in the earliest possible time is key to avoiding preventable blindness.

We further looked at the prognosis of most conditions after treatment was given. We found that 73% of all the cases had desirable outcome for all age groups after treatment was given. The study also found that 10% of the cases had developed amblyopia after intervention. 5% of the cases had lost their sight completely. The finding of this study indicate that there was total positive outcome as compared to complications. From our results we noted that amblyopia had resulted from other risk factors such as late treatment as well as lack of clarity from poor media (cataract). This finding tallies well with the studies by Powell C, Hatt S. 2009, Sheeladevi S, et al (2016) and Williams C, et al (2006.)

Studies by Gacia J (2016) further alluded that main risk factors associated with amblyopia include strabismus (ocular misalignment), significant bilateral refractive errors that cause

blurred vision (myopia, hyperopia, astigmatism), and anisometropia (asymmetric retractive error). These findings align well with our study as indications show that children with the mentioned cases had developed amblyopia when treatment was given later than 1 year. Less common risk factors are vision deprivation caused by media opacity (such as cataracts) or ptosis. Amblyopia is more common in prematurity, low birth weight, and when there is a positive family history, as those are risk factors for developing amblyogenic factors. (Delin et al (2021)

Additionally, our study found that time the intervention was given played a role in the prognosis. For example we found that children who were diagnosed and treated of congenital glaucoma, congenital cataract, strabismus among others, when they were within 1 year of age did not develop amblyopia. Only 3.5% of cases within one year had developed other complications. 10 % of the cases aged between 2 and 5 had developed amblyopia 7.5% of whom were aged 5 years. Time was considered a good predictor of the prognosis in this study as the results show that as the time increased (took longer time before intervention) the poorer the outcome and the higher the complications. The same observation was made for type of intervention given, however it was not as good a predictor as time was. Nonetheless there was a negative correlation between times, type and outcome. There were significant differences between age groups. This finding is consistent with Garcia Aguado J. (2016), who found that children who had undergone cataract surgery within six weeks of birth had better development of visual system than those done at 1 year or later. Additionally treatment for retinoblastoma is effective when the first 6 months of life, failure which it becomes incurable and prognosis is poor. (Gregersen PA 2016)

5.2 CONCLUSION

The study looked at the situation of eye care delivery at Mzuzu central hospital especially for under-five children. We found that the prevalence of ocular disorders among the under-five children varied according to age. However, the majority of the cases were within 1 year of age. We also found that time and type of intervention were significant predicators of prognosis. For children that came were diagnosed and assisted within one year, the outcome of their treatment was good unlike those aged 3 and above. The study found that there is no proper screening guideline as evidenced by the way children are

being cared for at Mzuzu central hospital. There is serious need for reorganization of the services so that new born are screened for various conditions and in that way a lot of conditions will be discovered when their impact on vision and life can be reversed.

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Table 2.1 Chi square analysis TYPE and out

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	140.586[a]	8	.000
Likelihood Ratio	138.999	8	.000
Linear-by-Linear Association	90.177	1	.000
N of Valid Cases	400		

a. 5 cells (33.3%) have expected count less than 5. The minimum expected count is 1.50.

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Interval by Interval	Pearson's R	-.475	.038	-10.780	.000[c]
Ordinal by Ordinal	Spearman Correlation	-.483	.040	-11.019	.000[c]
N of Valid Cases		400			

Research Ethics Approval
The postgraduate dissertation study

Evaluation of newborn screening practice and intervention for ocular disorders among under-five children at Mzuzu central hospital, Malawi.

Submitted as part requirement for the completion of the program:

Masters in health care management.

……

Did not require / required the approval of research ethics committee (please circle accordingly)

Conflict of Interest Declaration Title of
postgraduate dissertation:

There is no conflict of interest

a) I, **Precious Emmanuel Chisale** hereby declare **no conflict of interest** for the postgraduate dissertation study submitted today as part requirement for completion of the program **Masters in health care management.**

(UU-MHM-595)