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USER ACCESSIBILITY TO REFRACTIVE ERROR CORRECTION SERVICES IN SELECTED ZAMBIAN HOSPITALS

By

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DEDICATION

To the memory of my dear late sister Makano Judith Kapatamoyo

ABSTRACT

Background: Uncorrected Refractive Errors (UREs) are the most common cause of vision loss globally. The burden is particularly worse in low- and middle-income countries like Zambia, where access to Refractive Error Correction Services (RECS) is limited. This study aimed to assess the user's accessibility to RECS in selected Zambian Hospitals.

Methods: Twenty (20) public health facilities offering RECS were conveniently selected using a cross-sectional design. These represented 20 districts in eight provinces of Zambia. A questionnaire-based on access to health care services framework was administered. The framework assessed service accessibility in terms of availability, geographical accessibility, and affordability. Facility managers completed and submitted the questionnaire via email.

Results: Completed questionnaires were received from 20 facilities. Nineteen facilities were located in rural areas whilst one facility was located in an urban area. Most facilities (84%) had the Ministry of Health recommended equipment, though essential equipment such as tonometers were lacking in most facilities (70%). Fifteen facilities (75%) reported having Optometry Technologists as the main staff offering services. Only two facilities (10%) had an Ophthalmologist each and no facility had an Optometrist. School-based programmes were not carried out in all facilities. Only one (5%) facility was able to dispense spectacles soon after refraction as it had a spectacle manufacturing workshop. For some facilities (60%), a poor road network posed a challenge to geographical accessibility. Insufficient funding limited access to RECSs. Facility representative stated that not all patients could meet the cost of services in all the facilities.

Conclusion: Access to refractive error correction services in the 20 facilities was limited due to a combination of eye health programme deficiencies and general challenges typical in low- and middle-income countries. Funding, human resources and equipment were insufficient. Inadequate road network and infrastructure undermined service delivery. The accessibility shortcomings identified should be used to improve user accessibility of refractive services.

Keywords: Refractive error, eye health care access, Zambia

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DECLARATION

I, *ESNART KAPATAMOYO*, hereby declare that the work on which this thesis is based is my original work (except where acknowledgements indicate otherwise) and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university.

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PLAGIARISM DECLARATION

"This thesis has been submitted to the Turn-it in module and I confirm that my supervisor has seen my report and any concerns revealed by such have been resolved with my supervisor."

I have employed Vancouver referencing in this Thesis

Name: ESNART KAPATAMOYO

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Signature: Signed by candidate

Date: 26-07-2021

SYNOPSIS

The Master of Public Health (MPH) mini dissertation is a study to assess the user's accessibility to refractive error correction services in selected Zambian hospitals.

Vancouver referencing has been employed in this mini dissertation.

The dissertation is organized into three parts.

Part A is a research protocol that presents a background on the problem of uncorrected refractive errors. Using previously conducted studies and existing literature, it presents practical ways of assessing the accessibility to refractive error correction services within the Zambian context.

Part B is a manuscript format of the study suitable for publication in PLOS ONE Journal. Instructions for authors are appended in part C.

Part C contains all the appendices used in the development of the study.

This will include the acknowledgements, questionnaire, ethics consent forms, including approvals from the various institutions, selected tables and figures and instructions for authors' guidelines for Plos One Journal.

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LIST OF ABBREVIATIONS AND ACRONYMS

GAP	Global Action Plan
IAPB	International Agency for the Prevention of Blindness
LMICs	Low Middle-Income Countries
NEHSP	National Eye Health Strategic Plan
NGO	Non-Governmental Organisation
OCO	Ophthalmic Clinical Officer
ON	Ophthalmic Nurse
RAAB	Rapid Assessment of Avoidable Blindness
RECS	Refractive Error Correction Services
RN	Registered Nurse
UREs	Uncorrected Refractive Errors
VA	Visual Acuity
WHO	World Health Organization
NHRA	National Health Research Authority

GLOSSARY OF TERMS

TERM	DEFINITION
Refractive error	An optical defect of the eye that prevents parallel light rays from being brought to a clear focus.
Refractive error correction services	Activities aimed at the correction of refractive error. These may include screening, refraction, and the provision of spectacles.
Visual impairment	A condition of reduced visual performance that cannot be remedied by refractive correction (spectacles or contact lenses), surgery or medical methods
Visual acuity	Ability to discern the shapes and details of the things you see.

PART A: PROTOCOL

USER ACCESSIBILITY TO REFRACTIVE ERROR CORRECTION SERVICES IN SELECTED ZAMBIAN HOSPITALS

1.0. INTRODUCTION

1.1 Background

Vision loss is a major public health concern worldwide [1, 2]. According to the 2019 World Vision Report, at least 2.2 billion people worldwide are living with some form of vision loss [3]. More than one billion of these have vision loss due to preventable causes such as uncorrected refractive errors (UREs), the most common vision problem [2]. Resulting from the abnormal shape and length of the eyeball, UREs are the second leading cause of preventable vision loss worldwide [4]. Regardless of age, sex, and race [5], vision loss is known to cause a devastating social and economic impact on individuals, families and the community at large [3, 6]. For example, poor eye health has been said to be a significant cause of poverty as it may affect income, limit access to education and employment opportunities and lead to poor quality of life [2, 4, 7].

The last three decades have seen various concerted efforts to lessen vision loss and eliminate avoidable blindness as a global public health problem. For example, the World Health Organization (WHO) and the International Agency for the Prevention of Blindness (IAPB) have collaboratively developed and supported various global initiatives. These included the VISION 2020: The Right to Sight in 1999 [8], the four World Health Assembly (WHA) resolutions [9] and in 2013, "*Universal eye health*: a global action plan (GAP) 2014–2019" [10].

In low- and middle-income countries (LMICs), home to 90% of visually impaired people [11], the burden of UREs is estimated to be four times higher compared to high-income countries [12]. In the world's poorest communities, access to eye care is often unavailable [9]. According to a policy briefing on strengthening eye health, the WHO estimates that in Africa, less than 30% of those in need have access to eye health services [6]. The burden is especially worse among women, migrants, those in rural communities and other underserved populations [3].

In Sub-Saharan African countries, where poverty and poor health status is common, vision loss which may result from UREs is ranked among the leading causes of preventable disability [1]. This may be partly due to the limited access to comprehensive health care service for people living in Sub-Saharan Africa [13]. According to Peters et al. (2008), the relationship between access to health care services and poverty can be compared to a causative cycle [13]. For example, limited access to refractive error correction services (RECS) due to poverty may worsen loss of vision, whereas, loss of vision may hinder education, career opportunities, employment and loss of income which could eventually lead to impoverishment [3, 4, 6].

In Zambia, the prevalence of blindness was estimated at 2% of the population in 2017 [14, 15]. Like other sub-Saharan African countries with similar demographics such as Malawi and Rwanda, UREs are the second leading cause of vision loss in Zambia [15, 16]. In a Rapid Assessment of Avoidable Blindness (RAAB) survey carried out in the Southern part of Zambia in 2012, UREs (29.2%) were ranked second after cataract (34.9%) as a leading cause of visual impairment (VI) [16]. The International Classification of Diseases 11 (2018) classifies vision loss as presenting distance visual acuity of <6/12 to ≥3/60 or near visual acuity worse than N6 or M.08 at 40cm with existing correction. Distance VI has been further subdivided into mild (visual acuity worse than 6/12 to 6/18), moderate (visual acuity worse than 6/18 to 6/60), severe (visual acuity worse than 6/60 to 3/60) and blindness (visual acuity worse than 3/60) [17].

Various studies have also shown refractive error correction (with spectacles) as a simple and cost-effective form of treatment [18]. Most UREs, however, remain uncorrected due to factors such as lack of availability, geographical accessibility and affordability of services [3, 18]. Dandona & Dandona (2001) further state that "blindness due to UREs in any population may suggest that eye care services in that population are inadequate" [4]. Reducing refractive errors may, therefore, require that resources to improve access to eye care services such as sufficient personnel, appropriate infrastructure and provision of affordable reasonable-quality spectacles become more readily available in low resource settings [4, 18, 19].

1.2. Zambia country profile

Zambia is a landlocked Sub-Saharan country situated on the great plateau of central Africa [20]. It lies between 8- and 18-degrees southern latitudes and 22- and 34-degrees eastern longitudes [21]. It has a total surface area of 752,614 square kilometres and shares borders with eight countries [20, 21]. In 2020, the Zambian population was estimated at 18,348,224 [22] with an average annual growth rate of about 2.8% [21]. Fifty-one per cent of Zambia's population lives in urban areas [15]. Zambia is divided into 10 provinces [23] which are further subdivided into 116 districts as of May 2019 [24]. Lusaka is the country's capital city and seat of government.

1.3. Eye Health Service Delivery in Zambia

Health plays a critical role in the development of the country [21]. The majority of Zambian health services (90%) are provided by the government [20], with faith-based providers, private for-profit providers and the mines providing the rest [15]. Overall coordination and management, strategic planning, resource mobilization, and policy formulation are carried out by the government at the national level [15]. Health Service delivery is delivered according to a three-tier system of hospitals (primary, secondary, and tertiary levels) as well as health centres and posts [20]. These are managed through the ten provincial health offices (PHOs), the 116 district health offices (DHOs) and statutory bodies like the National Health

Research Authority and the Health Professions Council of Zambia, operating under the Health Professions Act No. 24 of 2009 and the Laws of Zambia [20].

There is one physician for every 17,000 inhabitants in Zambia according to the 2017-2021 National Eye Health Strategic plan (NEHSP) [15]. For the delivery of eye health services, one ophthalmologist is responsible for more than 1,000,000 citizens [15]. This negatively impacts the delivery of eye health care services. This situation has triggered global participation and coordinated efforts with local governments, non-governmental organization (NGOs) and the private sector to fight against preventable blindness including URE.

Since 1999, the Zambian Ministry of Health (MOH) with cooperating partners such as Sight savers [25], Vision Aid Overseas (VAO) [26] and OneSight [27] have collaborated on various refractive error and blindness prevention programmes [15]. One such programme was the 'Zambian MOH-OneSight organisation' memorandum of understanding (MOU) to set up eye units that offer RECS across the country in 2017 [28]. As a result of this collaboration, the Zambian MOH with support from OneSight organisation, an independent non-profit organisation, established RECS units within Zambia's public health care facilities [28].

In just three years of the MOH-OneSight collaboration, 37 RECS units had been set up across all 10 provinces of Zambia. Thirty-four (92%) of these facilities were solely supported by the government. These consisted of 25 (74%) primary and nine (26%) secondary facilities located in all 10 provinces of Zambia. Three (8%) second level government facilities which are located in Luapula, North Western and Southern provinces receive support from faith based organization [28]. All these three facilities were secondary facilities located in the Southern, Luapula and North-western provinces of Zambia.

OneSight organisation supported the Zambian MOH by providing equipment, material, computers, and smartphones for RECS. To facilitate the operation of these facilities, they were designed to operate through an internet cloud system that allowed them to offer RECS uniformly. For example, spectacle lenses and frames which were being ordered through the internet cloud system had a standard price. Spectacles were manufactured centrally at a spectacle manufacturing lab in Lusaka, Zambia's capital. Upon cutting and fitting of the spectacles, these were sent back to the various facilities. Though overall management of the facilities belonged to the Zambian MOH, monitoring through technical support such as adherence to supply chain were facilitated by a team of OneSight employees [28, 29].

Efforts to eliminate preventable blindness such as the MOH-OneSight collaboration have helped intensify national advocacy on eye health, supported the development of national eye health plans and strengthened national prevention of blindness programmes in Zambia [29]. With URE being one of the major causes of

avoidable vision loss worldwide [18], effective strategies for service delivery must be developed to eliminate this easily treatable cause of blindness and vision loss in Zambia [14]. Despite these efforts, Zambia does not have adequate RECS and therefore affords limited access to these services for her population in need of them [29]. In order to optimise their vision and ability to function in society, it is estimated that two to three billion people worldwide need on-going access to eye care services [30]. To improve access to RECS, much development is needed in terms of infrastructure, equipment, health information management, human resource development and disease control [19, 31]. The service characteristics and the cost of the service to ascertain the comprehensive nature of the service being offered also requires further exploration.

A health system analysis of eye care services conducted in Zambia by Bozzani et al. (2014) identified factors that led to the underperformance of the eye health care system. These included inadequate financing, shortage and inequitable distribution of human resource and a lack of routine monitoring [29]. A similar study was conducted by Rivka et al. (2018) in three districts of South Africa to strengthen primary eye health care services [32]. This assessment suggested that visual acuity (VA) measurements were likely to be compromised as good quality VA charts were either not available or not used correctly in most of the facilities [32].

In 2018, a situation analysis of eye care services in Swaziland also showed that eye care services were not adequate to meet the needs of the citizens [33]. A clinic facility assessment conducted in this study found that a lack of human resource and inadequate equipment prevented them from effectively delivering appropriate eye care services. Assessment of eye health services enables the identification of gaps in the service, highlights the nature of service being offered, as well as current and future needs. The program assessment plays an important role in the development of services and help determine whether or not the health system meets the population needs [33].

1.3. Study rationale

Uncorrected refractive errors are the most common cause of vision loss. In Zambia, eighty per cent of blindness is due to avoidable causes including UREs [15]. Generally, the use of spectacles, contact lenses and refractive laser surgery are the most common ways of correcting refractive error [3]. In Zambia, however, the use of spectacles is the most common and cost-effective [16, 34].

Correcting refractive errors could restore vision and improve the quality of life by providing an individual with the opportunity for an education, employment, and the ability to contribute to the socioeconomic status of the country [15]. It is, therefore, important that an individual with URE also has adequate access to RECS [19].

However, there is a gap in knowledge, attitude and practice of accessibility to RECS because there are too few studies conducted on this topic. To date, only one such study, conducted by Bozzani et al. in 2011 has been carried out [35]. This study showed that accessibility to RECS was underperforming due to factors such as shortage of human resource, inadequate equipment and infrastructure [35]. Over the last decade, a significant increase in the delivery of eye health services occurred in Zambia [15]. According to the 2017-2021 NEHSP, tremendous progress has been made in terms of health information, human resource development, financing and service delivery [15]. Additionally, the introduction of the National Health Insurance Management Authority (NHIMA) in 2019 which covers selected eye care services could have likely increased access to RECS in the country [36]. Considering the magnitude of the development encountered, there is a need to assess the accessibility of RECS in Zambia.

We, therefore, propose a study to determine the service user's accessibility to RECS in selected Zambian hospitals, adapted from a specially developed conceptual framework by Peters et al. (2008) [13]. This framework contains aspects also used in various studies on accessibility to health services [37-39] and is similar to those used in previously conducted studies in Zambia [29, 40].

To the best of our knowledge, this will be the first effort to assess the accessibility to services addressing the high burden of vision loss due to UREs. The study will fill a gap in the evidence of RECS in Zambia, and potentially the Southern African region. It is hoped that having carried out the assessment, the findings may;

1. Provide an up-to-date situational analysis of the accessibility to RECS in the selected facilities, which can be used to project the accessibility of refractive error correction services on a national level;

2. Assist policy-makers and stakeholders to make evidence-based decisions for planning and meeting national objectives;

3. Identify strategies to overcome barriers in the uptake of RECS and help in developing RECS assessment tools for future use in Zambian hospitals;

4. Initiate the cultivation of research findings in eye care service delivery;

1.4. Conceptual framework of Access

Providing equitable access to health care services is an important goal for all countries [38]. In a lower-middle income country like Zambia, the provision of RECS that are accessible to the community is important to solve the problem of the high burden of URE [15, 16]. According to the 2017-2021 Zambia NEHSP, accessibility to health services is among the key characteristics of a well-functioning health system. It describes an accessible health service as one that is "permanently and directly accessible with no undue barriers of cost, language, culture or geography" [15]. Le Grand (1982) describes access to health services as a combination of factors such as distance to a health facility, out of pocket costs and waiting time [41]. Other researchers such as Aday & Andersen (1974) [42] and Collins & Klein (1980) [43] have used access synonymously with utilisation based on the assumption that it is a subject of both demand and supply [44]. Donabedian (1972) added that, the presence of a facility alone was not proof of accessibility but that the use of the services at the facility was proof of access [45].

Despite substantial research on the meaning of 'access to health care' [37], there are still differences in understanding the precise meaning, and consensus on appropriate measurement methods have not been found [37, 39]. As noted by Cabieses & Bird (2014), one of the key challenges faced by researchers trying to define the precise meaning of the term "access to health care" is its close relation to the social context [37]. The definition of access to health care can therefore vary across different populations since it is connected to the level of development of the country, its demographic characteristics, and its values about health. These all depend on broad economic, cultural and social aspects [37]. For example, the concept of access to health care services may be different for high-income countries and LMICs. This is due to differences in the health care system [46], infrastructure and human resource which are restricted in LMICs [47], as well as other epidemiological and demographic differences [37].

Our study adopts an approach that assesses RECS in the context of LMICs. McIntyre et al. (2009) in their study on access as a policy-relevant concept in LMICs for example, define access to health care as "a multidimensional concept based on the interaction or degree of fit between health care systems and individuals, households and communities" [39]. The conceptual framework of access being a fit between the individual and the health system has equally been proposed by Penchansky (1981) [48]. In terms of RECS, this means that the service must not only be available as and when needed but also relevant and effective if the population must gain access to satisfactory services. This approach also recognises that individuals from different settings may have different opportunities and constraints when seeking RECS [38].

A study by Ricketts & Goldsmith (2005) has shown that various frameworks on access to health care services have been proposed [44]. Though these frameworks may be different in the way they define "access to health care", it is also important to note that they are context-specific and therefore relevant depending on the context in which they are being applied [37]. For this study, a conceptual framework by Peters et al. (2008) will be used. In that study, which focused on the "access to health care in developing countries", Peters et al. (2008), add that access is related to the "timely use of services according to need" [13]. Built on longstanding descriptions of access to health services, they developed a conceptual framework for assessing access to health care services based on four dimensions: Geographical accessibility, availability, financial accessibility, and acceptability [13].

As shown in Figure 1, the development of this study's conceptual framework applied three dimensions of the framework from the study by Peters et al. (2008) [13]. With a focus on the role of poverty, the concepts of this framework have been widely used to assess access to health care particularly in LMICs [39, 49].

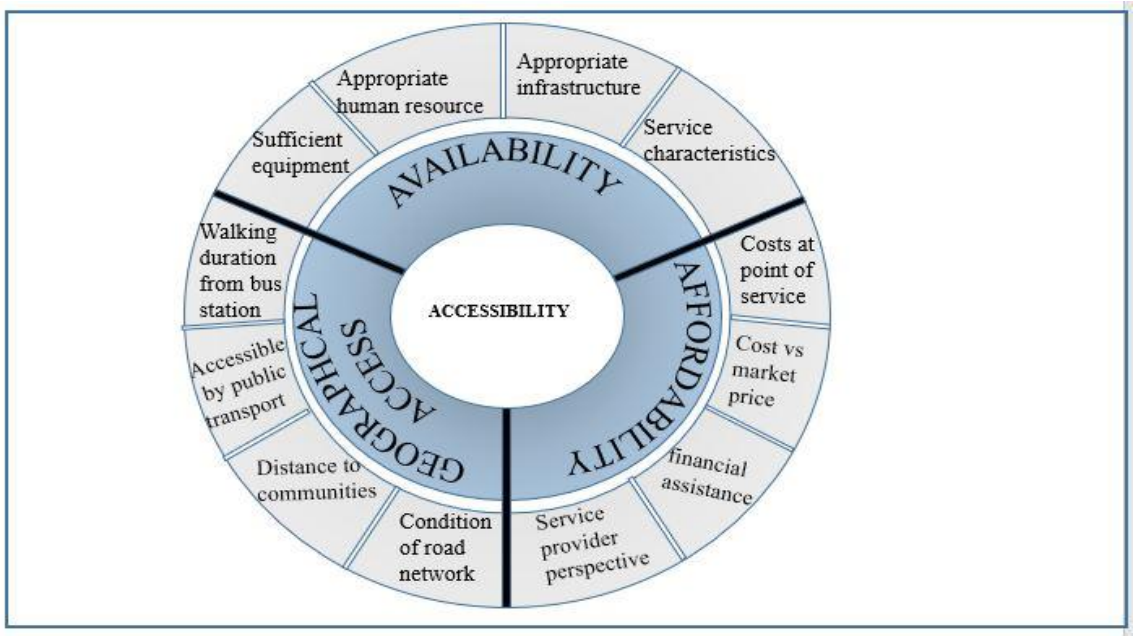

Figure 1: Conceptual framework for assessing access to refractive error correction services [Adapted from Peters et al. (2008)].

The fourth dimension which Peters et al. (2008) named 'acceptability' will be excluded in our study. It may be defined as the "degree of fit between provider and patient attitudes and expectations of each other" [39]. Cabieses & Bird (2014) add that an individual's beliefs, attitudes, and expectation can influence the utilisation of health care services [37]. Making an appropriate assessment regarding this

dimension will therefore require the measurement of patient-level information such as attitudes, norms, values, and expectations [50]. To make a valid claim, our study would therefore require the participation of both the service provider and user. Given that the nature of our study only focuses on the provider's perspective of accessibility makes this dimension unsuitable for our study.

In this framework, three main dimensions and corresponding indicators of accessibility to RECS are described.

Availability

McIntyre et al. (2009) define availability as having the right type of care available to those who need it at the right time and place [39]. In terms of RECS, this may require that the appointment systems, working hours, working days, community screenings and waiting times meet the demands of those who would use the service [18, 19, 49]. Another important indicator that is a major focus of the WHO GAP eye service delivery initiatives is the availability of adequate and appropriate human resources to provide the service [51-53].

An accessible RECS will also include the availability of fully functioning equipment and infrastructure [29]. According to Naidoo & Ravilla (2007), providing a complete RECS will include an affordable spectacle dispensing service so that people who have been refracted and received a spectacle prescription can collect their glasses [18]. This may mean having infrastructure that promotes a good flow for the service users and an environment with equipment that supports quality refraction.

Geographical accessibility

Geographical accessibility is another important dimension of access to health care services especially in LMICs [13, 37]. Access to RECS does not only depend on the availability or affordability of the services but also on whether the eye health care facility can be physically reached by the majority of the people surrounding it [40, 54]. Peters et al.(2008) stated that the use of health services and distance to health facilities or travel time have an inverse relationship [13]. For example, health facilities that are remotely situated will require patients to spend more time travelling. This may take away time from daily economic activities and therefore pose as an obstacle to obtaining care especially for the poor.

Whether a facility can be reached by using public transportation or not may also create a barrier for users, particularly the poor who may not be able to afford private transportation [40]. The road network system which is often poor in developing countries' remote areas is also an important indicator for geographical accessibility [55]. A good road network system will benefit both service users and providers by facilitating communication services such as distribution of supplies, supervision of health workers and timely referrals in case of emergency [13].

Financial accessibility

Financial accessibility or affordability is an important determinant of access especially in LMICs as it is directly associated with poverty [13]. McIntyre et al. (2009) define financial accessibility as the "degree of fit between the full cost of services to the individual and the individual's ability and willingness to pay for the services" [39]. According to Gulliford et al. (2002), the extent to which a population "gains access" to a particular service also depends on the financial barriers that limit the utilization of that service [38]. Though affecting different socio-economic groups in different ways [38], financial accessibility would therefore be determined by the extent to which these barriers are overcome in the context of various demands on the household budget [40]. In addition to other costs such as transportation and loss of a day's wages, payments at the point of service delivery, unofficial user fees [56] and the cost of spectacles may amount to substantial costs payable, limiting the ability of the user to take up the service [13, 40].

1.5. Problem Statement

Providing an accessible RECS is essential to help solve the problem of UREs in LMICs like Zambia [18]. Vision loss due to refractive error can significantly affect an individual's quality of life [7] by limiting economic productivity, workforce participation [57, 58] and increasing the chances of depression and anxiety [40, 54]. Adequate user accessibility entails a service that is affordable, geographically accessible by those in need and with adequate, appropriate provision of consumables, equipment, and human resources [35]. The characteristics and provision of services must also meet the demand of those in need [18]. User accessibility to RECS seems to be a challenge in the Zambian setting although the extent is not known [29].

In an earlier study conducted in Zambia, data on the accessibility to these services was lacking and existing information on the provision of RECS at the time of the study was inadequate [29]. These inadequacies included various equipment that needed repair and that the seven dispensing workshops present at the time of the study were unable to meet the demand [26]. Skewed distribution of the already insufficient human resource was also reported. It is likely that these challenges could still be present, hence the pursuance of this research [35].

1.6. Research question

What is the accessibility of refractive error correction services for public service users from a provider's perspective in selected Zambian Hospitals?

1.7. Study Aim

To assess the accessibility of refractive error correction services for public service users from a provider's perspective in selected Zambian Hospitals.

1.8. Study Objectives

1. To describe the characteristics of available refractive error correction services being offered and compare these with the provisions in the NEHSP.
2. To determine the availability of equipment needed to provide refractive error correction equipment in selected Zambian Hospitals.
3. To determine the availability of human resources needed to provide refractive error correction services in selected Zambian hospitals.
4. To determine the geographical accessibility of refractive error correction services in selected Zambian Hospitals.
5. To establish the financial accessibility of refractive error correction services in selected Zambian Hospitals.

2.0. METHODOLOGY

2.1. Study design

A cross-sectional quantitative study design will be chosen to describe the status of RECS in the Zambian public health facilities. The participants will be provided with a questionnaire to complete. The questionnaire will consist of questions on various aspects of RECS. The 2017-2021 Zambian National Eye Health Strategic Plan (NEHSP) will be used as a reference document with which to compare some of the service characteristics of RECS in Zambia.

2.2 Study setting

The study will be conducted in Zambian healthcare facilities offering eye care services, including RECS. These will consist of public hospitals funded by the government only and those funded by the government with support from faith-based organisations. Seventy-six (76) hospitals were said to offer eye care services in 2011. Of these, 37% operated as private for-profit facilities, the majority of which (73%) were optical shops [35].

Since 2011, the Zambian MOH has made tremendous progress in the development of eye health service delivery. In January 2017 for example, the NEHSP recognised the establishment of five secondary eye care facilities and two were under development: one each in Eastern (Chipata General Hospital) and Central (Kabwe General Hospital) Provinces [15]. In the same year (2017), the Zambian MOH in collaboration with OneSight organisation, an independent non-profit organisation, established an additional 37 refractive error correction units within Zambia's public hospitals. Among these were 34 that were solely funded by the government and three that were funded by the government with support from faith-based organisations.

Among the government-funded facilities are 25 primary and nine secondary facilities distributed amongst the 10 Provinces of Zambia. All three facilities that received support from some faith-based organisation were secondary facilities located in the Southern, Luapula and North-western Provinces of Zambia.

2.3. Study population

The study population will consist of public hospitals which offer RECS in Zambia. This will include hospitals that are either supported solely by the government or by the government with support from faith-based organisations. In a 2011 study, seventy-six (74) facilities were said to offer RECS in Zambia. This included 37% that operated as private for-profit facilities [35].

In 2017, the Zambian MOH in collaboration with OneSight Organisation established the addition of 37 RECS units within Zambia's public hospitals. These units have been established within both primary and secondary hospitals.

Our study population will consist of RECS units that have been established in Zambia's primary and secondary public health care facilities. For this study, these units will be referred to as RECS 'facilities.

2.4. Sampling and sample sizes

Convenient sampling will be used to select the facilities where MOH and OneSight organization are collaborating to offer RECS. This sample was chosen because OneSight is collaborating with more than half (55%) of Zambia's public facilities offering RECS. This sample will also have respondents that are easy to reach via email and phone since the facilities have been supplied with computers and smartphones that enable them to connect to the internet. This technique was chosen because there is an already available database of MOH facilities working in collaboration with the OneSight organisation.

2.5. Inclusion criteria

All public facilities where MOH and OneSight organization will be collaborating to offer RECS will be included in the study. This will include hospitals that are either supported solely by the government or by the government with support from faith-based organisations. Only facilities that have been working for more than a year and are no longer in the pilot phase of their operation will be included in the study.

Hospitals where the Zambian MOH in collaboration with OneSight organization offer RECS will be selected for the study.

These will be facilities generally working in collaboration with OneSight organization to offer RECS.

2.6. Exclusion criteria

Private, for-profit facilities will be excluded from the study, since ninety per cent of patients in Zambia seek care in public facilities [20]. Also given that they mainly operate on a profit basis, they are likely to be better resourced and located in big cities where they serve higher-income patients [35, 59]. This would make them less easily comparable to the rest of the facilities. Public facilities that are not benefiting from OneSight support will be excluded from the study. Facilities that have been operating for less than a year will also be excluded from the study since they will still be in the pilot phase of their operation. Facilities that are considered inactive on the OneSight cloud system will also be excluded from the study.

2.7. Data collection tools

Study data will be collected from electronic questionnaire to be filled in by a participant from each eye health facility.

2.8. Data collection procedure

The electronic questionnaire customized for use in this study. This method was chosen as the main data collection tool. Given that the study requires information on various aspects of accessibility (Figure 2), this method would ensure the collection of data on multiple variables at the same time [60]. Also given the vastness of the country and wide geographical distribution of Zambian eye health facilities [35], carrying out face to face interaction is likely to increase the cost of carrying out the study [61]. Marshall (2004) adds that using a questionnaire in cases where the target audience is geographically spread still allows the researchers to identify and define the participants [62]. Research has shown that questionnaires have the advantage of providing privacy, minimizing interruption and undue coercion from the interviewer [61, 63]. A participant from each facility offering RECS will receive a questionnaire. Since facilities affiliated with OneSight have been provided with smartphones and computers that have internet access, questionnaires will be sent by email and/or WhatsApp messenger. Data collection by email is also an advantage for both the researcher and respondent since it would not have any personal financial implications on the respondent and will pose minimal costs on the researcher. Dimond (2012), argues that data collection by email may provide less detailed information as compared to a phone call. However, in cases like ours where study participants do not need to go into in-depth details to provide responses, this approach offers substantial advantages. For example, less effort is required from both the researcher and the subject, and the researcher is able to obtain more responses with the same effort [64]. The electronic questionnaire will maximize the benefits of real-time technology, thus likely to reduce completion and submission time. This will minimize inconvenience for the participants on their day-to-day duties with the patients. This method was chosen because the participants were likely to have access to the internet through their facility. As they were professionals, they are intellectually capable of completing an electronic questionnaire with minimal outside assistance. The questionnaire will consist of sections to give an overview of the RECS various facilities. To address our study objectives, the sections of the questionnaire will be structured according to the three dimensions of the accessibility framework being applied in the study. These will include; availability, affordability, and geographical accessibility. It will also include sub-dimensions such as human resource, equipment, infrastructure, and other domains that address the various dimensions as shown in Appendix II. The main questions are structured in a way that allows respondents to tick or provide a short-written response. Studies have shown that in some circumstance, short responses may improve the quality of data collected as compared to detailed responses [62, 64].

Data will be entered by two independent individuals to increase the accuracy of the data being collected [65]. To ensure reliable and accurate answers to the questionnaire, the participant will preferably be the

core supervisor of the eye health facility. This participant must be one that occupies a position that allows him/her to have knowledge of RECS and daily facility operations. Upon completion and submission of the questionnaire, the responses will be captured into Microsoft Excel. Steps will be taken to clarify any conflicting information and ensure the correct data is collected. Considering the busy nature of the work of the participants, a time frame of three days will be given to complete the questionnaire. Daily reminders will be sent via text messages throughout the three days and non-respondents will be contacted by a phone call.

2.9. Validity and reliability

Validity and Reliability are among some of the ways in which research communicates rigour and trustworthiness in the findings [66]. Judith (2010) defines reliability as the "extent to which a test or procedure produces similar results under the same conditions and at all times" [63]. On the other hand, validity is about "the closeness of what we believe we are measuring to what we intended to measure" [66]. To ensure this, the questionnaire will be specifically designed for this study. It will be based on the framework developed by Peters et al. (2008) on the accessibility to health care services in developing countries [13]. The questions will be structured according to three accessibility dimensions of the framework to ensure that the data collected represents the accessibility concept we wish to measure [67]. Data collected will also be verified through the office of the Zambia NEH coordinator. Whenever there is a conflict between the two, steps will be taken to ensure the correct information is collected.

To determine the level of ease with which the questionnaire will be completed [68], the questionnaire will be piloted at Levy Mwanawasa Medical University (LMMU) teaching eye clinic, a non-participant facility at the time of the study. Piloting questionnaires has been said to ensure the validity and reliability of a test instrument [69]. It may help clear confusing instructions and correct the wording of the instrument which may then be redrafted [62].

To ensure that questions are clear and without scope for ambiguous answers, questions will be reviewed with the various eye health experts at the facility, a population similar to our target audience [62]. They will be asked to fill in the questionnaire regarding LMMU teaching eye clinic. Responses will then be checked to see if the respondents give the same information. This step will be critical to ensure the questions in the questionnaire mean the same things to the various respondents [63]. According to Carmine & Zeller (1979), if this procedure yields the same results, it may be said that the instrument is reliable [70]. The criteria used to choose the health professionals to complete the questionnaire will be individuals serving as head or supervisor of eye health facilities offering RECS. These will be chosen since their position makes them more likely to understand the RECS being offered and also able and willing to give accurate information.

To further ensure validity in the study, data collected will be entered by two independent individuals. Atkinson (2012) defines the entry of data by two independent data entry clerks as ‘double data entry’ [65], a procedure known to increase accuracy [71] and minimize errors in the data being collected [72]. The 2017-2021 Zambian NEHSP document will also be reviewed. It is a compilation of MOH reports collected and synthesized by various stakeholders of the Zambian health system which will inform on the policy environment regarding eye health care in Zambia.

3.0. DATA ANALYSIS

Responders will complete and submit the questionnaire electronically. Variables derived from the survey will be entered into Microsoft Excel and uploaded to R-Studio statistical package for analysis. The variables will be summarized using descriptive statistical methods.

Means with standard deviation will be presented for normally distributed data and medians and interquartile range for data that is not normally distributed. Categorical variables will be presented using frequencies and proportions.

To address the first objective, data collected from the questionnaire on each dimension of access will be compared with information contained in the 2017-2021 NEHSP which will be used as a reference. The three dimensions; availability, geographical accessibility and affordability will be the basis of the analysis.

Availability of refractive error correction services will be investigated by exploring available human resource, equipment, infrastructure, and services. The analysis will be based on the type and number of human resource and equipment available, presence or absence of infrastructure, daily service characteristics and frequency of community activities.

To investigate geographical accessibility, distance, and travel time to reach the facility will be analysed. The condition of the road network and whether a facility is accessible by public transport will also be investigated.

To investigate affordability, factors such as whether patients are required to pay a consultation fee or patient file fee will be explored. The price of items being sold at the facility such as lenses, frames and reading glasses will be investigated. These prices will be compared with the prices at other local providers to determine the patient's affordability in relation to the local market.

4.0 RECRUITMENT AND ENROLMENT

Contact details of all public and faith-based facilities collaborating with OneSight organisation will be obtained from the office of the National Eye Health Coordinator through the Ministry of Health.

The sampled participants will be contacted telephonically through the facility mobile phones provided by the OneSight organisation. A brief description of the study purpose will be given to the participant during the phone call. Participants who consent to take part in the study will then receive a consent form through email or phone. Once this has been signed and submitted to the PI, participants will receive a link to a self-administered electronic questionnaire via email or WhatsApp.

5.0 ETHICAL CONSIDERATION

To ensure that all ethical standards are upheld, the proposal will be submitted to the Levy Mwanawasa Medical University Ethics Committee. The research will only commence after the committee has reviewed and given clearance for the commencement of the study. Consent to participate in the study will be obtained from each participant through a telephone call. An electronic consent form (Appendix VI) will be sent to each participant for signing and submission to the PI before receiving the questionnaire. This form will be stored electronically on a secure computer or laptop with strict access control belonging to the principal investigator. This phone call will also include a brief orientation of the study purpose and details on how to fill in the questionnaire. An opportunity will be given for the participants to ask questions concerning the study. Participants will also be informed that their refusal to participate or drop out of the study would not attract any negative consequences. No personal details will be required on the electronic questionnaire so that information submitted will not be traced by people outside the study. Participants and the facilities to which they belong will be anonymised during analysis, interpretation, and report of the study. The questionnaire will be self-administered to minimize coercion and allow privacy.

Approval to conduct this study in MOH facilities will be obtained from the Ministry of Health. To ensure that the research adheres to all national policy and guidelines regarding health research, consent will also be obtained from the National Health Research authority of Zambia (NHRA), an institution in charge of all health-related research.

As this study forms part of academic studies of a student at the University of Cape Town (UCT), ethics approval will also be sought from the UCT Research Ethics Committee.

5.1. Risks and benefits

The study will not adversely affect the rights or welfare of the participants and therefore presents minimal risk to the participant. It may, however, infringe on their time as they answer the questionnaire.

Considering that this activity will be authorized by MOH, it may be done during working hours where the inconvenience may be absorbed as part of the normal activities of these staff members.

To minimize the time spent on the questionnaire, researchers will ensure that the questionnaire is easy to understand and that details on how to respond are properly explained. Except for the likelihood of personal satisfaction, the study has no direct benefit to the participants. However, it has the potential to improve the way in which services are offered should the factors that affect the users' access to their services be addressed.

6.0. DATA SAFETY AND MONITORING

The principal investigator and supervisors will provide oversight of the study. Before any engagement with the participants, approval will be obtained from the MOH and NHRA. This will ensure that the study is conducted according to the approved research plan. Data will also be reviewed for errors, quality, accuracy, and completeness.

7.0. PLAN FOR DATA DISSEMINATION

The findings of the study will be shared with various stakeholders. Reports will be submitted to the MOH, and presentations will be shared with the Zambia Ophthalmological Society (ZOS). Efforts will also be made to share the information with the various eye health facilities via email and/or phone. Further dissemination will be made through publications in peer-reviewed journals, workshops, and conference presentations.

PART B: MANUSCRIPT

USER ACCESSIBILITY TO REFRACTIVE ERROR CORRECTION SERVICES IN SELECTED ZAMBIAN HOSPITALS

1.0. INTRODUCTION

1.1. Background

Vision loss is a significant public health concern worldwide [1, 2]. Globally, at least 2.2 billion people live with some form of vision loss [3]. More than 80% of these suffer from preventable causes such as uncorrected refractive error (UREs), the second leading cause of vision loss [9].

Uncorrected refractive errors are the most common cause of vision loss [73]. They result from the abnormal shape or/and length of the eyeball which make it hard to see clearly [74]. Vision loss has a devastating social and economic impact on individuals, families, and the community at large. An individual suffering from vision loss may have limited access to education, social networks, and employment opportunities [3]. This may affect the ability to produce an income [3], contribute economically to society and may eventually lead to poverty [2, 4]. For example, a study by Smith et al. (2009) showed that $269 billion in productivity is lost annually by the global economy due to UREs [57].

Vision loss and access to health care services have been closely linked to poverty [13]. This argument has also been demonstrated by the disproportionate burden of UREs between countries in different regions of the world [6]. For example, 90% of visually impaired people are said to live in Low-Income countries (LICs) [9, 75]. The burden is estimated to be four times higher as compared to high-income countries [12]. In Sub-Saharan African countries, where poverty and poor health status are more common, vision loss is ranked among the leading and preventable causes of disability [1]. It is especially worse among women, migrants, those in rural communities and other underserved populations [3].

In Zambia, a 2012 Rapid Assessment of Avoidable Blindness (RAAB) survey carried out in the Southern Province ranked UREs (29.2%) second after cataract (34.9%) as a leading cause of vision loss in Zambia [16]. In 2017, the prevalence of blindness was estimated at 2% of the Zambian population as reported in the 2017-2021 National Eye Health Strategic Plan (NHSP) [15]. According to Muma & Mumbi (2019), 15.3% of vision loss in Zambia is attributable to UREs [14].

Dandona & Dandona (2001) further state that “blindness due to UREs in any population may suggest that eye care services in that population are inadequate” [4]. Other RAAB surveys carried out in Rwanda [75], Malawi [76] and India [77] have shown similar results for UREs. The World Health Organization (WHO) and other international partners have since 1999 developed and supported various global efforts to lessen vision loss as a public health concern. Among these are the VISION 2020: The Right to Sight initiative developed in collaboration with the International Agency for the prevention of blindness (IAPB) [8] and the most recent, “Universal eye health: a global action plan (GAP) 2014–2019” [6, 10].

Despite millions of people at risk of vision loss, cost-effective interventions exist for the major causes of vision loss. According to the 2019 World Report on Vision , 80% of vision loss is avoidable [3]. This means it can be prevented or treated [3, 10]. For example, refractive error correction with spectacles is a simple and cost-effective form of treatment [4, 18, 19]. Despite being easily detected, measured, and corrected, the burden of uncorrected refractive errors remains high due to limited access especially in LMICs [9, 18, 19]. In Africa, for example, not more than 30% of those in need have access to eye health services [6]. A Refractive Error and Visual Impairment study carried out among children in Durban, South Africa found that only 20% of those in need of spectacles had them.

Access to health care services is a multidimensional concept [37], despite substantial research, differences in understanding the precise meaning and lack of consensus on appropriate measurement methods still exist [13, 37-40, 78]. Availability of resources, the poor geographical location of the facility and the inability to afford the cost of services may all limit access to healthcare services.

A 2011 situation analysis study conducted in Zambia showed insufficient data on accessibility to eye care services [35]. The existing information identified inadequacies such as insufficient human resource, equipment, and infrastructure. However, the past ten years have seen a significant increase in the delivery of eye health services [15, 29]. Considering the magnitude of the development encountered, there is a need to assess the accessibility of RECS as it is still possible that these challenges still exist.

This study aims to assess the user's accessibility to RECS in selected Zambian hospitals offering RECS by adapting a conceptual framework by Peters et al. [13]. The study will investigate RECS using three dimensions; availability, geographical accessibility, and affordability [13]. This study will provide an up-to-date situational analysis of the accessibility to RECS in selected facilities, identify possible barriers in the uptake of services and initiate the cultivation of research in eye care service delivery in Zambia.

Measures of Accessibility

To analyse access to RECS in Zambia, this study adapted a conceptual framework developed by Peters et al. (2008) (Figure 2) [13]. This framework was developed to assess access to health care services in developing countries. With a focus on poverty, it identified four dimensions: 1) availability, 2) accessibility, 3) affordability and 4) Acceptability. Three of the dimensions were adopted and used for the study: 1) availability, 2) accessibility and 3) affordability. Other researchers such as McIntyre et al. (2009) [39], Ashiagbor et al. (2020) [78], Cabieses & Bird (2014) [37] and Zhang et al. (2008) [79] have also identified these dimensions as being essential components that determine the accessibility to health care services.

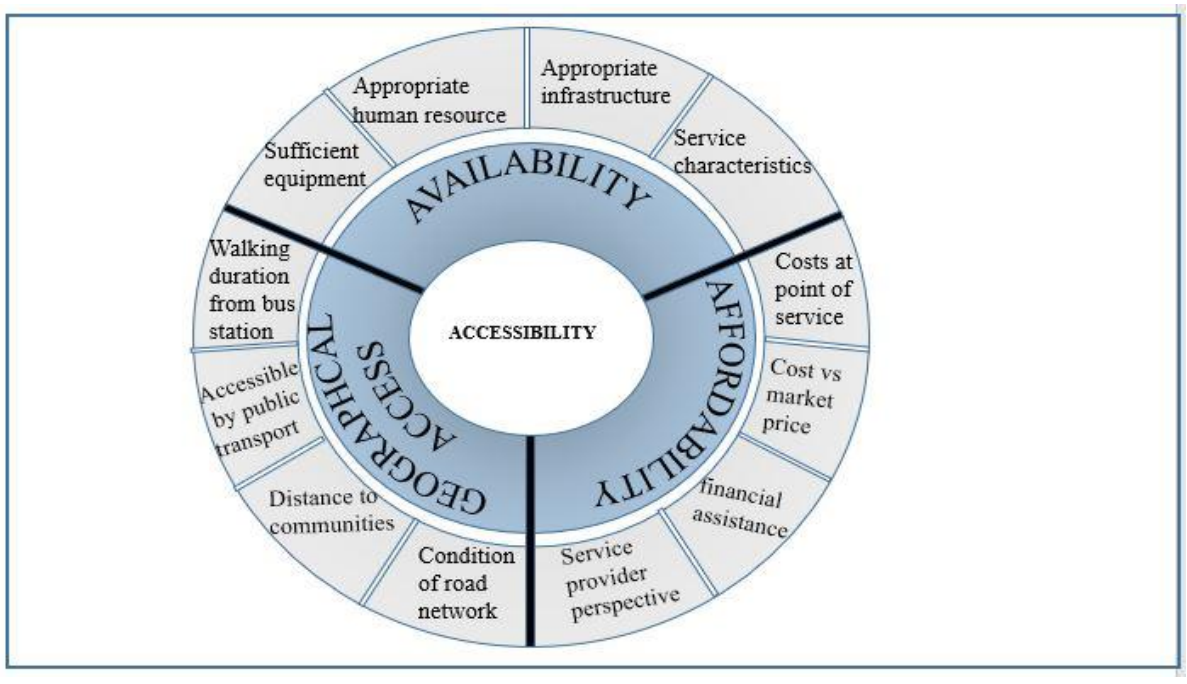

Figure 2: Conceptual framework for assessing access to refractive error correction services [Adapted from Peters et al. (2008)].

Availability

Availability of services may be said to be having the right type of care available to those who need it at the right time and place [39]. This was measured by considering the number and type of human resource and equipment available at the facility. Having the right type of care also meant that the appropriate infrastructure was available to deliver the service. Outreach activities conducted by the facility and several other service characteristics were also considered an essential component that determined the availability of RECS and was therefore measured.

Geographical accessibility

Also known as physical accessibility was measured to determine whether the location of the facility would determine how accessible the facility was to those seeking care. The condition of the road network was an important factor that was measured. Whether or not a facility was accessible by public transportation and even how long patients were required to walk from the bus station was measured. The furthest distance travelled by patients from their residence was also measured to determine the geographical accessibility of the facility.

Affordability

This was measured by considering the financial barriers that may be faced before an individual could successfully access RECS. This included payments at the point of service delivery such as user fees, payments to obtain a patient file and any formal or informal charges incurred by the patient.

Availability of financial assistance for patients unable to afford the cost of spectacles was also considered as a key component of affordability. The costs of lenses, frames and reading glasses were also measured against the market price to help determine the patient's affordability in relation to other RECS providers.

2.0. METHODOLOGY

2.1. Study setting and context.

As ninety per cent (90%) of health care services in Zambia were provided by the government, the study was conducted in Zambia's public hospitals providing RECS in collaboration with OneSight, an independent Non-Governmental Organisation (NGO).

In line with the NEHSP, the Zambian MOH in collaboration with OneSight organisation established RECS centres within Zambia's primary and secondary hospitals. Among the established facilities were three secondary facilities that received some support from faith-based organisations. These were in the Southern, Luapula and North-western provinces of Zambia. Among facilities fully supported by the government were 25 primary and nine secondary facilities located in all ten provinces of Zambia.

2.2. Study design

A cross-sectional quantitative study design was used to describe the status of RECS in Zambia's public health care facilities. Participants who included eye health care facility representatives were provided with a self-administered structured questionnaire through their health facility email and/or mobile phones. The questionnaire consisted of questions on various aspects of RECS. The 2017-2021 NEHSP was used as a reference document with which to compare some of the service characteristics of RECS in Zambia.

2.3. Sampling

Convenient sampling was used to select the public facilities that were working in collaboration with OneSight organisation to provide RECS. These study participants were easy to reach via phone and email since OneSight supported facilities were provided with internet-connected smartphones and computers. Additionally, there was an already existing database of OneSight supported facilities, making it convenient to choose this sample.

2.4. Inclusion and Exclusion criteria

All public facilities where MOH and OneSight organisation were collaborating to offer RECS were included in the study. This also included those that received some support from faith-based organisations. Only facilities that had been working for more than a year since their establishment at the time of the

study (2020) and no longer in the pilot phase of their operation were included in the study. Public facilities that were not benefiting from OneSight organisation support were excluded from the study.

OneSight supported public facilities that had been operating for less than a year since their establishment were excluded from the study since they were still in the pilot phase of their operation.

Private for-profit facilities were also excluded from the study as they may not make a good representative sample for the study since ninety per cent of patients were reported to seek care in public facilities [20]. Also, since they mainly operated on a profit basis, they are likely to be in big cities where they serve higher income-level patients. This would, therefore, make them less easily comparable to the rest of the study population [34, 35]. Facilities that were considered inactive on the OneSight cloud system were also excluded from the study.

2.5. Data Collection

Study data was collected using a questionnaire, which was sent to participants via email, who returned completed questionnaires via email to the principal investigator.

The questionnaire was filled in by a participant from each RECS facility.

The questionnaire was an adaptation of an 'accessibility to health care services framework' by Peters et al. (2008) [13]. The various sections of the questionnaire consisted of questions regarding the availability, geographical and financial accessibility of the RECS in each facility.

The questionnaire consisted of structured questions that allowed the respondent to tick or provide short words or numeric responses on their perspective of the provision of RECS services of the facility at that time.

2.6. Data collection Procedure

Through the Zambian MOH, eye health facility supervisors (study participants) were identified through a list of public hospitals (government-supported) working in collaboration with OneSight organisation to provide RECS.

A self-completion questionnaire was sent by email and/or WhatsApp messenger to each facility through the smartphones and computers provided by the OneSight organisation.

Participants were allowed a minimum of three days within which they could complete the questionnaire. Daily reminders were sent via text messages throughout the three days. Non-respondents were followed up by phone call. Upon completion and submission of the questionnaire, responses were captured into Microsoft excel.

3.0. FINDINGS

There was a total of 20 RECS facilities in the study, distributed amongst the provinces as shown in Table 1. Six (30%) secondary and 14 (70%) primary level facilities were located in 20 different districts and eight provinces of Zambia. Nineteen facilities were located in rural areas whilst one facility was located in an urban area. No tertiary level hospitals were included in the study since no tertiary level facilities were offering RECS in collaboration with OneSight organisation at the time of our study.

Table 1: Refractive Error Correction Service Facilities in the Study in Relation to the 2020 Projected Population of Zambia

PROVINCE	POPULATION	GOVERNMENT		FAITH-BASED		TOTAL
		Primary	Secondary	Primary	Secondary	
Eastern	2,065,590	3	1	0	0	4
Southern	2,135,794	1	1	0	0	2
Luapula	1,276,608	1	1	0	0	2
Western	1,076,683	1	1	0	0	2
Lusaka	3,360,183	1	0	0	0	1
Muchinga	1,095,535	3	0	0	0	3
Northern	1,520,004	1	1	0	0	2
North-western	950,789	3	0	0	1	4
Total	**13,481,186**	**14**	**5**	**0**	**1**	**20**

Source: Zambia Population and Demographic Projections, 2011-2035

Description of refractive error correction service provision

A total of 13 facilities recorded a weekly patient number of between 10 and 20, whereas four reported a number of more than 20. Three facilities reported a weekly patient number below 10. All facilities met the opening time of 08:00 hours as per government regulation and stayed open for the required eight working hours per day. Some facilities (35%) opened earlier than 08:00 hours and closed later, meaning that they offered services beyond the required eight working hours (Table 2). Table 2 below provides a general service description of the RECS facilities working in collaboration with OneSight organisation to provide

RECS. The results are further presented with respect to the three dimensions of access by Peters et al. (2008); availability, affordability, and geographical accessibility.

Table 2: Descriptive characteristics of RECS facilities in the study

Description	**Facility type**	
	Primary (total- 14) (%)	***Secondary (total- 14) (%)***
Weekly number of patients	Below 10 patients = 2 (14.3) 10-20 patients = 10 (71.4) More than 20 patients = 2 (14.2)	Below 10 patients = 1(16.7) 10-20 patients = 3 (50.0) More than 20 = 2 (33.3)
Furthest distance travelled from patient's residence.	Less than 50 km = 1 (7.1) 50 to 150 km = 6 (42.9) More than 150 km = 7 (50)	Less than 50 km = 0 (0) 50 to 150 km = 6 (100) More than 150 km = 0 (0)
Waiting duration for refraction	Less than 30 mins = 12 (85.7) More than 30 mins = 2 (14.2)	Less than 30 mins = 6 (100) More than 30 mins = 0 (0)
Working hours per day	Up to 8 hours = 9 (64.3) More than 8 hours = 5 (35.7)	Up to 8 hours = 4 (66.7) More than 8 hours = 2 (33.3)
Working days per week	Five days = 12 (85.7) Seven days = 2 (14.2)	Five days = 5 (83.3) Seven days = 1 (16.7)
Total human resources for eye health	More than 1 = 4 (28.6) Only one = 10 (71.4)	More than 1 = 5 (16.7) Only one = 1 (16.7)
Other human resource (non-ophthalmic)	One or more = 10 (71.4) None = 4 (28.6)	One or more = 5 (83.3) None = 1 (16.7)
Facilities with the following essential refraction equipment (*Retinoscope, Trial case, Trial frame, VA Chart, Ophthalmoscope*)	13 facilities (92.9)	5 facilities (83.3)
Geographical accessibility (walking duration from bus station)	Less than 30 mins = 9 (64.3) More than 30 mins = 5 (35.7)	Less than 30 mins = 6 (100) More than 30 mins = 0 (0)
Affordability of consultation service	Services charged = 1 (7.1) Services are free = 13 (92.9)	Services charged = 3 (50) Services are free = 3 (50)

More than half the facilities (71%) indicated having an average of 10-20 patients per week (or 2-10 per day) which is normal considering that most facilities are not in densely populated areas.

3.1. AVAILABILITY

Service Characteristics

All facilities attended to patients as and when they presented to the facility (walk-in service), and none offered an appointment for another day. Seventeen facilities (85%) reported working five days a week. The rest of the 3 facilities (15%) reported working seven days a week.

Waiting times

Eighteen facilities (90%) reported that their patients waited less than 30 minutes before they could be seen for refraction (Table 2). Two facilities (10%) reported that patients waited more than 30 minutes before they could be seen for refraction. All facilities reported that patients waited more than two weeks before receiving their spectacles.

Outreach activities

All the facilities in the study reported carrying out at least one community screening and one awareness programme per year. However, seven facilities (35%) reported that they did not participate in school-based programmes (Table 3).

Table 3: Frequency of Outreach Activities in RECs Facilities in the Study

Outreach Activity	**Frequency per year**	**Primary level = 14**	**Secondary level = 6**
Community screenings	More than 5 times: 2-4 times: Once: Never:	7 7 0 0	0 5 1 0
Awareness programmes	More than 5 times: 2-4 times: Once: Never	4 9 1 0	0 4 2 0
School-based screenings	More than 5 times: 2-4 times: Once: Never	1 7 2 4	1 1 1 3

Infrastructure

Eighteen facilities (90%) reported having a dark room for objective refraction. Among these, six (33%) were secondary facilities and 12 (67%) were primary facilities. Of the 20 facilities in the study, only one secondary facility (5%) reported having an optical laboratory. All primary and secondary facilities reported having a spectacle dispensary unit within their facility.

AVAILABILITY OF EQUIPMENT IN THE STUDY

According to the 2017-2021 NEHSP, eight different types of equipment have been recommended as a requirement for primary facilities offering RECS in Zambia. On the other hand, eleven types of equipment have been recommended for secondary facilities offering RECS.

Table 4: Availability of Equipment in comparison to the NEHSP recommendations.

Type of Equipment	***Primary level (n = 14)***		***Secondary level (n = 6)***	
	Minimum number of equipment recommended by the NEHSP'	Number of facilities meeting NEHSP recommendation	Minimum number of equipment recommended by the NEHSP'	Number of facilities meeting NEHSP recommendation
Distance Vision Chart	5	4	6	1
Near Vision chart	5	0	8	0
Trial set	2	3	4	2
Adult trial frame	2	4	2	3
Children's trial frame	0	NA	2	0
Retinoscope	2	4	5	0
Lensmeter	0	14	1	6
Direct Ophthalmoscope	2	2	4	0
Autorefractometer	0	14	1	5
Slit lamp	1	14	4	0
Tonometer	2	0	4	0

All the facilities in the study reported having distance VA charts (APPENDIX III). Five facilities in the study met the recommended number of distance VA charts. All except one facility reported having near vision reading charts. None of the facilities met the recommended number of near vision charts. Of the nineteen facilities that reported having trial sets, five facilities met the number recommended by the NEHSP.

All facilities reported having adult trial frames. Of these facilities, seven facilities met the recommended number of adult trial frames. Children's trial frames were not a requirement for primary facilities but were reported to be present in two (14%) facilities. Of the secondary facilities, none met the recommended number of children's trial frames. Four facilities met the recommended number of retinoscopes. All the 20 facilities in the study met the recommended number of lensmeters. Two facilities met the recommended number of direct ophthalmoscopes. Nineteen facilities met the recommended number of autorefractometers. Fourteen facilities in the study met the NEHSP recommended number of slit lamps. None of the facilities in the study met the recommended number of tonometers. The six facilities that had tonometers did not meet the number recommended by the NEHSP.

AVAILABILITY OF HUMAN RESOURCE

According to the NEHSP, ophthalmologists, optometrists, optometry technologists, registered Ophthalmic nurses, ophthalmic clinical officers and Registered nurses are the recommended type of human resource for eye health required to deliver RECS in Zambia [15]. These health workers are all specialised in eye and vision care.

Human resource in the study facilities

There were two ophthalmologists reported in the study (APPENDIX IV). There was no ophthalmologist reported among the primary facilities which was not a requirement for primary level facilities.

None of the facilities met the required number (1) of optometrists in the sample since there was no optometrist reported in the study (APPENDIX IV). However, 75% of the facilities in the study had an

optometry technologist. The NEHSP recommended number of optometry technologist was met in 15 facilities (Table 5).

Eight facilities reported having registered ophthalmic nurses (ONs) but none of them met the recommended number of registered ONs per facility. There were eight facilities that reported having registered nurses (RN) and five of them met the required number of RNs per primary facility as shown in the table below.

Table 5: Availability of Human resource in comparison to the NEHSP recommendations.

Type of human resource	Primary level ***(n = 14)***		Secondary level ***(n = 6)***	
	Recommended # by NEHSP	# of facilities meeting NEHSP recommendation	Recommended # by NEHSP	# of facilities meeting NEHSP recommendation
Ophthalmologists	0	N/A	2	0
Optometrists	1	0	1	0
Optometry Technologists	1	10	1	5
Registered Ophthalmic Nurses	3	0	6	0
Registered nurses	1	5	5	0

Other Human resource in the study

Though not among the recommended human resources for eye health, the study reported having other types of human resources working in the various facilities providing RECS. For example, one primary facility (5%) reported having one General Clinical Officer. One primary facility (7%) and two secondary facilities (33%) reported having casual daily employees (CDEs). One primary facility even reported having a physiotherapist attached to work in their eye department.

3.2. GEOGRAPHICAL ACCESSIBILITY

In the study, it was reported that 18 (90%) facilities were reachable by public transportation (Table 6). Most facilities (60%) indicated that the furthest distance travelled by people seeking RECS was between 50 and 150 kilometres from their places of residence.

Three quarters (75%) of the participants in the sample indicated that their patients walked for less than 30 minutes before reaching the facility from the bus station. There were 12 (60%) facilities that reported having a poorly maintained road network leading to the facility (Table 6).

Table 6: Geographical accessibility of RECS study facilities.

Description	**Primary (n = 14)**	**Secondary (n = 6)**
Number reachable by public transport Number reachable by other means of transportation	12 2	6 0
Furthest distance travelled from patient's residence (km)	Less than 50 = 1 50-150 = 6 More than 150 = 7	Less than 50 = 0 50-150 = 6 More than 150 = 0
Walking duration from bus station (minutes)	Less than 30mins = 9 30- 60 = 5	Less than 30 mins = 6 30- 60 = 0
Condition of road network	Poor road network = 10 Good road network = 4	Poor road network = 2 Good road network = 4

3.3. AFFORDABILITY

In the study, 16 (80%) of the facilities reported that they did not charge any consultation fees at the point of service (Table 7). However, four (20%) facilities in the study reported that they charged consultation fees at the point of service. Ten facility representatives (50%) reported perceiving their services as affordable (Table 8). Nine (45%) participants. perceived the cost of their services as being fair and one primary facility level representative perceived them as being costly. Twelve facilities (60%) in the study reported not having financial assistance services for patients unable to afford the cost of spectacles (Table

7). Four primary facilities (20%) reported that whether financial assistance services were available in the facility was not known. Four (20%) primary facilities reported that financial assistance was available for patients that were unable to afford the cost of spectacles.

Table 7: Financial accessibility to RECS in the study facilities.

Description	**Primary** ***(total- 14) (%)***	**Secondary** ***(total- 6) (%)***
Consultation service charged	Yes = 1 (7.1) No = 13 (92.9)	Yes = 3 (50) No = 3 (50)
Service provider's perception of service affordability	Affordable = 7 (50) Fair = 6 (42.9) Costly = 1 (7.1)	Affordable = 3 (50) Fair = 3 (50) Costly = 0 (0)
Financial assistance services	Not provided = 6 (42.9) Not Known = 4 (28.6) Yes, provided= 4 (28.6)	Not provided = 6 (100) Not Known = 0 (0) Yes, provided = 0 (0)

Measuring affordability in relation to other RECS providers in Zambia.

A price list of assorted items such as single vision lenses, bifocal lenses, spectacle frames and reading glasses was obtained from various RECS providers in Zambia (APPENDIX V). Analysis of the various prices of items was done in which a comparison was made against the prices of the same items in the study facilities where prices of all items was the same (Table 8). Prices were expressed in both the local Zambian currency Kwacha (ZMW) and the United States Dollars (USD). A comparison of the price of items in the study facilities and other RECS providers showed a significant variance (Table 8).

Table 8: Comparison of study facility RECS eyewear prices with private hospitals and optical shops

ITEM	DESCRIPTION	PRIVATE Price in USD (ZMW)	OPTICAL SHOPS Price in USD (ZMW)	STUDY FACILITY Price in USD (ZMW)
Single vision Lenses	Clear	32-41 (700-900)	5-9 (100-200)	1 (30)
Single vision Lenses	Colourmatic	64-73 (1,400-1,600)	19-27 (400-600)	11 (240)
Bifocal vision Lenses	Clear	73-82 (1,600-1,800)	21-23 (450-500)	4 (95)
Bifocal vision Lenses	Colourmatic	91-109 (2,000-2,400)	34-43 (750-950)	14 (315)
Frames	Assorted	16-1100 (350-25,000)	9-82 (200-1800)	8-13 (180-300)
Reading glasses	Assorted	27-43 (600-950)	3-4 (70-80)	2 (50)
ZMW: Rebased Zambian Kwacha USD: United States Dollars Exchange rate: 0.0457 USD : 1 ZMW				

CHALLENGES AFFECTING ACCESSIBILITY TO RECS AS HIGHLIGHTED BY STUDY PARTICIPANTS (THE SERVICE PROVIDERS)

There were various challenges highlighted by study participants as affecting the various dimensions of access to RECS (Table 9). The number of facilities that highlighted each challenge was also indicated as shown. The lack of spare parts for the various equipment (50%) and insufficient space for RECS (40%) were the two most common challenges reported among the study participants.

Table 9: Challenges affecting access to RECS as highlighted by the study participants.

DIMENSION	CHALLENGES	Number of study participants reporting challenge n (%)
AVAILABILITY		
	○ Insufficient and lack of skill mix for human resources	4 (20%)
	○ Some equipment faulty and in need of repair	6 (30%)
	○ Lack of technicians to repair equipment	4 (20%)
	○ No spare parts for equipment	10 (50%)
	○ Insufficient space allocated to refractive services	8 (40%)
	○ Resources unable to support multiple activities	1 (5%)
	○ Lack of utility vehicles and funding for outreach	2 (10%)
	○ Delay in receiving spectacles	3 (15%)
GEOGRAPHICAL ACCESS		
	○ Poor road network	5 (25%)
	○ Some distances are too far for patients to walk	3 (15%)
AFFORDABILITY		
	○ Patients in poor rural communities unable to afford the cost of spectacles	1 (5%)

3.4. Validity and Reliability in the Study

The questions were structured according to three accessibility dimensions of the framework to ensure that the data collected represented the accessibility concept we wished to measure [67]. Participants were called by phone and oriented on the accurate completion of the questionnaire. This helped ensure that the questions in the questionnaire meant the same things to the various respondents [63] and that they yielded the same results [70].

To check for dubious information and eliminate confusing questions, the questionnaire was piloted at the Levy Mwanawasa Medical University (LMMU) teaching eye clinic, a non-participant facility at the time of the study. It was piloted among various eye health experts at the facility, a population similar to our

target audience [62] to ensure validity and reliability in the study [69]. To increase accuracy [70] and minimize errors in the data being collected [72], data was entered by two independent individuals.

The free text sections of the questionnaire were also analysed to ensure that these were consistent with the overall responses being communicated by the questionnaire. Incomplete and unclear questionnaire responses were followed up by a telephone call.

3.5. Study Limitations

Our study had some limitations that should be considered when interpreting the results. Firstly, measuring accessibility to RECS was only from the provider's perspective. This limited the inclusion of a vital component of accessibility, acceptability, which measures patient-level information like attitudes, beliefs, and opinions. The questions that were included regarding the three dimensions of access were best answered by the service providers. Future research may assist in understanding to what degree socio-cultural attitudes may affect accessibility to RECS.

Secondly, the results may not be generalised to the entire country since the inclusion of only OneSight supported facilities may not give a true representation of all RECS in Zambia. This was because there were other public facilities and privately owned facilities offering the same services but not included in the study since they were not in collaboration with OneSight organisation. Also, not all OneSight funded facilities were included in the study since the establishment of RECS facilities was an ongoing process even at the time of the study. As a result, some facilities that were in the pilot phase could not be included in the study. However, our study population included public facilities which are aimed to serve 90% of the Zambian population. Additionally, public facilities that receive support from the OneSight organisation have representation in all 10 provinces of Zambia, and for this, we believed that our study included a great proportion of the RECS being offered in the country at the time of the study.

Thirdly, since the questionnaires were sent by email and/or WhatsApp message, as opposed to face-to-face interviews did not allow direct engagement with the respondents. This approach did not allow respondents to directly ask questions for clarity regarding the purpose of the study, which may have

affected their responses. The researcher attempted to counter this by making a phone call before sending the questionnaire. This helped ensure that all participants received the same information and that potential questions were answered. A participant information sheet with an email address and phone number were also included with the questionnaire so that participants could familiarise themselves with the purpose of the study before proceeding to answer the questions.

4.0. DISCUSSION

The present study assessed access to RECS in selected Zambian hospitals. Similar to other studies [13, 37, 39], accessibility was based on a three-dimensional framework anchored on availability of services, geographical accessibility, and the affordability of RECSs. Our study included 8 of the 10 Provinces of Zambia since one Province (Central Province) did not have RECS facilities in collaboration with OneSight at the time of the study and the facilities in the other Province (Copperbelt Province) were still in pilot phase at the time of the study. All the facilities sampled became operational after 2017, in line with the 2017-2021 NESHP. Our study showed that several service characteristics of the facilities favoured the availability of RECSs. In accordance with other studies [37, 39], a lack of appointment systems and short waiting time found in our study meant patients who required urgent attention could access services without delay in service provision. Service frequency such as extended working hours and days favoured accessibility since working adults who may have been unable to access services during normal working hours could still access services. However, there were other factors identified that underlined poor accessibility to RECSs.

The insufficient number of school-based outreach activities found in the study undermined the early detection and treatment of eye conditions, a key strategy to prevent future visual impairment in children [1-3]. The unmet need for outreach activities particularly school-based programmes had also been confirmed among school-going children in another study elsewhere [80]. In accordance with other studies [16, 29, 35] including the NEHSP [15], eye health outreach activities in Zambia were inadequate and segmented to only certain parts of the country. The lack of outreach programmes has been shown to have a negative effect on the awareness of available eye care services in Zambia [16], which in turn undermines utilisation [81, 82] observed also in our study. Only one facility in the study had an optical laboratory which often ran out of stock. In accordance to a previous Zambian study [35], the poor availability of spectacle manufacturing workshops limited access to RECS infrastructure. As a result,

refracted patients who received a spectacle prescription and had no immediate access to spectacles were unable to carry out their daily economic activities.

The lack of sufficient space to conduct refraction reported in almost half of the facilities in the study compounded the already poor infrastructural development. As a result, patients had limited access to an environment that favoured quality RECSs and were unable to access a comprehensive RECS [18]. Availability as a means of access to RECS goes beyond the service characteristics and physical structure but also requires that patients have access to sufficient and fully functioning equipment that meet the patient demand.

Equipment for the identification and correction of UREs was present in the majority of facilities. However, this positive finding may not be true for other RECS facilities that did not receive support from OneSight. Our study also found that despite the presence of equipment, the quantities of some types of equipment available in the facilities may have been unable to meet the demands of the people since they did not meet the numbers recommended by the NEHSP. The poor availability of equipment in good working condition found in this study confirms findings of previous studies in Zambia [35] and elsewhere [33]. Having insufficient and faulty equipment limits the user's access to RECSs since it forces the service providers to work without the essential equipment required to provide quality services. The insufficient and poor state of some RECS equipment could be attributed to the absence of maintenance technicians, a human resource challenge previously cited in Zambia [29, 35] and observed in 20% of the study facilities.

In line with efforts that have been made to mitigate the shortage of eye health human resource in Zambia, training for mid-level eye health personnel was introduced in 2006 for ONs and 2010 for optometry technologists at Chainama College of Health Sciences now LMMU [15]. Success in this development was shown in our study where 75% of the facilities did not only have an optometry technologist but also met the recommended number in line with the NEHSP. Although optometry technicians perform refractions and provide the basic RECS in Zambia, the lack of optometrists in the study showed a gap in the

provision of RECSs. In addition to refraction, optometrists are able to offer specialised services such as low vision, vision rehabilitation services that may be of great benefit to the provision of RECSs in Zambia. The absence of optometrists may therefore compromise the provision of a comprehensive service and limit access to specialised RECSs. The contribution of non-eye health workers in the delivery of RECS was also an important aspect noted in the study and their active participation is likely to improve early diagnosis and treatment, critical in the delivery of effective eye health services [15]. OneSight has also supported human resource by employing project coordinators, logistic managers, and other non-health workers to ensure the efficient running of RECS facilities. It is also anticipated that the shortage of ophthalmologists, optometrists, ONs, and RNs will be addressed by the newly introduced eye health training courses at LMMU in 2020. Access to RECS does not only depend on the availability of specific services, equipment, and human resource but also on whether or not the geographical location of the facility is accessible to those in need.

Geographical accessibility is one of the major determinants of whether or not the facility can be reached by the majority of people in need of services [37]. Though majority of the study facilities (90%) could be reached by public transportation, the cost of transportation was still likely to undermine geographical accessibility especially for the poor. The poor geographical accessibility evidenced by long physical distance from the facility and poor road network limited access to RECSs especially for people in remote and rural areas [78]. Though not addressed in the NEHSP, poor geographical accessibility has a major implication on the ease of getting to a health care facility [83]. It hinders the optimal uptake of RECS, thereby contributing to the inability of the MOH to address the high burden of vision loss. Access to RECS will not only depend on availability and geographical accessibility but also on whether or not the patient's economic condition allows them to meet the cost of the available services.

The full cost of services and the individual's ability and willingness to pay determines the financial accessibility of a service [39]. Poor financial accessibility was evidenced by the need for patients to pay a consultation fee at the point of service in spite of the removal of user fees in Zambia [84, 85]. Since

more than half of the facilities (60%) reported not providing financial assistance for patients, inability to afford the cost of services may deter the user especially the poor from seeking treatment. Poor financial accessibility may pose as a barrier to the utilisation of health services [85] since even minimal service costs still add to other costs such as the cost of spectacles, transportation, lodging and other expenses that may limit accessibility to RECS. Affordability of services was also measured by comparing the cost of eyewear at various RECS facilities. The lower patient expenditure on eyewear in the study facilities as compared to private facilities confirms findings of a previous study on the differences in payments for health services between public and private sectors [86]. These findings show that individuals seeking RECSs may have had an opportunity to acquire eyewear that was affordable, contributing to the financial accessibility of RECSs.

Since RECSs form a major part of eye care services delivery [18, 49], this study helps identify some of the possible policy-relevant strategies necessary to improve the delivery of eye care services in Zambia. Policy-relevant strategies would include the tabling of eye care services as essential on the national agenda such as in the implementation of the National health strategic plan (NEHSP). This would improve funds to allow the creation of funded positions for eye health workers particularly optometrists and help develop the much-needed appropriate infrastructure for eye health services. The initiation of collaborative efforts with partners to optimise use of resources and lessen dependence on external support for the provision of services would ultimately help improve the delivery of refractive error correction services in the country.

The investigation into user accessibility of refractive errors services in selected Zambian health facilities provided useful results. These results should inform strategies for the development of RECS on a national level.

5.0. CONCLUSION

We set out to assess the user's accessibility to refractive error correction services in selected Zambian hospitals. The study was able to provide a comprehensive assessment of eye care services in Zambia. The study findings showed that there has been significant improvement in the delivery of eye care services since the last situation analysis of eye care services in 2011. The establishment of new vision centres and procurement of new equipment showed significant progress towards the achievement of the VISION2020 initiative goals.

However, the study also found that refractive error correction service delivery was undermined by insufficient outreach activities, a lack of appropriate infrastructure development, faulty equipment, a shortage of human resources, poor road network and inadequate funding. These findings indicate that access to RECS in Zambia was limited given that our study facilities were represented in 80% of the Zambian Provinces and previous studies conducted in Zambia have shown similar results. This study clearly illustrates the deficiencies and challenges faced by most developing countries in the delivery of effective eye care services.

Assessing access to refractive error correction services is a significant step in addressing the high burden of uncorrected refractive error. The investigation into user accessibility of refractive errors services in selected Zambian health facilities provided useful results. It helped identify barriers to the uptake of refractive error correction services and highlighted areas that need to be addressed to improve and ensure the delivery of effective eye care services in general. These results should inform strategies for the development of RECS on a national level.

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PART C: APPENDICES

USER ACCESSIBILITY TO REFRACTIVE ERROR CORRECTION SERVICES IN SELECTED ZAMBIAN HOSPITALS

APPENDIX I: DATA COLLECTION SCHEDULE

	Facility 1	Facility 2	Facility 3
NAME OF FACILITY			
LEVEL OF FACILITY			
FACILITY FUNDED BY			

HUMAN RESOURCE AVAILABLE			
EQUIPMENTS AVAILABLE			
DARK ROOM FOR OBJECTIVE REFRACTION			
SPECTACLE MANUFACTURING WORKSHOP			
DISPENSARY			
ACCESSIBILITY MODE			
WORKING HOURS			
WORKING DAYS			
WAITING DURATION (REFRACTION)			
WAITING DURATION (SPECTACLE COLLECTION)			
COMMUNITY SCREENS			
COMMUNITY REFRACTIONS			
COMMUNITY AWARENESS			
SCHOOL BASED PROGRAM			
PUBLIC TRANSPORT			
WALKING DURATION			
FURTHEST DISTANCE TRAVELLED FROM PATIENT'S RESIDENCE			
ROAD NETWORK			
USER FEE			
FILE FEE			
PRICE OF ITEMS			
PARTICIPANT OPINION OF AFFORDABILITY			
AVAILABILIY OF FINANCIAL ASSISTANCE			

APPENDIX II: FACILITY REPRESENTATIVE QUESTIONNAIRE

SERIAL NUMBER: 01

This questionnaire has been designed as a tool to assess the user's accessibility to refractive error correction services in your facility. This will be measured using three dimensions; ***availability of services, affordability, and geographical accessibility.*** *Your participation is greatly appreciated.*

Information from this survey will be kept confidential and used strictly for research purposes

FACILITY PROFILE

Please indicate in the spaces provided details regarding your facility.						
1.	Name of facility					
2.	District					
3.	Please indicate with an (x) the main funder for your facility. You can select more than one.	NGO	GRZ	Faith-based	Other(specify)	

SECTION 1 AVAILABILITY

1.0. HUMAN RESOURCE		
Please indicate the number of the following personnel available in your facility. If unavailable, please indicate **[0]**.		
	PERSONNEL	**NUMBER AVAILABLE**
1.	Ophthalmologist	
2.	Optometrist	
3.	Optometry – Technologist	
4.	Ophthalmic - Clinical Officer	
5.	Ophthalmic nurse	
6.	Lab technicians	

7.	Trained Dispensing Optician	
8.	Other (specify)	

1.1. EQUIPMENT AND MATERIAL

The following are a list of basic equipment and material used for refractive error services.

Please indicate in the spaces provided which items are available and in good usable condition. Indicate [0] where the item is unavailable.

	ITEM	NUMBER AVAILABLE
1.	Distance reading Charts	
2.	Reading charts	
3.	Trial lens set (complete)	
4.	Trial Frame (Adult)	
5.	Trial Frame (children)	
6.	Jackson crossed cylinder (JCC)	
7.	PD ruler	
8.	Retinoscope	
9.	Lensmeter	
10.	Ophthalmoscope (direct)	
11.	Auto-refractometer	
12.	Refractor	
13.	Pupilometer	
14.	Slip lamp	

15.	Low Vision Evaluation kit	
16.	Other (Specify)	
17.	Please state any challenges you experience regarding the equipment and material at your facility.	

1.2. INFRASTRUCTURE		
Regarding the infrastructure at your facility, please tick 'Yes' or 'No' in the boxes [] provided		
1.	Is there a dark room at the facility specifically designed for performing refraction i.e., correct lighting and distance?	Yes [ ] No [ ]
2.	Is there an optical lab within the facility for the cutting and fitting of spectacle lenses?	Yes [ ] No [ ]
3.	Does the facility have a dispensary for spectacle dispensing services?	Yes [ ] No [ ]
4.	Briefly mention any challenges you experience regarding the infrastructure that provides refractive error correction services at your facility.	

1.3. SERVICES		
Regarding the services offered at your facility, please indicate in the spaces provided.		
1.	What is the average number of refractive error patients seen per	_____Patients.

	week?		
2.	How do patients access refractive error correction services	[ ] As they walk in [ ] By appointment.	
3.	Please indicate your facility's opening and closing times.	Open: _____am close: _____pm	
		Please tick with an (X) the appropriate response	
4.	How often does the facility offer refraction to patients?		Selected days per week
			5 days a week
			7 days a week
			Half a day
5.	How long does a patient wait before they can be seen for refraction?		Less than 30 mins
			Between 30 mins to 1 hour
			Between 1 hour to 2 hours
			Over 2 hours
6.	How long do patients wait to collect their spectacles after having a refraction?		Within the same day
			Within a week
			Between 2 - 4weeks
			More than a month
OUTREACH: Regarding outreach services, please tick *(✓)* in the appropriate BOX.			
7.	How often does the facility conduct **community screening** programmes? More than five times [ ] 2-4 times [ ] Once a year [ ] Never[ ]		

8.	How often does the facility conduct **community awareness** programmes for refractive error? More than five times [ ] 2-4 times [ ] Once a year [ ] Never [ ]
9.	How often does the facility conduct **school-based programme** for refractive errors in children? More than five times [ ] 2-4 times [ ] Once a year [ ] Never [ ]
10.	Regarding the provision of refractive error correction services mentioned above, briefly state some of the challenges you experience

SECTION 2 GEOGRAPHICAL ACCESSIBILITY

2.0	Please answer the following in regard to the geographical accessibility of your facility		
1.	Is the facility accessible by public transportation?	[ ] Yes [ ] No	
2.	What is the furthest distance people travel to the facility from their place of residence?	…….km	
3.	How long do people walk from the bus stop to the health facility? Please tick(X)		Less than 10mins
			10 to 30 mins
			Between 30 min to1hour
			More than 1 hour
4.	Please indicate (**x**) the type of road connecting the facility to where most of the community resides?		Well maintained Tarmac
			Poorly maintained Tarmac
			Well maintained gravel
			Poorly maintained gravel

5.	In not more than 3 sentences, please give reason(s) for your answer in the above question

SECTION 3 AFFORDABILITY

3.0		Indicate answer here
1.	Are patients required to pay a fee to be attended to?	[ ] Yes [ ] Sometimes [ ] No
2.	Are patients required to pay to acquire a patient file?	[ ] Yes [ ] Sometimes [ ] No

The following question regard the cost of eyewear at your facility. Please indicate in the third column the cost of each item.

	ITEM	*Please indicate below the cost*
3.1	*Frames*	
1.	Frames (most costly)	
2.	Frames (least costly)	
3.	Ready to clip (lens & frame)	
4.	Readers	
3.2	*Lenses*	
1.	Basic Single vision lens (non-photo chromatic)	
2.	Single vision lens (Photo-chromatic)	
3.	Basic bifocal vision lens (non-photo chromatic)	

4.	Bifocal vision lens (Photo-chromatic)	

	Please Tick(✓)
3. Is there financial assistance for patients unable to afford the cost of spectacles? Yes [ ] Sometimes [ ] No [ ] Do not know [ ]	
4. Based on your opinion, how do you consider the affordability of services for your patient? Very Affordable [ ] Affordable [ ] Fair [ ] Costly [ ] Very costly [ ]	
In not more than 3 sentences, please give a reason for your answer in the above question.	

APPENDIX III: AVAILABILITY OF EQUIPMENT IN THE STUDY FACILITIES

ID	TYPE OF FACILITY	VISUAL ACUITY CHART	READING CHART	TRIAL SET	ADULT FRAME	CHILDREN FRAME	JACKSONCROSS CYLINDER	PUPILLAR DISTANCE RULER	RETINOSCOPE	LENSMETER	DIRECT OPHTHALMOSCOPE	AUTO_REF	REFRACTOR	PUPILOMETER	SLITLAMP	LOW_VISION_KIT	TONOMETER
VC1	SECONDARY	yes	yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes
VC 2	PRIMARY	yes	yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No
VC 3	PRIMARY	yes	yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	No	No
VC 4	PRIMARY	yes	yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No
VC 5	PRIMARY	yes	yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No
VC6	PRIMARY	yes	yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	yes
VC7	SECONDARY	yes	yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No
VC8	PRIMARY	yes	yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No
VC9	PRIMARY	yes	yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No
VC10	PRIMARY	yes	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No
VC11	SECONDARY	yes	yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	yes

VC12	PRIMARY	yes	yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No
VC13	PRIMARY	yes	yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No
VC14	SECONDARY	yes	yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes
VC15	PRIMARY	yes	yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	No
VC16	PRIMARY	yes	yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
VC17	PRIMARY	yes	yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No
VC18	PRIMARY	yes	yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes
VC19	SECONDARY	yes	yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No
VC20	SECONDARY	yes	yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes

VC : VISION CENTER

APPENDIX IV: AVAILABILITY OF HUMAN RESOURCE WORKING IN THE RECS STUDY FACILITIES (VISION CENTRES)

ID	TYPE OF FACILITY	Ophthalmologist	Optometrist	Optometry Technologist	Ophthalmic Clinical	Ophthalmic Nurse	Registered Nurse	Enrolled Nurse	Clinical Officer	Other Human resource
VC1	SECONDARY	No	No	yes	No	Yes	Yes	No	No	NONE
VC 2	PRIMARY	No	No	No	No	Yes	No	No	No	Physiotherapist
VC 3	PRIMARY	No	No	No	Yes	No	No	Yes	Yes	NONE
VC 4	PRIMARY	No	No	No	No	Yes	No	Yes	No	NONE
VC 5	PRIMARY	No	No	yes	No	No	Yes	No	No	NONE
VC 6	PRIMARY	No	No	yes	No	Yes	No	No	No	NONE
VC 7	SECONDARY	Yes	No	yes	No	No	Yes	No	No	NONE
VC 8	PRIMARY	No	No	yes	No	No	Yes	Yes	No	NONE
VC 9	PRIMARY	No	No	No	No	Yes	No	No	No	NONE
VC10	PRIMARY	No	No	yes	No	No	Yes	No	No	NONE
VC11	SECONDARY	No	No	yes	No	No	No	No	No	NONE
VC12	PRIMARY	No	No	yes	No	No	Yes	No	No	1 CDE
V13	PRIMARY	No	No	yes	Yes	No	No	No	No	NONE

VC14	SECONDARY	No	No	No	No	Yes	No	Yes	No	NONE
VC15	PRIMARY	No	No	yes	No	Yes	Yes	No	No	NONE
VC16	PRIMARY	No	No	yes	No	No	No	Yes	No	NONE
VC17	PRIMARY	No	No	yes	No	No	No	No	No	NONE
VC18	PRIMARY	No	No	yes	No	No	No	Yes	No	NONE
VC19	SECONDARY	Yes	No	yes	Yes	Yes	No	Yes	No	NONE
VC20	SECONDARY	No	No	yes	Yes	No	Yes	No	No	2 CDE

VC : VISION CENTER

APPENDIX V: PRICE LIST FOR RECS ITEMS

ITEM	DESCRIPTION	FACILITY A (PRIVATE HOSPITAL) Price in USD (ZMW in brackets)	FACILITY B (OPTICAL SHOP)	FACILITY C (OPTICAL SHOP)	STUDY FACILTY
Single vision Lenses	Clear	35 (800)	8 (200)	8 (200)	1 (30)
Single vision Lenses	Colourmatic	71 (1,600)	26 (600)	26 (600)	11 (240)
Bifocal vision Lenses	Clear	79 (1,800)	22 (500)	22 (500)	4 (95)
Bifocal vision Lenses	Colourmatic	106(2,400)	42 (950)	36 (850)	14 (315)
Frames	Assorted	1103 (350-25,000)	9-79 (200-1800)	11-40 (250-900)	8-13 (180-300)
Reading glasses	Assorted	26 (600)	3 (70)	4 (80)	2 (50)
	ZMW: Zambian Kwacha USD: United States Dollars				

APPENDIX VI: PARTICIPANT INFORMATION SHEET

Study title: User accessibility To Refractive Error Correction Services in Selected Zambian Hospitals

Principle investigator: Miss Esnart Kapatamoyo

Introduction

My name is Esnart Kapatamoyo, a lecturer specialised in eyes (Optometry) at Levy Mwanawasa Medical University. I am conducting a study to assess your perspective on factors that may affect the patient's accessibility to refractive error correction services.

Ensuring that these services are accessible to the community is important to solve the problem of high burden of UREs especially in LMICs like Zambia. The following three dimensions will be used to assess access to refractive error correction services.

- Availability
- Financial accessibility
- Geographical accessibility

Explanation of process

If you accept to participate in the study, the following process will be carried out:

- You will receive a questionnaire through your facility's WhatsApp or email.
- The questionnaire should not take more than 10 minutes to be filled in.

Risks and discomforts

Answering the questionnaire may infringe on your time or you may feel uncomfortable answering some of the questions in the questionnaire. However, the study has very low risk of personal harm or injury.

Confidentiality

All information gathered from the study and your identity will remain confidential throughout the study. Data collected will be kept in a secure computer with strict access control. The results may be published for planning and awareness to others.

Benefits for the facility

- There will be no direct benefit to you, but your participation is likely to increase the knowledge on your facility's refractive error correction services and how accessible they are to the service users.

Withdrawal without prejudice

Ministry of Health has granted permission for your participation in this study. However, in the case that you are unable or unavailable to participate in this study, MOH through your institution will be required to select another participant. "You can say "yes" and join the study; or you can also say "No," you don't want to join. If you participate in the study, you can change your mind later and decide that you do not want to participate anymore. This will not attract any penalty or prejudice.

Costs and/or payments to subjects for participation in research.

You will not be paid to participate in this research project.

APPENDIX VII: CERTIFICATE OF CONSENT

CERTIFICATE OF CONSENT

I have read the foregoing information. I have had the opportunity to ask questions about it and any questions I have asked have been answered to my satisfaction. I consent voluntarily to be a participant in this study.

Name of Participant_____
Signature of Participant _____
Date _____
Day/month/year

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

A copy of this ICF has been provided to the participant.
Name of Researcher_____
Signature of Researcher_____
Date _____
Day/month/year

Questions
Please ensure that you sign the certificate of consent above.
In case of any problem or questions concerning this study, you are free to contact the principal investigator: **Miss Kapatamoyo E.**
Telephone: +260 965 691724, e – mail; esnartpk@gmail.com or kpesn001@myuct.ac.za
Or
Chairman of the LMMU research and ethics committee:
Telephone; +260-211-283827, e – mail; lmmurec@lmmu.ac.zm
P. O. Box 33991, LMMU, Lusaka, Zambia.

APPENDIX VIII: UCT HUMAN RESEARCH ETHICS APPROVAL

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

Room G50- Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 406 6492
Email: hrec-enquiries@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

07 December 2020

HREC REF: 808/2020

Dr D Minnies
Department of Surgery
Email: - d.minnies@uct.ac.za
Student: Kptesn001@myuct.ac.za

Dear Dr Minnies

PROJECT TITLE: USER ACCESSIBILITY TO REFRACTIVE ERROR CORRECTION SERVICES IN SELECTED ZAMBIAN HOSPITALS-MASTERS CANDIDATE-MISS ESNART KAPATAMOYO

Thank you for submitting your study to the Faculty of Health Sciences Human Research Ethics Committee (HREC) for review.

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

This approval is subject to strict adherence to the HREC recommendations regarding research involving human participants during COVID -19, dated 17 March 2020 & 06 July 2020.

Approval is granted for one year until the 30 December 2021.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

The HREC acknowledge that the student: - Ms Esnart Kapatamoyo will also be involved in this study.

Please quote the HREC REF in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, FHS HUMAN RESEARCH ETHICS COMMITTEE

HREC/REF:808/2020sa

APPENDIX IX: LMMU RESEARCH ETHICS COMMITTEE APPROVAL LETTER

Levy Mwanawasa Medical University

RESEARCH ETHICS COMMITTEE

Telephone: +260-211-283827
Telegram:
Telex:
Telefax: +260-211-283827
IORG No. IORG0010491

Chainama Area
P.O. Box 33991
Lusaka, Zambia
Email: lmmurec@lmmu.ac.zm
OMB No. 0990-0279

7th October, 2020

Your REF. No. LMMU-REC 00004/20

Dr. Esnart Kapatamoyo

Levy Mwanawasa Medical University
LUSAKA

Dear Ms. Kapatamoyo,

RE: ACCESSIBILITY TO REFRACTIVE ERROR CORRECTION SERVICES IN SELECTED ZAMBIAN HOSPITALS

The above-mentioned research proposal was presented to the Levy Mwanawasa Medical University Research Ethics Committee on 6th October, 2020. The proposal is approved. The approval is based on the following documents that were submitted for review:

i. **Study proposal**
ii. **Participant Information Sheet**
iii. **Consent Form**
iv. **Questionnaire**

APPROVAL NUMBER : REF. LMMU-REC 00004/20

This number should be used on all correspondence, consent forms and documents as appropriate.

- **APPROVAL DATE :** **6th October, 2020**
- **TYPE OF APPROVAL :** **Ordinary**

- **EXPIRATION DATE OF APPROVAL : 5th October, 2021**

After this date, this project may only continue upon renewal. For purposes of renewal, a progress report on a standard form obtainable from the LMMU-REC Offices should be submitted one month before the expiration date for continuing review.

- **SERIOUS ADVERSE EVENT (SAE) REPORTING:** All SAEs and any other serious challenges/problems having to do with participant welfare, participant safety and study integrity must be reported to LMMU-REC within 3 working days using standard forms obtainable from LMMU-REC.
- **MODIFICATIONS:** Prior LMMU-REC approval using standard forms obtainable from the LMMU-REC Offices is required before implementing any changes in the Protocol (including changes in the consent documents).
- **TERMINATION OF STUDY:** On termination of a study, a report must be submitted to the LMMU-REC using standard forms obtainable from the LMMU-REC Offices.
- **NHRA:** You are advised to obtain final study clearance and approval to conduct research in Zambia from the National Health Research Authority (NHRA) before commencing the research project.
- **QUESTIONS:** Please contact the LMMU-REC on Telephone No. +260-211-283827 or by email: lmmurec@lmmu.ac.zm.
- **OTHER:** Please be reminded to send in copies of your research findings/results for our records. You're also required to submit electronic copies of your publications in peer reviewed journals that may emanate from this study. Use the LMMU online portal or email for further submissions.

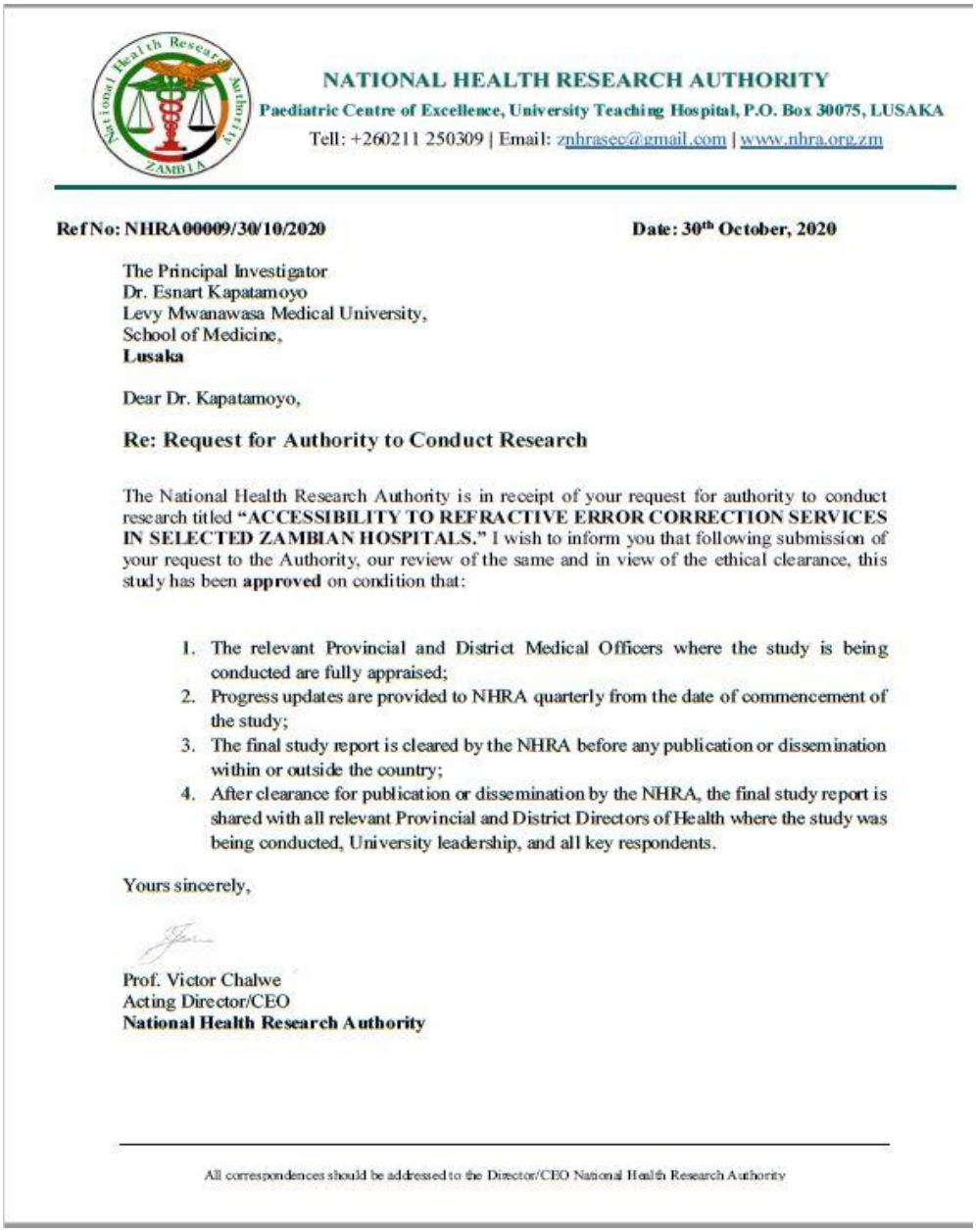
Yours sincerely,

Prof. Lonia Mwape, BSc., MSc., PhD
CHAIRPERSON

Tel: +260 979093045

E-mail: loniamagolo@gmail.com

APPENDIX X: ZAMBIA NATIONAL HEALTH RESEARCH AUTHORITY



NATIONAL HEALTH RESEARCH AUTHORITY

Paediatric Centre of Excellence, University Teaching Hospital, P.O. Box 30075, LUSAKA

Tell: +260211 250309 | Email: znhrasec@gmail.com | www.nhra.org.zm

Ref No: NHRA00009/30/10/2020 **Date: 30th October, 2020**

The Principal Investigator
Dr. Esnart Kapatamoyo
Levy Mwanawasa Medical University,
School of Medicine,
Lusaka

Dear Dr. Kapatamoyo,

Re: Request for Authority to Conduct Research

The National Health Research Authority is in receipt of your request for authority to conduct research titled **"ACCESSIBILITY TO REFRACTIVE ERROR CORRECTION SERVICES IN SELECTED ZAMBIAN HOSPITALS."** I wish to inform you that following submission of your request to the Authority, our review of the same and in view of the ethical clearance, this study has been **approved** on condition that:

1. The relevant Provincial and District Medical Officers where the study is being conducted are fully appraised;
2. Progress updates are provided to NHRA quarterly from the date of commencement of the study;
3. The final study report is cleared by the NHRA before any publication or dissemination within or outside the country;
4. After clearance for publication or dissemination by the NHRA, the final study report is shared with all relevant Provincial and District Directors of Health where the study was being conducted, University leadership, and all key respondents.

Yours sincerely,

Prof. Victor Chalwe
Acting Director/CEO
National Health Research Authority

All correspondences should be addressed to the Director/CEO National Health Research Authority

APPENDIX XI: ZAMBIAN MINISTRY OF HEALTH RESEARCH APPROVAL

All Correspondence should be addressed to the Permanent Secretary
Telephone: +260 211 253040/5
Fax: +260 211 253344

REPUBLIC OF ZAMBIA
MINISTRY OF HEALTH

In reply please quote:
MH/53/2/16
No.....

NDEKE HOUSE
P. O. BOX 30205
LUSAKA

27th November, 2020

Deon Minnies
Primary Supervisor
Community Eye Health Institute
University of Cape Town
SOUTH AFRICA

Dear Sir

RE: AUTHORITY TO UNDERTAKE RESEARCH: ESNART KAPATOMOYO

Reference is made to your dated 24th November, 2020 in which you requested for approval of proposal and authority to conduct research in respect of Ms. Kapatomoyo in order for her to fulfill the requirement to be awarded a Master's degree.

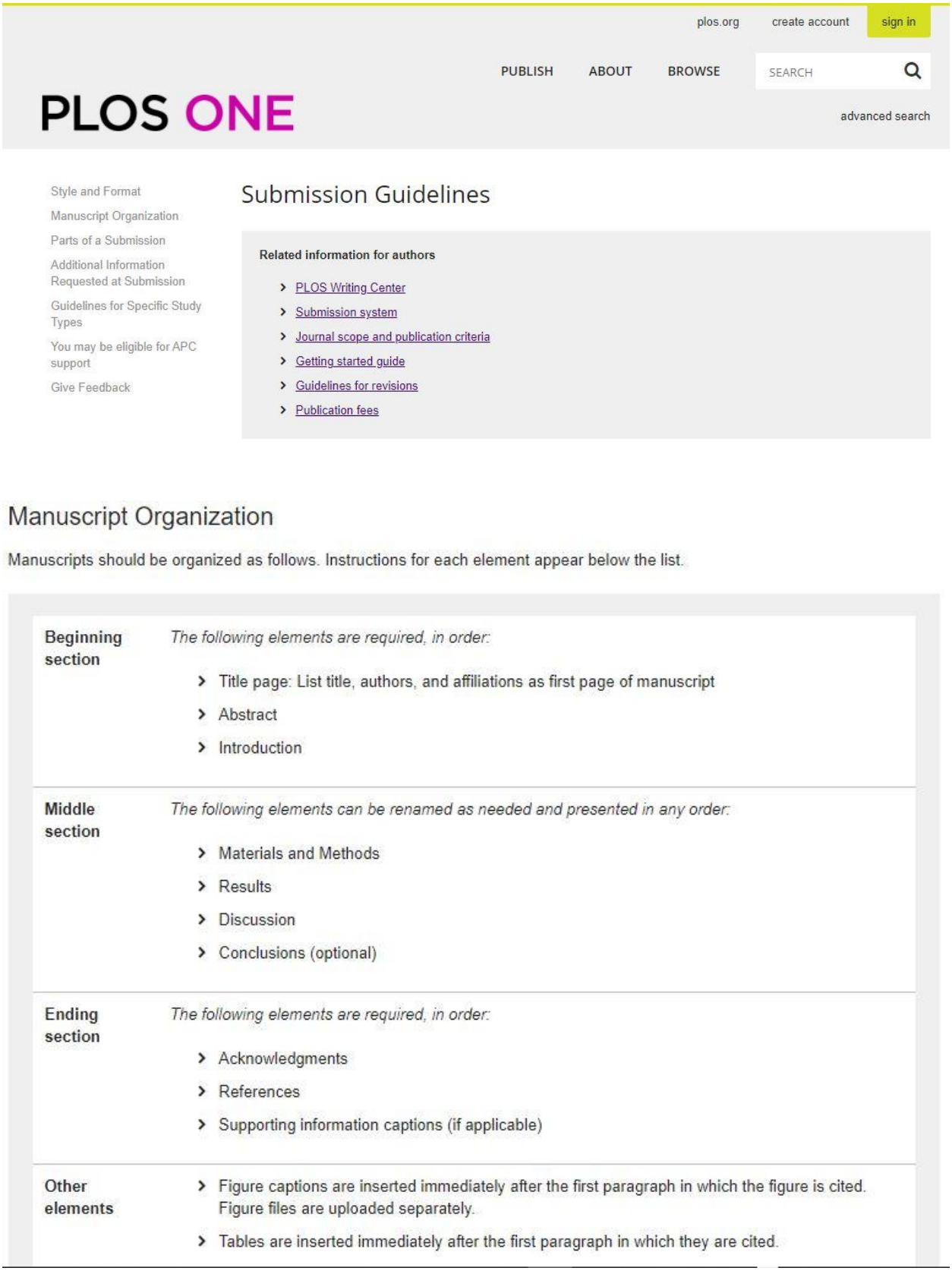
I write to inform you that the proposal has been approved and henceforth authority has been granted for her to conduct the research.

Yours faithfully,

Kakulubelwa C. Mulalelo
Permanent Secretary – A
MINISTRY OF HEALTH

c.c. **Ms. Esnart Kapatamoyo**

APPENDIX XII: JOURNAL AUTHOR GUIDELINES



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Manuscript Organization

Manuscripts should be organized as follows. Instructions for each element appear below the list.

Beginning section	*The following elements are required, in order:* › Title page: List title, authors, and affiliations as first page of manuscript › Abstract › Introduction
Middle section	*The following elements can be renamed as needed and presented in any order:* › Materials and Methods › Results › Discussion › Conclusions (optional)
Ending section	*The following elements are required, in order:* › Acknowledgments › References › Supporting information captions (if applicable)
Other elements	› Figure captions are inserted immediately after the first paragraph in which the figure is cited. Figure files are uploaded separately. › Tables are inserted immediately after the first paragraph in which they are cited.

Style and Format

File format	Manuscript files can be in the following formats: DOC, DOCX, or RTF. Microsoft Word documents should not be locked or protected. LaTeX manuscripts must be submitted as PDFs. Read the LaTeX guidelines.
Length	Manuscripts can be any length. There are no restrictions on word count, number of figures, or amount of supporting information. We encourage you to present and discuss your findings concisely.
Font	Use a standard font size and any standard font, except for the font named "Symbol". To add symbols to the manuscript, use the Insert → Symbol function in your word processor or paste in the appropriate Unicode character.
Headings	Limit manuscript sections and sub-sections to 3 heading levels. Make sure heading levels are clearly indicated in the manuscript text.
Layout and spacing	Manuscript text should be double-spaced. Do not format text in multiple columns.
Page and line numbers	Include page numbers and line numbers in the manuscript file. Use continuous line numbers (do not restart the numbering on each page).

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