Access to Surgical Care for Hearing Loss in Africa: A Systematic Review Across African Settings and a Qualitative Study of ENT Care providers in Nigeria



A thesis submitted for the degree of

Master of Science by Research in Surgical Sciences

Syntyche Jonah

Nuffield Department of Surgical Sciences (NDS)

Linacre College

Trinity Term 2026



Table of Contents

Supervisors....4
Foreword....4
Acknowledgements....4
Abstract....6
List of Abbreviations....9

Chapter 1: Introduction....10
1.1 Global Burden of Hearing Loss....10
1.2 Surgical Management of Hearing Loss....11
1.3 Ear and Hearing Care Systems in Africa....11
1.4 Access to Surgical Care in Global Surgery....13
1.5 Evidence gaps....13
1.6 Project Outline:....14

Chapter 2: A Systematic Review Exploring Barriers and Facilitators to Accessing Surgical Care for Hearing Loss in Africa....16
2.1 Aims and Research Questions:....16
2.2 Methods....17
2.2.1 Eligibility Criteria....17
2.2.2 Information Sources....19
2.2.3 Search Strategy....19
2.2.4 Selection Process....21
2.2.5 Data Collection Process....22
2.2.6 Study Risk of Bias Assessment....25
2.2.7 Synthesis Methods....28
2.3 Results....29
2.3.1 Study Selection....29
2.3.2 Master Table....31
2.3.3 Risk of Bias....36
2.3.4 Study Characteristics....38
2.3.5 Geographical Distribution....42
....42
2.3.6 Cross-Country Patterns in Reported Barriers....43
2.3.7 Studies by Year of Publication....43
2.3.8 Overview of Reported Barriers and Facilitators....44
2.3.9 Sensitivity Analysis Excluding High Risk of Bias Studies....47
2.3.10 Availability....48
2.3.11 Accessibility....49
2.3.12 Affordability....50
2.3.13 Acceptability....51
2.3.14 Accommodation....52

2.3.15 Cross-Domain Patterns by Population Type....53
2.3.16 Cross-Domain Interactions of Barriers....53
2.4 Discussion....55
2.4.1 Summary of Evidence....55
2.4.2 Interpretation of Findings....55
2.4.3 Facilitators and Emerging Solutions....63
2.4.4 Comparison with High-Income Settings....67
2.4.5 Strengths and Limitations....69

Chapter 3: ENT Provider Perspectives on Access to Hearing Loss Surgery in Nigeria: A Cross-Sectional Survey Study....72
3.1 Aims, Objectives and Research Questions....72
3.2 Methods....72
3.2.1 Data collection....72
3.2.2 Sample characteristics....73
3.2.3 Survey administration....73
3.2.4 Ethical considerations....73
3.2.5 Statistical analysis....74
3.3 Results....74
3.3.1 Respondent characteristics....74
3.3.2 Descriptive results....75
3.3.3 Availability of Hearing Loss-Related Services....76
3.3.4 Workforce and Referral Systems....76
3.3.5 Perceived Barriers to Accessing Surgical Hearing Loss Care....80
3.3.6 Proposed Interventions to Improve Access....84
3.4 Discussion....87
3.4.1 Summary of Findings....87
3.4.2 Interpretations....87
3.4.3 Limitations....92
4.1 Summary....93
4.2 Contribution to the Field....95
4.3 Future work....96

Chapter 5: References....98

Chapter 6: Appendices....104

Supervisors

Professor Kokila Lakhoo

Professor Ashok Handa

Foreword

For most people, hearing is an invisible part of everyday life. Only when hearing is lost does its importance often become apparent. We need our hearing from infancy for language and speech development, and then subsequently to engage with most education systems, employment, music and the world around us. Across the world, millions of people live with hearing impairment, and many have no access to the care needed to restore it. Throughout my time working in Otolaryngology, I have witnessed the profound impact hearing loss can have on patients and their families. I saw patients distressed by the loss of their hearing and the effect it had on their daily lives. I have, however, also had the privilege of being involved with hearing restoration, assisting in children receiving grommets, mastoidectomies and cochlear implants (CI), and observing the remarkable difference these surgical interventions made. These experiences prompted reflection on the inequities that exist in access to healthcare around the world. If hearing loss can cause such distress for individuals living in well-resourced healthcare systems, what must the experience be for those living in resource-constrained settings?

Acknowledgements

I would like to express my gratitude to my supervisors, Professor Kokila Lakhoo and Professor Ashok Handa, for the opportunity to be part of their wonderful research group. I am grateful for their guidance, support and continuous encouragement throughout this project. Without their support, this work would not have been possible.

I would also like to thank Dr. Dennis Mazingi for his ongoing support, advice and invaluable feedback that has helped structure this project from the start. I am grateful for the wider Global Surgery research group, whose encouragement, support and enthusiasm have made this year successful.

To my collaborator and dear friend, Viktorija Kaminskaite, thank you for refusing to let me underestimate myself. Had it not been for your relentless encouragement and belief in me, I may never have embarked on this journey. To Viktorija and Sean Daniel for their time, patience and contributions to the successful completion of the systematic review. I would like to thank Hannah McGivern, the Bodleian Outreach Librarian who generously offered her expertise, helping me design a thorough search strategy for the review. To Professor Kufre Iseh, thank you for your willingness, support and commitment to the successful design and distribution of the survey component of this thesis.

Finally, I would like to thank my family and friends. To my parents, thank you for your prayers, encouragement and unending love and support. You sacrificed so much, moved to a foreign country to provide my siblings and me with a brighter future. I will forever be grateful and in awe of your resilience and determination.
To my siblings, thank you for your love and encouragement, particularly during the hard times. To my friends, thank you for continuously inspiring me to keep pushing, for looking after me, and for ensuring that I was never without a reason to smile.

And finally, to my biggest supporter and best friend, Adam, thank you for your endless love, patience, understanding, and encouragement. Thank you for being a constant source of happiness and strength even from 10,000 miles away.

Abstract

Hearing loss is a major cause of disability globally and disproportionately affects populations in Africa. Surgery plays an important role in preventing, treating and restoring hearing, yet there are significant challenges in accessing surgical hearing care in many African settings. Although it has been recognised as a public health priority, barriers and facilitators influencing access to hearing loss surgery have not been comprehensively explored nor has the evidence been systematically synthesised. This thesis investigates barriers and facilitators that affect access to surgery for hearing loss in Africa through a systematic review and survey of Ear, Nose and Throat (ENT) care providers in Nigeria.

The systematic review evaluates existing literature on barriers and facilitators to surgical hearing care access in Africa, mapping these factors to an access framework. Seventeen studies were eligible for inclusion. Barriers related to workforce capacity, infrastructure and surgical equipment availability were the most frequently reported. Financial burden, rural-urban disparities and delays in surgical pathway were also common. Facilitators were less frequently described and were primarily focused on workforce strengthening and service expansion.

The survey of ENT care providers yielded 71 respondents. Financial barriers were perceived as major challenges to accessing surgery for hearing loss in Nigeria. Like the systematic review, respondents proposed service availability interventions, including improving specialist training, equipment provision and workforce development as priority interventions to improve access in this context.

Access to surgical care for hearing loss in Africa is influenced by challenges that interconnect. Addressing these barriers requires a multifaceted approach to achieve equitable access. Future research should evaluate the efficacy of these interventions and explore differences in access pathways across populations and settings.

List of Figures and Tables

Figure 1: PRISMA diagram. A PRISMA flowchart demonstrating the search strategy and screening process. 30
Figure 2: Overall risk of bias results....37
Figure 3: Geographical distribution of countries represented in the included studies....42
Figure 4: Annual publication trend of included studies....43
Figure 5: Number of studies reporting barriers and facilitators to surgical care for hearing loss across access domains....44
Figure 6: Distribution of reported barriers to surgical care for hearing loss across access domains and components....45
Figure 7: Distribution of reported facilitators to surgical care for hearing loss across access domains and components....46
Figure 8: Heatmap illustrating number of studies reporting each access domain by population type....53
Figure 9: Heatmap illustrating the co-occurrence of barriers to access across the five domains. 54
Figure 10: Available hearing loss-related services at respondents' facilities....76
Figure 11: Perceived workforce capacity ratings relative to patient need....77
Figure 12: Multidisciplinary providers involved in ear and hearing-loss care at respondents' facilities....78
Figure 13: Proportion of respondents reporting support from visiting ENT or otology specialists....79
Figure 14: Typical referral pathways for patients requiring surgical care for hearing loss....80
Figure 15: Perceived workforce barriers limiting access to surgical care for hearing loss 81

Figure 16: Perceived barriers to accessing surgical care for hearing loss among ENT providers in Nigeria 82
Figure 17: Perceived priority changes to improve access to surgical care for hearing loss 85

Table 1: Summary of inclusion and exclusion criteria 18
Table 2: The search strategy 20
Table 3: Data collection categories....22
Table 4: The Joanna Briggs Institute Checklists....25
Table 5: Master table of included studies with overview of key components....31
Table 6: JBI RoB assessment for cross-sectional studies 36
Table 7: JBI RoB assessment for case series....36
Table 8: JBI RoB assessment for cohort studies....37
Table 9: JBI RoB assessment for quasi-experimental studies 37
Table 10: Summary of study characteristics of included studies (n = 17)....38
Table 11: Sensitivity analysis of reported access domains following exclusion of high risk of bias studies....48
Table 12: Characteristics of study participants....75
Table 13: Themes, percentages and illustrative quotes from additional barriers perceived by ENT providers through free-text responses (n = 37) 83
Table 14: Themes, percentages and illustrative quotes from additional changes proposed by ENT providers through free-text responses (n =55) 86

List of Abbreviations

BAHA – Bone-anchored hearing aid

CHE - Catastrophic health expenditure

CI – Cochlear implant

CSOM – Chronic suppurative otitis media

EHC – Ear and Hearing Care

ENT – Ear, Nose and Throat

GBD – Global Burden of Disease

HICs – High income countries

JBI – Joanna Briggs Institute

LMICs – Low- and middle-income countries

NGOs – Non-governmental organisations

OOP - Out-of-pocket

ORLSON – Otorhinolaryngological Society of Nigeria

OxTREC - Oxford Tropical Research Ethics Committee

RoB – Risk of Bias

SALT – Speech and Language Therapist

SD – Sean Daniel

SJ – Syntyche Jonah

UNHS - Universal newborn hearing screening

VK – Viktorija Kaminskaite

WHO – World Health Organisation

YLDs – Years lived with disability

Chapter 1: Introduction

1.1 Global Burden of Hearing Loss

Hearing loss is a common and disabling condition that poses a significant global health challenge. The World Health Organization (WHO) has reported that over 1.5 billion people worldwide live with some degree of hearing loss, with approximately 430 million requiring some form of treatment. This number is predicted to rise to nearly 700 million by 2050[1].

The burden is disproportionately concentrated in low- and middle-income countries (LMICs), where access to timely diagnosis and treatment remains limited[2]. In the WHO African Region, approximately 40 million people currently live with hearing loss (~3.6% prevalence), with projections estimating an increase to 54 million by 2030 if no interventions are implemented[3].The increasing global prevalence is said to be driven by factors including an ageing population, environmental and occupational noise, and increasing presence of preventable ear disease particularly in LMICs[1].

If left untreated, hearing impairment has varying consequences. In children, it can negatively affect language development, education and psychosocial development, while in adults, it has been associated with social isolation, decreased employability and mental health issues[2,4]. It has been identified as the third largest cause of disability in the global burden of disease (GBD), often linked to ageing or preventable causes, and contributes to years lived with disability (YLDs) worldwide[2]. Loss of hearing does not only affect health systems but also the economy. It is estimated that untreated hearing loss results in global costs of approximately $980 billion yearly, but potential reduction by $49 billion is possible with a 5% decrease in prevalence[5].

Despite the recognition of hearing loss as a major public health challenge, ear and hearing care (EHC) remains neglected within global health systems and access to management remains unequal globally.

1.2 Surgical Management of Hearing Loss

Although hearing loss can be managed conservatively and medically with the use of assistive devices, medication and lifestyle adaptations, surgery plays an essential role in the treatment of some common aetiologies. Chronic suppurative otitis media (CSOM), a major cause of preventable hearing loss in many LMICs is often managed surgically through procedures like tympanoplasty and mastoidectomy[6]. This can be for definitive management, prevention of disease progression and complications, and to restore hearing. Surgery is mostly indicated for conductive hearing loss, with procedures like implantation of bone-anchored hearing aids (BAHA) done to bypass damaged outer and middle ear structures and amplify sound into the inner ear[7]. BAHAs can provide effective hearing rehabilitation for patients with conductive or mixed hearing loss. Compared with conventional air-conduction hearing aids, reported benefits include improved sound quality and comfort, while avoiding occlusion of the external auditory canal may be advantageous in patients with recurrent ear infections or chronic ear discharge.[7]. Surgery is also utilised for other causes of hearing loss, including cholesteatoma, otosclerosis, traumatic ear injury and congenital abnormalities[8]. Cochlear implantation is a surgical procedure done for individuals with severe to profound sensorineural hearing loss, and it has been shown to significantly improve speech development, social communication and quality of life for its users, especially if done early[9]. Effective surgical management of hearing loss provides benefits beyond sensory restoration. It can contribute to social wellbeing by improving academic opportunities, employment potential and enhanced economic wellbeing[10].

1.3 Ear and Hearing Care Systems in Africa

The absence of a universal newborn hearing screening programme can contribute to delayed diagnosis and treatment of hearing loss which is unsurprising given only 38% of the

population worldwide have access to newborn hearing screening[1]. EHC services are underprioritised in national health systems, often competing with communicable and non-communicable diseases for resources that are already often scarce[1]. Workforce shortages have been reported, with many African countries having insufficient numbers of trained otolaryngologists, audiologists, speech and language therapists (SALT)[1,11]. It has been reported that approximately 56% of the African countries have fewer than one ENT specialist per one million of the population, this is in comparison to the European region where there are about 50 specialists per one million of the population[1]. These shortages are often worsened by inequities in geographical distribution of services, with a higher concentration of personnel within urban and tertiary hospitals, leaving rural populations underserved[1]. Additionally, a lack of training and career developing opportunities may contribute to this disparity with migration of personnel to developed countries that offer better opportunities and remuneration for surgical training[11,12].

Many facilities across Africa lack the equipment and infrastructure for delivery of comprehensive EHC services, with most countries within the African region reporting equipment availability as a challenge or recommendation for future development[3]. Essential otology diagnostic and surgical equipment like microscopes, drills and radiological imaging are largely unavailable in most countries and availability of cochlear implantation programmes are limited across sub-Saharan Africa[11].

This is all likely to be compounded by a lack of dedicated financing for EHC within national health service budgets[3]. A lack of public funding may result in increased out-of-pocket (OOP) costs and catastrophic health expenditures (CHE) for patients and families. This is particularly important in surgical care for example, in cochlear implantation where costs may extend beyond the operation and device to include device maintenance and rehabilitation[13]. This may prevent access to services even where they are technically available.

1.4 Access to Surgical Care in Global Surgery

Access to safe surgical care has been recognised as a key priority in global health, with The Lancet Commission on Global Surgery estimating that five billion people lack access to safe, timely, and affordable surgical services[14]. Improving surgical access has therefore become an essential part of universal health coverage and health system development[14].

The concept of access extends beyond just availability of a service to the population. It reflects how the health system fits around the needs of the population it serves, and this is said to be influenced by a range of structural, geographical, financial and sociocultural factors[15]. Penchansky and Thomas conceptualised healthcare access across five dimensions: availability, accessibility, affordability, acceptability, and accommodation, providing a framework for understanding how barriers operate across the healthcare pathway[15].

Availability refers to adequacy of resources centred around workforce, infrastructure and equipment. Accessibility is the relationship between geographical location of patients and the service, including distance to the service and mode of transportation. Affordability relates to financial costs associated with reaching and using the service. Acceptability covers sociocultural factors that influence health-seeking behaviour. Accommodation relates to the organisation of the service and how it aligns with the service users' needs, for example referral pathways, waiting times and administrative systems. The framework is particularly relevant to surgical care, where barriers are likely to arise at multiple points across the patient journey. These access dimensions provide a way to better understand the complex factors that influence access to surgical care.

1.5 Evidence gaps

While existing literature highlights barriers to EHC in LMICs and individual African settings, there has been limited synthesis of how barriers or facilitators to surgical hearing care are distributed across the different dimensions of access and across the African continent.

Applying a structured access framework may therefore provide important insights into which factors are the most bothersome and help identify priorities for policy development and future research.

Much of the available evidence has focused on barriers, with comparatively little evidence for interventions that may improve access. Consequently, there is limited understanding of how the facilitators address the different dimensions of access and where efforts for future development should be focused.

Furthermore, perspectives across care providers remain underexplored, with existing literature frequently focusing on health-system capacity and patient experiences. There is also limited evaluation of how barriers to access for hearing loss surgery are perceived differently between providers and service users. Shortage of contemporary evidence from African ENT providers involved in hearing loss care creates a gap in understanding challenges and potential solutions within these settings. Exploring these perspectives will be essential for successful implementation of change that benefits the health system and the population.

Finally, previous assessments of surgical capacity in Nigeria have highlighted important workforce and infrastructure limitations but have also noted that a more detailed understanding of the factors affecting access to surgical care is required to adequately address population needs. Henry *et al.,* also argued that assessments of surgical capacity should be complemented by analyses of barriers influencing access to care[16].

1.6 Project Outline:

To address the gaps in this field and build on already suggested recommendations, this thesis adopts a two-stage approach. First, a systematic review to synthesise the available evidence on barriers and facilitators to accessing surgical care for hearing loss across Africa, using the Penchansky and Thomas' framework for healthcare access. Second, a cross-sectional survey

of ENT care providers in Nigeria exploring perspectives on barriers and priorities for improving access to hearing loss surgery within Africa's most populous country.

Chapter 2: A Systematic Review Exploring Barriers and Facilitators to Accessing Surgical Care for Hearing Loss in Africa.

2.1 Aims and Research Questions:

The aim of this review is to synthesise the evidence on the factors influencing access to surgical care for hearing loss in Africa, mapping them to Penchansky and Thomas' (1981) dimensions of healthcare access.

The objectives are:

- To describe the current landscape of surgical hearing care provision in Africa that is reported in literature.
- To identify and synthesise barriers and facilitators influencing access to surgical care for hearing loss in Africa.
- To map the barriers and facilitators identified to the five dimensions of access proposed by Penchansky and Thomas (1981).
- To assess the quality of available evidence and identify priorities for policy, practice and future research.

The research questions this review aims to answer:

1. How is surgical hearing care currently provided in Africa, and what aspects of workforce capacity and service availability may influence access to care?
2. What financial factors influence access to surgical care for hearing loss in Africa?
3. How do distance, travel burden, transportation and geographical distribution of ENT services affect access to surgical care for hearing loss in African settings?

4. What sociocultural factors act as barriers or facilitators to surgical care for hearing loss in Africa?
5. What organisational or service delivery factors impact access to surgical care for hearing loss in Africa?

2.2 Methods

This systematic review was written in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 checklist[17]. The protocol was registered on the PROSPERO database (ID: CRD420251172587). Given there were no human participants or identifiable data in the review, ethical approval from an Institutional Review Board was not required.

2.2.1 Eligibility Criteria

Included studies involved participants of any age with any type of hearing loss, irrespective of aetiology or severity. This inclusive approach was adopted to capture the full range of surgical indications relevant to hearing impairment across the life course. Studies were required to include surgical care or surgical treatment for hearing loss. This included any literature addressing surgical management, service delivery, or access to surgical interventions for hearing impairment. Studies were included if they described or evaluated any aspect of access to surgical care for hearing loss in line with the access dimensions defined by Penchansky and Thomas (1981), even where access was not an explicit study objective.

Only studies conducted in African countries were included. The geographical scope was defined using the African country filters outlined by the University of Alberta Library[18].

A broad range of empirical study designs was included to capture diverse perspectives on access to surgical care. Eligible designs comprised of peer-reviewed primary data and

relevant grey literature, including reports from Ministries of Health, WHO regional offices, and non-governmental organisations (NGOs). The search was restricted to studies published in the English language between January 2000 and November 2025. Studies published prior to the year 2000 were excluded to ensure that included evidence reflected contemporary surgical practices and health system contexts in African settings. Full details of inclusion and exclusion criteria are outlined in *Table 1*.

Table 1: Summary of inclusion and exclusion criteria

Inclusion Criteria	**Exclusion Criteria**
All ages with any type of hearing loss.	Populations without hearing loss-related indications or mixed ENT surgical cohorts where hearing-related cases are not separable.
Studies discussing ear surgery or surgical treatment for hearing impairment.	Non-surgical intervention for hearing loss.
Reports on availability, accessibility, acceptability, accommodation or affordability of ear surgery/surgical care for hearing impairment.	Reports on access to other surgical care not including ear surgery.
Studies from Africa only	Non-African countries or Global reviews and datasets without Africa-specific data.
Literature published between years 2000-2025.	Studies published before the year 2000.
Retrospective and prospective cohort studies, qualitative studies, case-control studies and case series, mixed method studies, observational studies, and relevant grey literature (reports from Ministries of Health, WHO regional offices, NGOs).	Editorials, commentaries, opinion pieces, letters to the editor, study protocols, conference abstracts, case reports, theses/dissertations. Animal studies, cadaveric studies and laboratory studies
Literature published in English	Non-English literature

2.2.2 Information Sources

A search across four databases was conducted. Three of the databases were on the Ovid search engine: EMBASE, MEDLINE, and Global Health. A systematic search was conducted across these databases and the Web of Science database. A grey literature search was performed using the World Health Organisation Institutional Repository for Information Sharing (WHO IRIS), Google Advanced Search function and Global Index Medicus. Forward and backward citation searching were conducted on 18th January 2026 on included studies after screening was completed using the online tool "Citation Chaser[19]."

2.2.3 Search Strategy

The search strategy was designed with the help of a Bodleian Libraries outreach librarian, an expert on literature searching across different medical and surgical specialities. Search terms used were relevant to the categories: hearing loss, ear surgery, access and Africa. The search terms were adapted for the different databases using specified filters (See *Table 2*). The initial search was conducted from the year 2000 up to the start date of the review on 11th November 2025.

Table 2: The search strategy

Database	#	Searches	Results
EMBASE	1	exp Hearing Loss/	155980
	2	((hear* adj3 (loss or impair* or device* or implant*)) or deaf*).ti,ab,kf.	156617
	3	1 or 2	212382
	4	exp Otologic Surgical Procedures/	38044
	5	((surg* adj2 (ear or otolog* or stape*)) or "cochlear implant*" or "bone anchored hearing aid" or grommet* or myringo* or tymp* or "eardrum" or stapedectom* or ossic* or canal* or "eustachian" or mastoidectom*).ti,ab,kf.	205628
	6	4 or 5	216952
	7	exp Africa/	476516
	8	(Africa* or Algeria or Angola or Benin or Botswana or "Burkina Faso" or Burundi or "Cabo Verde" or "Cape Verde" or Cameroon or Central African Republic or Chad or Comoros or Congo or "Cote d'Ivoire" or "Ivory Coast" or Djibouti or Egypt or "Equatorial Guinea" or Eritrea or Eswatini or Ethiopia or Gabon or Gambia or Ghana or Guinea or "Guinea-Bissau" or Kenya or Lesotho or Liberia or Libya or Madagascar or Malawi or Mali or Mauritania or Mauritius or Morocco or Mozambique or Namibia or Niger or Nigeria or "Nile Valley" or Rwanda or "Sao Tome" or Principe or Senegal or Seychelles or "Sierra Leone" or Somalia or "South Africa" or "Sub Saharan" or Sudan or Tanzania or Togo or Tunisia or Uganda or Zambia or Zimbabwe).mp.	1002026
	9	7 or 8	1002628
	10	3 and 6 and 9	976
	11	limit 10 to (english and yr="2000 - Current")	760
MEDLINE	1	exp Hearing Loss/	83747
	2	((hear* adj3 (loss or impair* or device* or implant*)) or deaf*).ti,ab,kf.	125887
	3	1 or 2	147655
	4	exp Otologic Surgical Procedures/	27539
	5	((surg* adj2 (ear or otolog* or stape*)) or "cochlear implant*" or "bone anchored hearing aid" or grommet* or myringo* or tymp* or "eardrum" or stapedectom* or ossic* or canal* or "eustachian" or mastoidectom*).ti,ab,kf.	178583
	6	4 or 5	183655
	7	exp Africa/	361855
	8	(Africa* or Algeria or Angola or Benin or Botswana or "Burkina Faso" or Burundi or "Cabo Verde" or "Cape Verde" or Cameroon or Central African Republic or Chad or Comoros or Congo or "Cote d'Ivoire" or "Ivory Coast" or Djibouti or Egypt or "Equatorial Guinea" or Eritrea	873025

		or Eswatini or Ethiopia or Gabon or Gambia or Ghana or Guinea or "Guinea-Bissau" or Kenya or Lesotho or Liberia or Libya or Madagascar or Malawi or Mali or Mauritania or Mauritius or Morocco or Mozambique or Namibia or Niger or Nigeria or "Nile Valley" or Rwanda or "Sao Tome" or Principe or Senegal or Seychelles or "Sierra Leone" or Somalia or "South Africa" or "Sub Saharan" or Sudan or Tanzania or Togo or Tunisia or Uganda or Zambia or Zimbabwe).mp.	
	9	7 or 8	873025
	10	3 and 6 and 9	793
	11	limit 10 to (english and yr="2000 - Current")	606
Global Health	1	exp hearing/	5985
	2	((hear* adj3 (loss or impair* or device* or implant*)) or deaf*).ti,ab.	10701
	3	hearing loss.mp.	6255
	4	1 or 2 or 3	12458
	5	ear surgery.mp.	123
	6	((surg* adj2 (ear or otolog* or stape*)) or "cochlear implant*" or "bone anchored hearing aid*" or grommet* or myringo* or tymp* or "eardrum" or stapedectom* or ossic* or canal* or "eustachian" or mastoidectom*).ti,ab.	16151
	7	5 or 6	16151
	8	exp Africa/	567386
	9	(Africa* or Algeria or Angola or Benin or Botswana or "Burkina Faso" or Burundi or "Cabo Verde" or "Cape Verde" or Cameroon or "Central African Republic" or Chad or Comoros or Congo or "Cote d'Ivoire" or "Ivory Coast" or Djibouti or Egypt or "Equatorial Guinea" or Eritrea or Eswatini or Ethiopia or Gabon or Gambia or Ghana or Guinea or "Guinea-Bissau" or Kenya or Lesotho or Liberia or Libya or Madagascar or Malawi or Mali or Mauritania or Mauritius or Morocco or Mozambique or Namibia or Niger or Nigeria or "Nile Valley" or Rwanda or "Sao Tome" or Principe or Senegal or Seychelles or "Sierra Leone" or Somalia or "South Africa" or "Sub Saharan" or Sudan or Tanzania or Togo or Tunisia or Uganda or Zambia or Zimbabwe).ti,ab.	598288
	10	8 or 9	671962
	11	4 and 7 and 10	165
	12	limit 11 to (english language and yr="2000 - Current")	149

2.2.4 Selection Process

Records were downloaded and exported into Covidence for screening. Auto-marked duplicate records were removed by the automation tool in Covidence and other duplicates

manually marked throughout the screening process[20]. Title and abstract and full-text screening were conducted by two independent reviewers (SJ and VK) against the eligibility criteria. Any discrepancies were resolved by a third reviewer (SD). A screening guide was designed for the selection of included studies and used for the literature selection process. The full screening guide is provided in *Appendix 1.*

Papers identified from citation searching were also uploaded into Covidence and any additional references identified underwent auto-marked duplication, title and abstract and full-text screening by the same two independent reviewers (SJ and VK) using the same screening tool and guide.

2.2.5 Data Collection Process

Data from each report for this systematic review were independently extracted by two reviewers (SJ and VK). Conflicts were discussed and resolved with a third reviewer (SD). Microsoft Excel was used to record 77 variables in 10 categories: publication details, study characteristics, population characteristics, surgical care context, access dimensions and facilitators *(Table 3).* The extraction table was designed in conjunction with supervisors, piloted and improved. The complete data extraction table is provided in *Appendix 2*.

Table 3: Data collection categories

Publication details	Title Author Year of publication Journal/Source Country
Study characteristics	Aim(s) Study period (months) Design Target group

	Sample size (n) Access dimensions identified
Population characteristics	Sex Age (mean or median) Type of hearing loss/impairment Aetiology of hearing loss/impairment
Surgical care context	Type of surgery Level of surgical care (tertiary, district, community, multi-centre) Type of facility (public, private, NGO, mixed) Setting (urban, rural, mixed)
Barriers to access dimensions (mapped under 5As of access)	
Availability	Workforce shortages Type of shortage Delays caused by staff shortages Description of delays Workforce training issues Task sharing/shifting Workforce density Provider-to-population ratio Surgical/theatre session availability Surgical equipment availability Verbatim excerpts
Accessibility	Travel burden Travel measure type (time in hours, distance in km, modelled 2-hour access, self-reported delay) Travel metrics Distance/time values Transport availability Care pathway structure (single or multi-centre visits) Geographical location described as barrier Verbatim excerpts
Affordability	Cost as barrier Cost type

	Indirect costs Cost value (USD) Cost relative to income (USD) Perceived affordability Catastrophic expenditure Impoverishing expenditure Government funding (%) Health coverage (%) Out-of-pocket expenditure (%) Charity funding (%) Coping strategies Household income information Verbatim excerpts
Acceptability	Cultural beliefs Acceptability measures Stigma around surgery Fear of surgery Use of alternative methods/traditional healers Types of alternative treatments Attitudes toward ear surgery Understanding of procedures Counselling/education interventions Verbatim excerpts
Accommodation	Organisation/service delivery barriers Age at diagnosis Diagnostic delay Complications at presentation Time to surgery (months) Age at surgery (mean or median) Total pathway time (months) Timeline issues Surgery cancellations/postponements Reasons for system delays

	Verbatim excerpts
Facilitators	Presence of facilitators Facilitator domains Verbatim excerpts

2.2.6 Study Risk of Bias Assessment

All literature included in the review were assessed for risk of bias (RoB) using assessment tools appropriate for each study design. The RoB was conducted by two reviewers (SJ & SD) working independently, with any conflicts being resolved by a third reviewer (VK). The Joanna Briggs Institute (JBI) critical appraisal checklists appropriate to each study design was used to assess RoB[21]. Separate JBI tools were applied for cross-sectional studies, cohort studies, case series, and quasi-experimental studies as applicable and described in *Table 4*. Although JBI does not recommend calculating an overall score, for consistency and transparency across included studies, we applied a structured categorisation approach whereby studies meeting ≥70% of applicable criteria were classified as low risk of bias, 50 - 69% as moderate risk, and <50% as high risk. Items marked "Not applicable" on the assessment questions were excluded from the denominator when calculating percentages.

Table 4: The Joanna Briggs Institute Checklists

Joanna Briggs Institute (JBI) Checklist for Analytical Cross Sectional Studies	
1	Were the criteria for inclusion in the sample clearly defined?
2	Were the study subjects and the setting described in detail?
3	Was the exposure measured in a valid and reliable way?
4	Were objective, standard criteria used for measurement of the condition?
5	Were confounding factors identified?
6	Were strategies to deal with confounding factors stated?

7	Were the outcomes measured in a valid and reliable way?
8	Was appropriate statistical analysis used?
Joanna Briggs Institute (JBI) Checklist for Case Series	
1	Were there clear criteria for inclusion in the case series?
2	Was the condition measured in a standard, reliable way for all participants included in the case series?
3	Were valid methods used for identification of the condition for all participants included in the case series?
4	Did the case series have consecutive inclusion of participants?
5	Did the case series have complete inclusion of participants?
6	Was there clear reporting of the demographics of the participants in the study?
7	Was there clear reporting of clinical information of the participants?
8	Were the outcomes or follow up results of cases clearly reported?
9	Was there clear reporting of the presenting site(s)/clinic(s) demographic information?
10	Was statistical analysis appropriate?
Joanna Briggs Institute (JBI) Checklist for Cohort Studies	
1	Were the two groups similar and recruited from the same population?
2	Were the exposures measured similarly to assign people to both exposed and unexposed groups?
3	Was the exposure measured in a valid and reliable way?
4	Were confounding factors identified?
5	Were strategies to deal with confounding factors stated?
6	Were the groups/participants free of the outcome at the start of the study (or at the moment of exposure)?

7	Were the outcomes measured in a valid and reliable way?
8	Was the follow up time reported and sufficient to be long enough for outcomes to occur?
9	Was follow up complete, and if not, were the reasons to loss to follow up described and explored?
10	Were strategies to address incomplete follow up utilized?
11	Was appropriate statistical analysis used?
Joanna Briggs Institute (JBI) Checklist for Quasi-Experimental Studies	
1	Is it clear in the study what is the "cause" and what is the "effect" (i.e. there is no confusion about which variable comes first)?
2	Was there a control group?
3	Were participants included in any comparisons similar?
4	Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?
5	Were there multiple measurements of the outcome, both pre and post the intervention/exposure?
6	Were the outcomes of participants included in any comparisons measured in the same way?
7	Were outcomes measured in a reliable way?
8	Was follow-up complete and if not, were differences between groups in terms of their follow-up adequately described and analysed?
9	Was appropriate statistical analysis used?

2.2.7 Synthesis Methods

All studies meeting the inclusion criteria were utilised in the primary synthesis. Given the heterogeneity in the study design, populations and reporting of access-related factors, studies were not grouped by intervention or outcome. Extracted variables relating to barriers and facilitators were synthesised and mapped according to the five dimensions of access described by Penchansky and Thomas (1981).

Data extracted from included studies were reviewed and standardised prior to synthesis. Missing or inconsistently reported quantitative indicators (e.g. costs, travel time, provider-to-population ratios) were extracted as reported and described where appropriate.

Data were summarised and presented in the form of structured tables, bar charts, geo-map and sunburst diagrams.

Due to methodological heterogeneity, inconsistency in reporting, and limited comparable quantitative outcome measures, statistical meta-analysis was not considered appropriate, therefore, no statistical software or meta-analytical models were used. A structured narrative synthesis using a theoretical framework was instead utilised. Within each access domain, thematic grouping was conducted to identify recurrent components and patterns across studies. Descriptive quantitative summaries of number and proportion of studies reporting each domain were generated to support the synthesis. Facilitators to access reported were analysed separately from barriers and subsequently compared to assess asymmetry in reporting.

Heterogeneity was explored descriptively by examining variation in reported access dimensions across country context and population type. Comparative analyses were conducted to assess for patterns between population type and interaction between access dimensions. These analyses were descriptive, not pre-specified as formal subgroup analyses, and no statistical tests of interaction were performed.

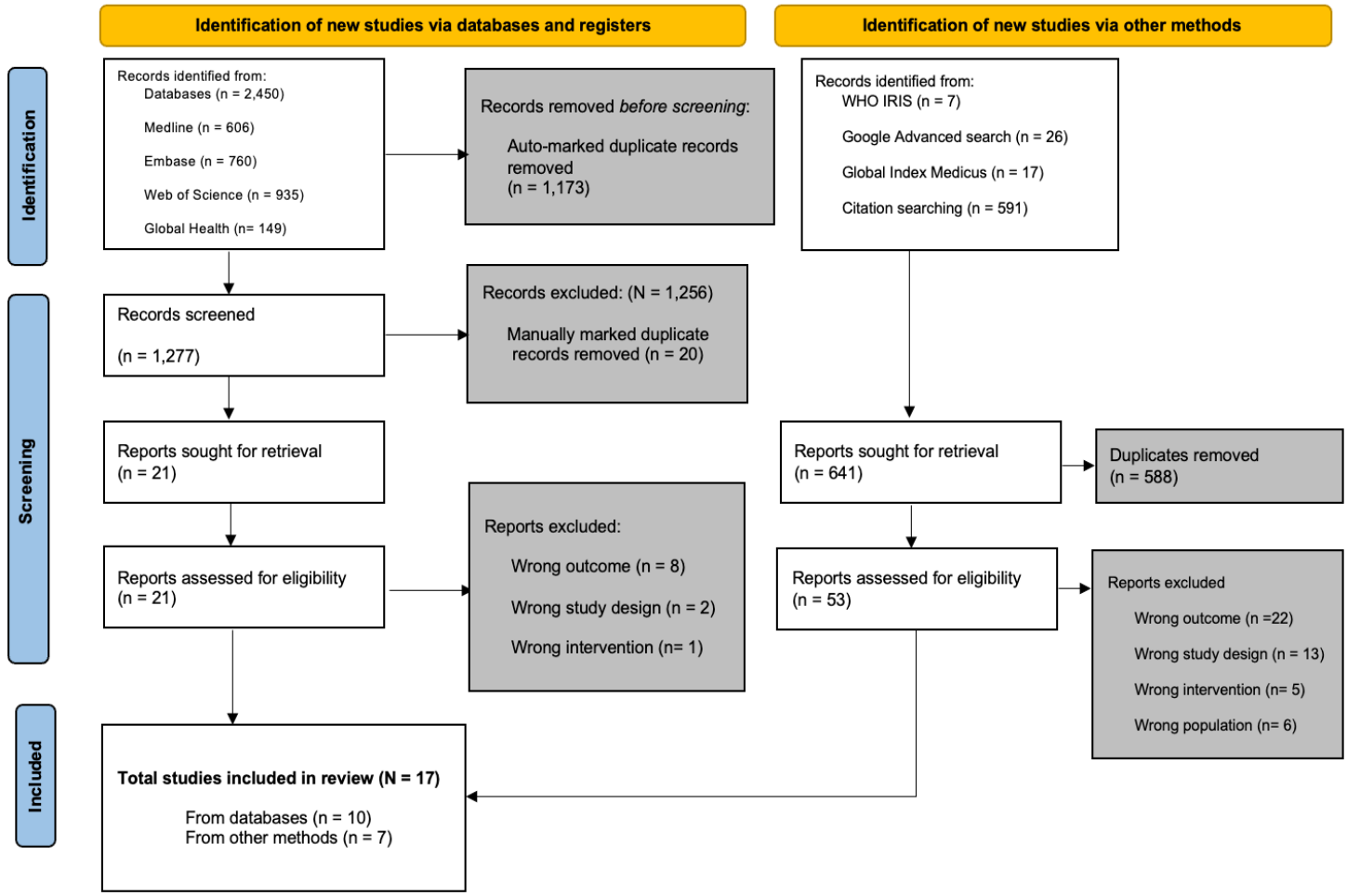
A narrative sensitivity analysis was conducted by reassessing the frequency and pattern of reported access dimensions following exclusion of studies assessed as having high risk of bias.

2.3 Results

2.3.1 Study Selection

The database search yielded 2,450 papers, of which 1,173 were auto-marked as duplicates and removed. 1,277 papers were screened for title and abstract, of which, 1,256 were excluded for not meeting the inclusion criteria as stated in the designed screening tool. 20 of the excluded studies at this stage were manually marked as duplicates. An additional 11 studies were excluded for reasons reported in *Figure 1*. 641 studies were retrieved from other sources, of which 7 were included for data analysis. A total of seventeen studies were included in the systematic review. Screening and selection process for this review is outlined in the PRISMA flowchart *(Figure 1).*

Figure 1: PRISMA diagram. A PRISMA flowchart demonstrating the search strategy and screening process.



2.3.2 Master Table

Table 5: Master table of included studies with overview of key components

Study ID: First author (year)	Country of Study	Aim of study	Study design	Population type	Sample size (n)	Level of surgical care	Facility type	Setting (Urban, rural, both)	Barriers to access dimensions identified	Facilitators to access dimensions identified
Khoza-Shangase (2025)	South Africa	To explore the views and perceptions of South African parents regarding CIs for their DHH children, with a specific focus on how financial, cultural, and informational barriers influence decision-making	Cross-sectional	Parents of DHH children	9	Unspecified	Unspecified	Both	Affordability Acceptability	
WHO AFRO (2024)	43 WHO African Region[a]	To summarize the status of EHC in the African Region and the country priorities and challenges. It is intended to serve as a starting point in strengthening EHC services in the African Region	Cross-sectional	National ear and hearing care services and workforce across WHO African Region member states	43	Mixed	Mixed	Both	Availability Affordability Acceptability Accessibility Accommodation	
Ibrahim (2023)	Egypt	To assess cochlear implant outcomes, identify predictors, and highlight decision-making factors and barriers to quality care	Cross-sectional	parents of children who received unilateral cochlear implants for bilateral severe- to-deep sensorineural hearing loss	200	Multi-centre	Mixed	Both	Affordability Acceptability Accessibility Accommodation	Acceptability
Bako (2022)	Nigeria	To examine the challenges of CI users in Jos, Nigeria	Cross-sectional	CI users, relatives, ENT personnel	41	Tertiary	Unspecified	Urban	Affordability Availability Accessibility Acceptability	
Choffor-Nchinda (2022)	Cameroon	To bring out the diagnostic attitude of hearing professionals in Cameroon towards congenital hearing impairment (CHI), assess availability of tests, neonatal screening, and create a national map of availability of treatment opportunities	Cross-sectional	Professionals in health facilities (ENT specialists, hearing care professionals, speech therapists and ENT nurses	93	Multi-centre	Mixed	Both	Availability Accessibility Accommodation	
El-Begermy (2020)	Egypt	To combat deafness by training local doctors for ear surgery to treat their local patients with low cost as possible	Prospective	ENT specialists	259	Multi-centre	Mixed	Urban		Availability Affordability

Lukama (2020)	Zambia	To investigate ENT service provision in Zambia with regard to availability of surgical procedures and supply of essential drugs	Cross-sectional	MoH-registered hospitals; Providers:clinicians/pharmacists/pharmacy technicians	109	Multi-centre	Mixed	Both	Availability Accessibility Affordability	Availability Accessibility Affordability
Bhamjee (2019)	South Africa	To determine and describe parent-perceived challenges related to the paediatric cochlear implantation process and support services received	Cross-sectional	Parents of children with CI	82	Multi-centre	Mixed	Urban	Affordability, Acceptability, Accessibility, Accommodation	
Mulwafu (2019)	Malawi	To describe Malawi's task-sharing model for hearing care and report outcomes of endoscopic myringoplasty performed by clinical officers	Prospective	Patients with tympanic membrane perforation	83	Tertiary	Public	Urban		Availability
Peer (2018)	12 African countries[b]	To determine the availability of paediatric ENT services in Africa, as well as that of paediatric surgery that would complement paediatric ENT	Cross-sectional	ENT specialists and paediatric surgeons	582	Unspecified	Mixed	Unspecified	Availability	
Mulwafu (2017)	22 SSA countries[c]	To determine the current status of ENT, audiology, and speech therapy services in sub-Saharan Africa	Cross-sectional	ENT specialists and audiologists	22	Unspecified	Unspecified	Unspecified	Availability Accessibility Affordability	Availability
Guntinas-Lichius (2014)	Ethiopia	To optimise the pre-treatment process before mobile ear surgery for CSOM	Prospective (interventional)	Patients with CSOM		Unspecified	Public	Rural		Availability Accessibility Accommodation
Byaruhanga (2013)	Uganda	To assess the effect of the frequency of visits to Uganda by North American Otolaryngologists on the surgical output (number of patients undergoing ear surgery) during foreign	Retrospective	Local Ugandan otolaryngologists performing middle ear surgery	193	Tertiary	Mixed	Urban	Availability	Availability

		surgeons' visits and by local surgeons in the absence of visiting otolaryngologists. visits and by local surgeons in the absence of a visiting Otolaryngologist								
Orji (2013)	Nigeria	To examine the extent to which health care facilities in Nigeria are equipped to address the management challenges of CSOM	Prospective	ENT specialists	17	Multi-centre	Public	Unspecified	Availability Accommodation	
Adoga (2010)	Nigeria	To highlight the socioeconomic burden of chronic suppurative otitis media on a northern Nigerian population with suggestions on ways to reduce this burden	Cross-sectional	Patients presenting to ENT department	74	Tertiary	Public	Urban	Affordability Accommodation	
Fagan (2009)	18 SSA countries[d]	To establish a database of ENT, audiology, and speech therapy services in sub-Saharan Africa; create awareness about the status of these services; propose effective intervention; gather data to lobby African governments, donor countries, and aid organizations; determine need for Developing World Forum for ENT, Audiology, and Speech Therapy services	Cross-sectional	ENT specialists and audiologists	18	Multi-centre	Mixed	Both	Availability Accessibility	
Akinpelu (2007)	Nigeria	To determine the prevalence of chronic suppurative otitis media and associated complications	Cross-sectional	Patients with symptoms and signs of CSOM	160	Tertiary	Public	Urban	Availability Accessibility Affordability Acceptability Accommodation	

*a - Algeria, Benin, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Comoros, Congo, *Côte d'Ivoire, *DRC, Equatorial Guinea, Eritrea, *Eswatini, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Seychelles, Sierra Leone, South Africa, South Sudan, Uganda, Tanzania, Zambia, and Zimbabwe.*

*b - *DRC, Egypt, Ethiopia, Ghana, Kenya, Malawi, Nigeria, Rwanda, South Africa, Tanzania, Zambia, and Zimbabwe.*

*c - Burundi, Cameroon, *D.R.C., Ethiopia, Ghana, Guinea, Kenya, Lesotho, Madagascar, Malawi, Mali, Nigeria, Rwanda, South Africa, Senegal, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia, and Zimbabwe.*

*d - Botswana, *DRC, Ethiopia, Ghana, Ivory Coast, Kenya, Lesotho, Madagascar, Malawi, Namibia, Nigeria, Senegal, South Africa, Swaziland, Tanzania, Uganda, Zambia, and Zimbabwe.*

**Some country names were standardised where applicable: Democratic Republic of Congo (DRC); Ivory Coast (Côte d'Ivoire); Swaziland (Eswatini).*

CI: Cochlear implant

CSOM: Chronic Suppurative Otitis Media

DHH: Deaf and Hard of Hearing

EHC: Ear and Hearing Care

MoH: Ministry of Health

SSA: sub-Saharan Africa

WHO AFRO: World Health Organization Regional Office for Africa

2.3.3 Risk of Bias

Table 6: JBI RoB assessment for cross-sectional studies

Study ID	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	RoB
Khoza-Shangase (2025)	✓	✓	✓	N/A	✓	✗	✓	✓	Low
WHO AFRO (2024)	✓	✓	✓	✓	N/A	N/A	✓	✓	Low
Ibrahim (2023)	✓	✓	✓	✓	✓	✓	✓	✓	Low
Bako (2022)	?	✓	?	✗	N/A	N/A	✗	✓	High
Choffor-Nchinda (2022)	✓	✓	?	✓	✗	✗	?	✓	Moderate
Lukama (2020)	✓	✓	✓	✓	✗	✗	✓	✓	Low
Bhamjee (2019)	✓	✓	✓	N/A	✓	✓	✓	✓	Low
Peer (2018)	✓	✓	?	✓	N/A	N/A	✗	✓	Moderate
Mulwafu (2017)	?	✓	?	✓	N/A	N/A	✗	✓	Moderate
Orji (2013)	✓	✓	✓	✓	✗	✗	✓	✓	Low
Akinpelu (2007)	✓	✓	✓	✓	✓	✗	✓	✓	Low
Fagan (2009)	?	✓	?	✓	N/A	N/A	✗	✓	Moderate

Table 7: JBI RoB assessment for case series

Study ID	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	RoB
Adoga (2010)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Low

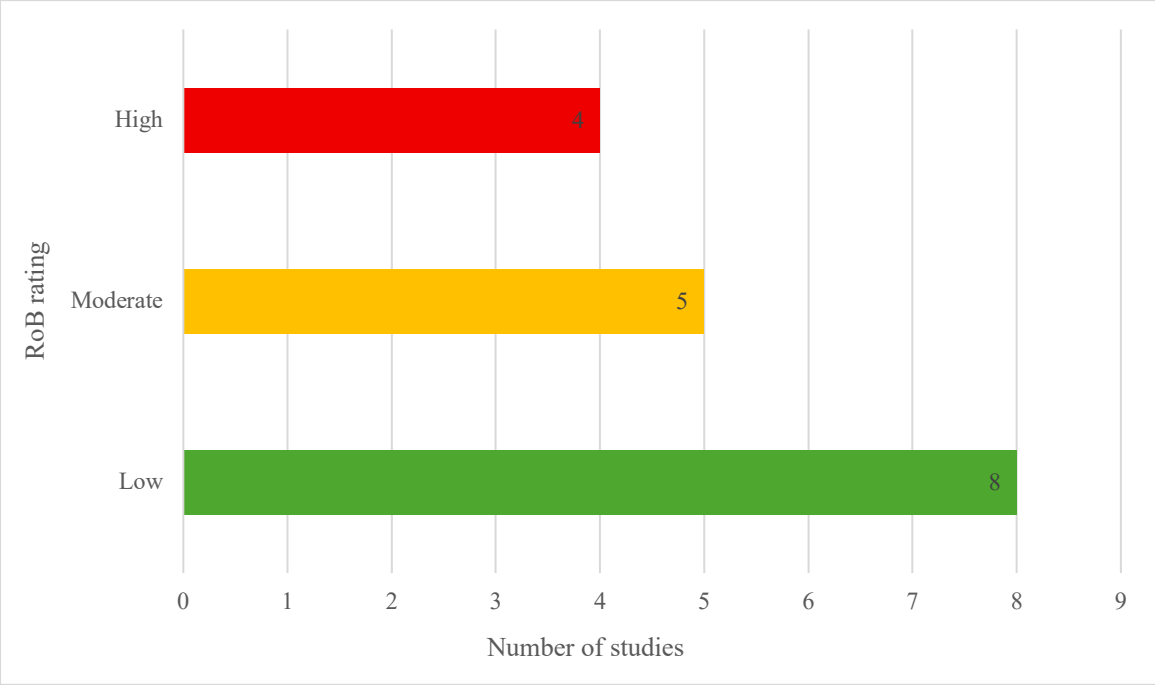
Table 8: JBI RoB assessment for cohort studies

Study ID	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	RoB
Mulwafu (2019)	✓	✓	✓	✗	✗	✓	✓	✓	?	✗	✗	Moderate
Byaruhanga (2013)	✓	✓	✓	✗	✗	N/A	✓	?	?	✗	✗	High

Table 9: JBI RoB assessment for quasi-experimental studies

Study ID	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	RoB
El-Begermy (2020)	✓	?	?	✗	✗	✗	✓	?	✗	High
Guntinas-Lichius (2014)	✓	?	?	✗	✗	?	✓	✓	✗	High

Figure 2: Overall risk of bias results



All studies were assessed for risk of bias using the JBI checklist. 47% were deemed to have low risk of bias, 29% and 24% had moderate and high risk of bias respectively.

2.3.4 Study Characteristics

Table 10: Summary of study characteristics of included studies (n = 17)

Characteristic	**n (%)**
Study design	
Cross-sectional	12 (70.6)
Prospective	4 (23.5)
Retrospective	1 (5.9)
Country representation*	
Nigeria	8
South Africa	6
Ethiopia	5
Malawi	5
Zambia	5
Democratic Republic of the Congo	4
Ghana	4
Kenya	4
Tanzania	4
Uganda	4
Zimbabwe	4
Cameroon	3
Egypt	3
Eswatini	3
Lesotho	3
Madagascar	3
Rwanda	3
Senegal	3
Burundi	2
Côte d'Ivoire	2
Guinea	2
Mali	2
Namibia	2
Algeria	1
Benin	1
Botswana	1
Burkina Faso	1
Cabo Verde	1
Central African Republic	1
Chad	1
Comoros	1

Congo	1
Equatorial Guinea	1
Eritrea	1
Gabon	1
Gambia	1
Guinea-Bissau	1
Liberia	1
Mauritania	1
Mauritius	1
Mozambique	1
Niger	1
Seychelles	1
Sierra Leone	1
South Sudan	1
Sudan	1
Togo	1
Type of hearing loss assessed	
Conductive hearing loss	4 (23.5)
Sensorineural hearing loss	3 (17.6)
Mixed hearing loss	0
Congenital hearing loss	2 (11.8)
Acquired hearing loss	1 (5.9)
Not specified	9 (52.9)
Type of surgery assessed	
Cochlear implantation	10 (58.8)
Middle ear surgery (tympanoplasty / mastoidectomy / myringoplasty)	9 (52.9)
Myringotomy/ ventilation tube / grommets	3 (17.6)
Unspecified / not reported	2 (11.8)
Level of surgical care assessed	
Multi-centre	8 (47.1)
Tertiary	5 (29.4)
Unspecified	4 (23.5)
Type of facility assessed	
Public	5 (29.4)
Private	0
Mixed (private, public, NGO)	9 (53)
Unspecified	3 (17.6)
Type of setting assessed	
Urban	7 (41.2)

Rural	1 (5.9)
Mixed (urban, peri-urban & rural)	6 (35.3)
Unspecified	3 (17.6)
Access dimensions reported	
Availability	
Shortage of ENT workforce	9 (53)
Task sharing/shifting	4 (23.5)
Problems with workforce training	5 (29.4)
Workforce density/ratio	4 (23.5)
Theatre/surgical session availability	2 (11.8)
Surgical equipment availability	7 (41.2)
Affordability	
Cost barrier	10 (58.8)
Catastrophic or impoverishing health expenditure	0
Government funding	1 (5.9)
Health insurance coverage	1 (5.9)
Out-of-pocket costs	1 (5.9)
Charity/missionary	1 (5.9)
Coping strategies to pay for care	3 (17.6)
Household income	4 (23.5)
Accessibility	
Travel burden as barrier	2 (11.8)
Geographical location as barrier	9 (52.9)
Transport availability	2 (11.8)
Care pathways (single/multi-centre visits)	4 (23.5)
Acceptability	
Cultural believes as barrier	5 (29.4)
Stigma	3 (17.6)
Fears	3 (17.6)
Alternative methods	2 (11.8)
Counselling/education around procedures	0
Accommodation	
Organisation/service delivery as barrier	7 (41.2)
Age at diagnosis of HL	1 (5.9)
Time period before diagnosis	2 (11.8)
Time from diagnosis of HL to surgery	1 (5.9)
Age at time of surgery	1 (5.9)
Complications at presentation	2 (11.8)

Delayed pathway timeline	4 (23.5)
Cancellations, rescheduling, postponements	0
Facilitators	7 (41.2)
- Values are presented as number of studies (n) and percentage of included studies (%), unless otherwise specified. *- Categories are not mutually exclusive as individual studies may contribute to more than one category, and percentages may not sum to 100%* ** Country counts reflect the frequency of representation across studies rather than the proportion of studies conducted in each country. The total, therefore, exceeds the number of included studies.*	

A total of 17 studies were included in the review. Most studies employed a cross-sectional design (n = 12, 70.6%), followed by prospective studies (n = 4, 23.5%) and a retrospective study (n = 1, 5.9%). The most frequently represented country was Nigeria (n = 8), followed by South Africa (n = 6), Ethiopia, Malawi and Zambia (n = 5 each).

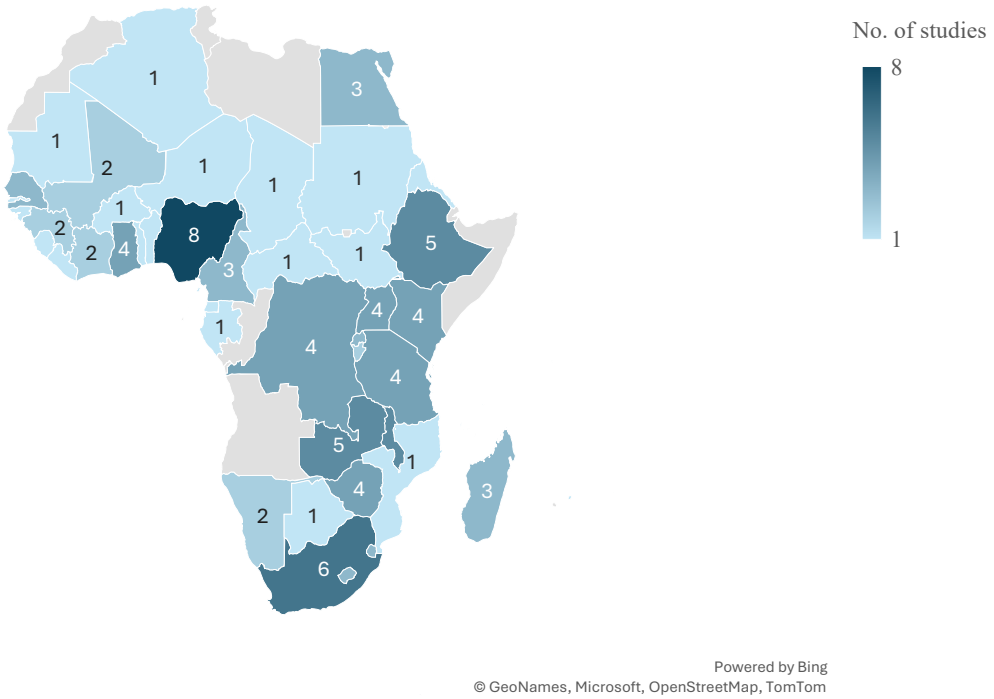
Cochlear implantation (n = 10, 58.8%) and middle ear surgery (n = 9, 52.9%) were the most common surgical interventions, while fewer studies examined procedures such as myringotomy or insertion of grommets. There was inconsistent reporting on the type of hearing loss assessed, with 52.9% of studies not specifying the type of hearing loss and instead describing severity.

Studies were most conducted in multi-centre settings (n = 8, 47.1%) or tertiary-level facilities (n = 5, 29.4%). Facility types studied were predominantly mixed public-private-NGO settings (52.9%) or public facilities (29.4%), and no studies focused exclusively on private services. Seven studies (41.2%) were conducted in urban settings alone and six (35.3%) in mixed urban-rural settings, while only one study (5.9%) was conducted in a purely rural setting.

Across the included studies, barriers were reported across all five dimensions of access. Availability constraints were most frequently reported, particularly shortages in the ENT workforce (53%), workforce training challenges (29.4%) and limited surgical equipment availability (41.2%). Cost was identified as a barrier in 58.8% of studies, while formal measures such as insurance coverage and CHE were rarely reported. Approximately half of studies identified geographical location as a barrier, whereas acceptability-related factors such as cultural beliefs and stigma were less frequently reported. Organisational barriers, including service delivery inefficiencies and delays in care pathways, were reported in 41.2% of studies. Facilitators were reported in fewer than half of the studies (41.2%).

2.3.5 Geographical Distribution

Figure 3: Geographical distribution of countries represented in the included studies



The map *(Figure 3)* illustrates the African countries where barriers or facilitators to accessing surgical care for hearing loss were reported across all included studies. The darker shades indicate higher frequency of reporting, with Nigeria (n = 8) and South Africa (n = 6) most

frequently represented. Several studies included multi-country analyses, contributing to broad geographical coverage across West, East, Central and South Africa. The representation, however, remained uneven, with many countries included in only one or two studies.

2.3.6 Cross-Country Patterns in Reported Barriers

The distribution of reported barriers varied across countries although interpretation is limited by the uneven representation of studies. Countries like Nigeria and South Africa with higher representation reported barriers across multiple domains. In contrast, multi-country and system-level studies more frequently described structural barriers, particularly those related to availability and accessibility.

Differences were also observed between single-country and multi-country studies. Single-country studies, particularly those involving patients and caregivers, were more likely to report affordability and acceptability barriers, whereas multi-country studies predominantly focused on system-level constraints.

2.3.7 Studies by Year of Publication

Figure 4: Annual publication trend of included studies

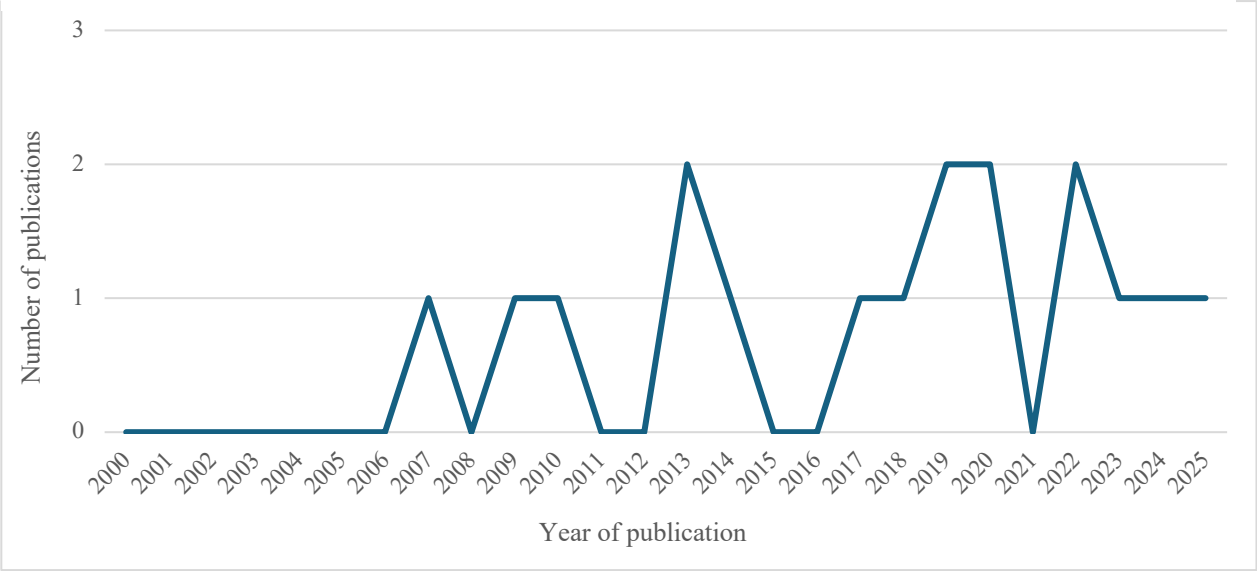
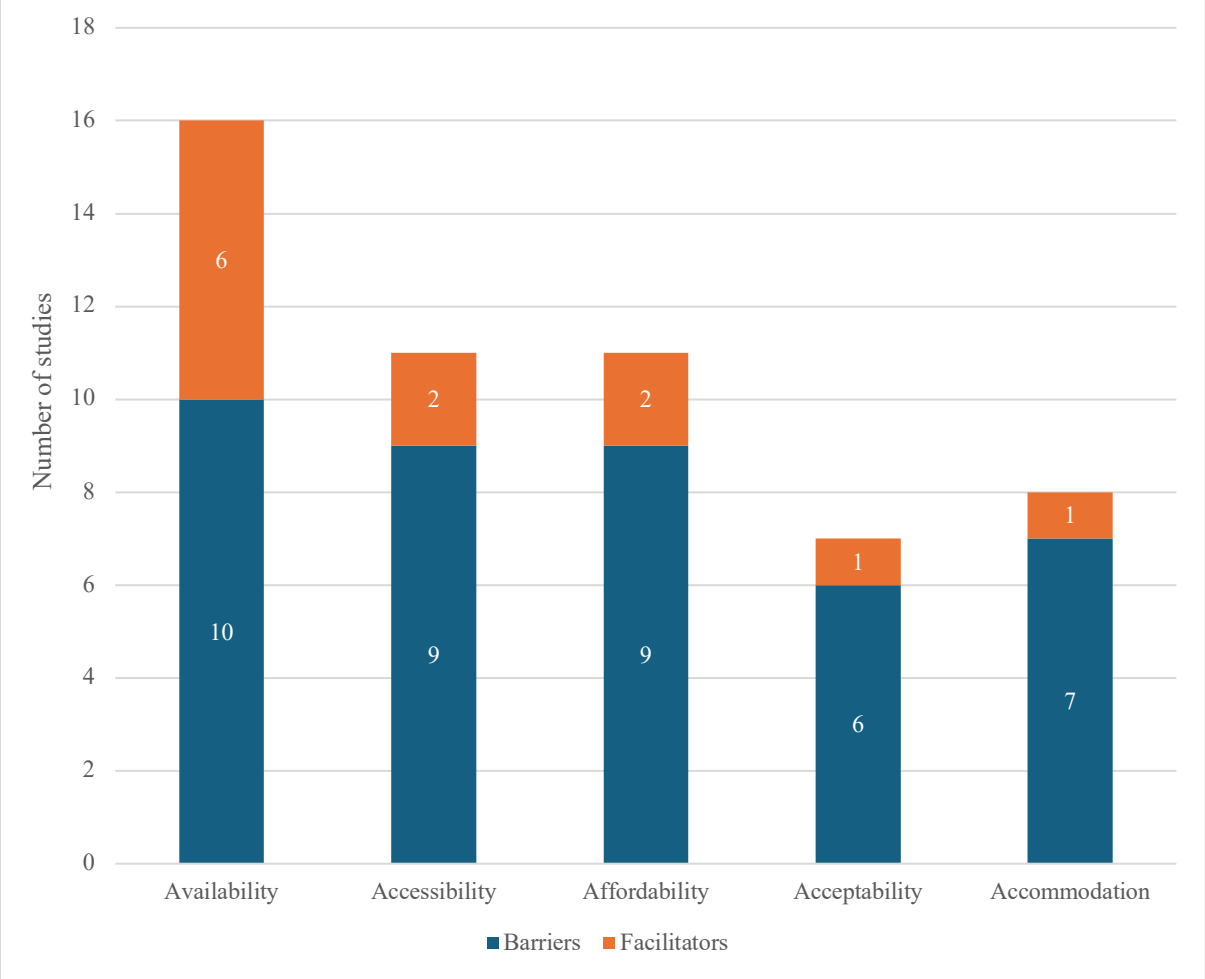


Figure 4 shows the number of studies published each year between 2000 and 2025. The distribution of studies suggests an increase in research activity over time, with relatively sparse publications prior to 2013 and more output in recent years, particularly between 2019 and 2022. The overall publication volume, however, remains limited.

2.3.8 Overview of Reported Barriers and Facilitators

Figure 5: Number of studies reporting barriers and facilitators to surgical care for hearing loss across access dimensions



Across the 17 included studies, barriers were reported across all five access dimensions with availability being the most frequently described domain (n =10, 58.8%), followed by accessibility and affordability (n = 9, 52.9%). Accommodation was the next most reported barrier domain (n = 7, 41.2%) and acceptability was the least described (n = 6, 35.3%).

Facilitators were less commonly described and were predominantly mapped under availability (n = 6, 35.3%). *Figure 5* shows the number of studies reporting barriers and facilitators across the five access dimensions.

Figure 6:Distribution of reported barriers to surgical care for hearing loss across access domains and components

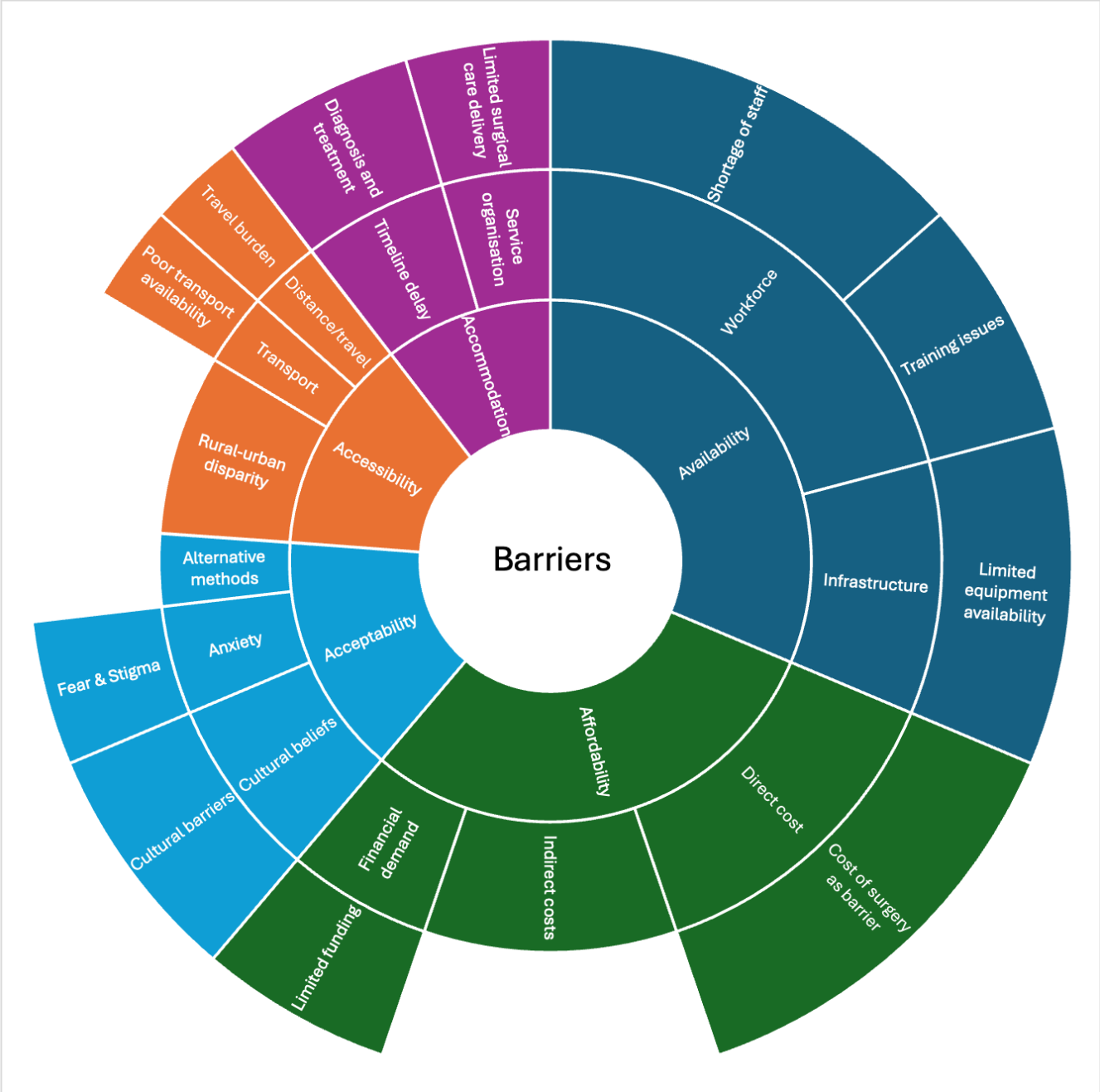


Figure 6 illustrates the hierarchical distribution of reported barriers to accessing surgical care for hearing loss across access dimensions and their constituent components. Availability,

affordability and accessibility contained the most reported components, with workforce-related constraints, direct cost of hearing loss surgery, travel burden and rural-urban disparities most frequently reported. Comparatively, there was limited reporting of accommodation and acceptability-related factors, although cultural beliefs, fear and stigma, and delays in diagnosis and treatment were notable factors.

Figure 7:Distribution of reported facilitators to surgical care for hearing loss across access domains and components



Figure 7 illustrates the distribution of reported facilitators to accessing surgical care for hearing loss across access dimensions and related components. Overall, these were less frequently reported, but were concentrated within the availability domains, particularly in relation to workforce strengthening initiatives such as training programmes, task-shifting, and the use of visiting surgeons. Facilitators to address accessibility constraints were also frequently described but comparatively less prominent to availability-related facilitators. Fewer interventions addressing financial protection, systemic delays and sociocultural barriers were described.

2.3.9 Sensitivity Analysis Excluding High Risk of Bias Studies

The overall pattern of reported barriers across access dimensions did not significantly change following exclusion of studies assessed as high risk of bias. Availability, accessibility and affordability remained the most frequently reported barriers identified in eight studies, accommodation and acceptability domains were reported in seven and five studies respectively. Evidence relating to facilitators were frequently derived from high RoB studies. The frequency of reported facilitators decreased within each access dimension after excluding high RoB studies, more notable within availability domain. This is shown in *Table 11*. The observed reduction in facilitator reporting within this narrative sensitivity analysis should be interpreted cautiously as facilitators were less frequently reported overall, irrespective of study quality.

Table 11: Sensitivity analysis of reported access domains following exclusion of high risk of bias studies

Access domain	All studies (n=17)	Excluding high RoB studies (n=13)
Availability barriers	10	8
Accessibility barriers	9	8
Affordability barriers	9	8
Acceptability barriers	6	5
Accommodation barriers	7	7
Availability facilitators	6	3
Accessibility facilitators	2	1
Affordability facilitators	2	1
Acceptability facilitators	1	1
Accommodation facilitators	1	0

2.3.10 Availability

Barriers relating to availability were primarily related to workforce capacity, training limitations, and infrastructure constraints. A shortage of trained ENT specialists, audiologists and SALTs was reported across multiple settings[3,22,23]. The reporting of workforce capacity was often limited, with few studies providing quantifiable metrics such as provider-to-population ratios or workforce density.

In addition to workforce shortages, several studies reported inadequate infrastructure and equipment as key constraints, including limited access to operating microscopes, audiological diagnostic tools and maintenance capacity[22–26]. There was limited reporting on surgical system capacity indicators, such as the number of available theatre sessions, surgical volume, or case throughput, restricting a comprehensive assessment of service availability. Access to

specialised procedures, including cochlear implantation and other advanced otologic surgery, was also restricted in several settings.

Task-sharing and workforce innovation were highlighted as facilitators within this domain. Some studies described the role of non-physician providers or general surgeons in delivering ENT care, particularly in resource-limited settings[27,28]. While these approaches were presented as pragmatic responses to workforce shortages, their implementation and effectiveness were not consistently evaluated across studies.

Additional facilitators included specialist training programmes, decentralisation of care, and international partnerships, aimed at strengthening the surgical workforce capacity and infrastructure.

2.3.11 Accessibility

Barriers related to accessibility were identified in 52.9% of included studies, and these were primarily driven by geographic inequities in the distribution of surgical services.

A common theme across the literature was the centralisation of ENT surgical services within urban tertiary centres, with several studies reporting limited access for populations residing in rural and peri-urban areas[3,22,23,25,29]. Patients and their care givers were often required to travel long distances to access surgical services, in some cases, across regions or national borders. These geographical barriers were further compounded by poor transport infrastructure. Some studies reported delays in presentation or treatment associated with travel requirements, while others described inability to access services altogether[30–32].

In addition to physical distance, indirect accessibility barriers were also reported. A few studies described fragmented and inefficient referral systems requiring patients to navigate multiple levels of care before reaching surgical services, which increased travel burden and in some cases led to loss to follow-up[25,31,32].

Facilitators addressing accessibility included decentralisation of services, where elements of care were delivered at lower-level facilities, and mobile outreach programmes, designed to provide surgical services in underserved areas[25,28].

2.3.12 Affordability

Financial barriers were reported in 52.9% of included studies. These barriers were categorised into direct medical, direct non-medical and indirect costs. Direct medical costs included surgical fees, diagnostic investigations, medications and total episode of hospital stay. Direct non-medical costs included transportation and accommodation expenses associated with accessing ENT specialist services. Indirect costs included loss of income and costs from longitudinal rehabilitation requirements. Both direct and indirect costs were identified. Surgical fees were commonly stated as the most significant direct medical cost barrier, while non-medical and indirect costs such as transportation, implantable device maintenance and loss of income further compounded the financial burden on service users[30,32,33].

There was notable inconsistency in the reporting of cost measures and comparable financial indicators across studies. Few studies provided standardised economic indicators such as OOP costs as a proportion of household income or rates of CHE.

Some studies report a range of coping mechanisms used by patients and caregivers in response to financial pressures, including borrowing money, selling assets or delaying care, which in some cases resulted in worsened clinical outcomes[30,32,34].

Although factors within this domain were identified as barriers in over half of the included studies, only a small number of studies described interventions related to affordability. These included subsidised costs of surgery, and national-level initiatives aimed at strengthening health system financing[25,35].

2.3.13 Acceptability

Acceptability barriers were reported in 35.3% of included studies. These were primarily related to sociocultural beliefs, perceptions of surgical risk, and knowledge of hearing loss and its management.

Several of the included studies reported on the influence of cultural beliefs and social perceptions on care-seeking behaviour. In some settings, hearing loss and its treatment were associated with stigma or misconceptions, which affected willingness to pursue surgical intervention[3,26,32,36]. Fear of surgery was also reported, including concerns about anaesthesia, operative risks and long-term outcomes, particularly among parents of children undergoing procedures[30,31,36]. These fears were often compounded by limited understanding of procedures and outcome, with one study reporting that 67% of participants had difficulty understanding available medical information[31].

Some studies reported care being sought via alternative methods with unlicensed, traditional practitioners prior to engaging with formal healthcare systems. Herbal preparations and other non-medical substances such as holy water, goat nasal discharge or honey were some reported treatments used within these practices to aid hearing impairment [30,34].

Some studies reported more positive perceptions of surgical care, particularly among individuals who had prior exposure to successful outcomes[31,32,36]. These attitudes, were however, often tempered by persistent misconceptions, fear and uncertainty, as well as societal influences. For example, one study described perceptions that surgical intervention could be viewed as “wasting resources” or being potentially harmful in the long-term[32].

Facilitators addressing acceptability were not as frequently reported but included health education, community involvement and counselling interventions.

2.3.14 Accommodation

Barriers related to the organisation and delivery of surgical services were reported in 41.2% of studies. A key finding across studies was the presence of prolonged and complex patient pathways, with delays occurring at multiple stages, including diagnosis, referral and surgical intervention. There was substantial inconsistency in the reporting of pathway-related variables, including age at diagnosis of hearing loss, time from symptom onset to diagnosis, time from diagnosis to surgery and rates of cancellations or rescheduling of procedures. Where data were available, delays varied across studies. One study reported time from symptom onset to diagnosis of CSOM ranging from months to over 10 years, with just over one-third of patients diagnosed between 1-5 years after symptom onset[34]. Another study reported time to diagnosis ranging from 8 months to 17 years[33]. Only one of the included studies reported time from diagnosis to surgery, reporting a mean of 19.34 months[30]. Perceived delays were also described, with one study reporting that over a third of parents perceived the timing between diagnosis of hearing loss and CI surgery to be delayed, and that 21.5% identified long waiting times as a barrier[31].

Some studies reported presentation with disabling hearing loss and advanced ear disease or complications, including mastoid abscess, intracranial infection, meningitis and facial nerve palsy[33,34]. One study reported complications in 28.8% of cases at presentations[34]. No studies reported data on cancellations, postponements, or rescheduling of procedures.

Barriers related to referral systems and care coordination were also described. One study reported that around 40% of patients experienced delays due to lack of prompt referral to specialised CI services[30]. Fragmented care pathways were described in some studies, including challenges in accessing appointments, contacting healthcare providers, and communication across levels of care[31].

Facilitators related to accommodation were rarely reported. Only one study described an intervention aimed at improving patient flow and pre-treatment preparation prior to surgical outreach for CSOM in Ethiopia[28].

2.3.15 Cross-Domain Patterns by Population Type

Different aspects of access are emphasised depending on the perspective of the population studied. The distribution of reported barriers differed by population group *(Figure 8).* Studies involving EHC providers most frequently reported barriers related to availability (n = 7), whereas studies involving patients and caregivers more commonly reported barriers related to affordability (n = 6), acceptability (n = 5) and accessibility (n = 4). Acceptability components were not reported in provider-focused studies. Barriers mapped to accommodation were reported in both groups, though more frequently among patients and caregivers (n = 4 vs n = 2), while accessibility barriers were reported equally across both groups (n = 4 each).

Figure 8: Heatmap illustrating number of studies reporting each access domain by population type

	population type	
Barrier domains	Patients/care giver	Providers
Availability	2	7
Accessibility	4	4
Affordability	6	2
Acceptability	5	0
Accommodation	4	2

*one study excluded - reports from multi-system survey/systemic, not from patients/providers.

2.3.16 Cross-Domain Interactions of Barriers

Several of the included studies reported barriers across multiple access dimensions simultaneously. The co-occurrence heatmap *(Figure 9)* demonstrates this. The most common

pattern observed was the interaction between availability and accessibility (n = 7), where shortages in ENT workforce and limited infrastructure contributed to the centralisation of services in urban tertiary centres, increasing travel burden for patients.

Accessibility barriers often intersected with affordability (n = 6), as the need to travel long distances resulted in additional costs related to transport and loss of income. In some cases, acceptability and affordability were seen to interact (n = 6), where patients opted for alternative treatments perceived as more culturally acceptable and affordable prior to engaging with formal surgical care. Co-occurrence between accessibility and both acceptability and accommodation were also frequently reported (n = 5 each).

Figure 9: Heatmap illustrating the co-occurrence of barriers to access across the five domains.

	Availability	**Accessibility**	**Affordability**	**Acceptability**	**Accommodation**
Availability	—	7	5	3	4
Accessibility	7	—	6	5	5
Affordability	5	6	—	6	4
Acceptability	3	5	6	—	3
Accommodation	4	5	4	3	—

Each cell represents the number of studies in which both domains were reported together. Darker shading indicates a higher frequency of co-occurrence. Studies reporting facilitators only were excluded from this analysis.

2.4 Discussion

2.4.1 Summary of Evidence

This review synthesised evidence on barriers and facilitators to accessing surgical care for hearing loss across African settings using the five dimensions of access described by Penchansky and Thomas (1981). Overall, the findings demonstrate that access to surgical care for hearing loss is shaped by complex and interrelated factors across all dimensions of access, rather than by isolated barriers.

A key observation was the predominance of system-level barriers, particularly those related to workforce capacity, infrastructure, and financing. These constraints were consistently reported across studies and reflect wider structural limitations within African health systems that influence the availability and delivery of surgical services. In addition, the inequity in geographical distribution of included studies mirrors wider disparities in both research output and service provision across the continent, with several regions remaining underrepresented. These findings are consistent with global surgery literature that indicates access to safe, timely, and affordable surgical care remains a problem for many populations, particularly in LMICs[14]. This review further highlights that surgical services for EHC remain underdeveloped and underprioritised despite the substantial and growing burden of hearing loss[1].

2.4.2 Interpretation of Findings

The context of the characteristics and quality of available evidence should be considered in the interpretation of these findings. There was substantial heterogeneity in the literature with more than half of the included studies (53%) being assessed as having either moderate or high RoB *(Figure 2).* This was most commonly due to limited comparability between study populations, and inadequate consideration of confounding factors inherent to predominantly

cross-sectional study designs, as detailed in the JBI checklist for cross-sectional studies in *Table 4*. Although the narrative sensitivity analysis demonstrated that the overall pattern of reported barriers remained largely unchanged following exclusion of high RoB studies, the quality of the evidence base remains an important limitation. Given the evidence base was largely descriptive and observational, it may partly explain the limited evaluation of interventions and facilitators identified in this review.

Figure 3 shows the geographical distribution of included studies. Research was concentrated within a small number of countries, particularly Nigeria and South Africa. This uneven distribution may reflect research capacity, service provision and academic output inequities across the continent, and may skew our current understanding of access to surgical hearing care. Similarly, most studies were conducted within tertiary or multi-centre settings and in urban environments, with limited rural-only representation. Consequently, the experiences of populations that may be facing the greatest geographical barriers to specialist surgical hearing care may be underrepresented, and the true extent of accessibility in hearing loss surgery underestimated.

Table 10 also highlights the limited characterisation of hearing loss populations and type of ear surgery assessed in the evidence base. 52.9% of studies did not specify the type of hearing loss under investigation. Barriers to accessing surgical care may vary between conductive, sensorineural and congenital hearing loss, particularly in terms of urgency of intervention and rehabilitation requirements. This also reduces comparability across studies and limits understanding of whether specific patient groups experience unique barriers. Cochlear implantations and middle ear surgery accounted for over half of the procedures being reported on. These are advanced ENT procedures and may likely be due to most of the literature coming from urban-tertiary settings. This means that less might be known about access barriers relating to other surgically managed causes of hearing loss or it may suggest a

lack of availability of the other procedures. The prominence of literature reporting on cochlear implantation may also partly explain the frequent reporting of affordability barriers, given the high costs associated with implantation, device maintenance and rehabilitation.

Barriers to access components identified in the literature were most frequently mapped to availability domain. A dominant finding was the limited availability of surgical services for hearing loss, driven primarily by shortages in trained ENT personnel, equipment and facilities. Regional surveys consistently report a severe shortage of ENT surgeons, audiologists, and supporting staff across sub-Saharan Africa, alongside limited training opportunities and inadequate infrastructure[23,29]. This scarcity is enhanced by unequal distribution of resources, as specialists and surgical services are concentrated in urban areas. In some settings, most ENT professionals are located only in a small number of regions, leaving large populations underserved[22]. Issues with workforce shortages are further compounded by inadequate training opportunities. Evidence from Nigeria highlights insufficient surgical exposure among ENT trainees. One study found 92% of trainees surveyed from six teaching hospitals rated the low exposure to tympanoplasty training as a moderate or gross omission from their training programme and none of them had ever performed the procedure [37]. The absence of necessary equipment was also identified as a reason for poor exposure to tympanoplasty by the ENT residents[37]. Reviews reporting low surgical volumes in tertiary centres indicate limited service provision and reduced opportunities for maintaining and developing surgical competencies[38,39]. The evidence suggests a cyclical problem, whereby limited workforce capacity decreases surgical output, which in turn limits training opportunities and perpetuates workforce shortages and availability of hearing loss surgery.

Poor surgical availability for hearing loss in Africa is further driven by inadequate infrastructure and equipment. Many facilities are reported to lack the basic tools required for

otologic surgery, with some hospitals unable to provide any ear procedures[25]. This is further supported by global evidence demonstrating significant gaps in access to essential otologic surgery equipment needed for the management of common and preventable causes of hearing loss in LMICs[40]. These findings indicate that limitations in the availability of hearing loss surgery are multifactorial, they reinforce one another and deficits in one area can lead to weaknesses in another. This aligns with the well documented, historical global data on the underdevelopment, specialist shortage and poor resource allocation of ENT services within health systems across Africa[11,41]. The evidence highlights that limitations in availability are not only driven by shortages in workforce and infrastructure, but also by gaps in the measurement and reporting of surgical capacity, which restricts ability to effectively assess and plan surgical service provision for hearing loss in Africa.

Geographic accessibility remains a major barrier to accessing surgical care for hearing loss in Africa, particularly for rural populations. Across the included studies, specialist ENT services were frequently concentrated in urban areas and tertiary settings, limiting access for rural and peri-urban populations where otology specialist care was often unavailable[22,28]. Therefore, service users were commonly required to travel long distances and navigate complex referral pathways to reach definitive surgical care[25,30]. These challenges were often compounded by poor transportation infrastructure and limited availability of affordable transport options[31,32,34]. This suggests that accessibility barriers are closely linked to other health-system challenges. Availability and accessibility were one of the access dimensions that co-occurred most frequently *(figure 9)*. The shortage of ENT surgeons, inadequacies in equipment and facilities may contribute to the centralisation of services meaning, patients must then travel longer distances, worsening travel burden. This suggests that barriers related to accessibility may be largely downstream consequences of availability constraints.

The observed delays can be conceptualised further using the "three delays" model framework outlined by Thaddeus and Maine in 1994, where barriers occur at the stages of seeking, reaching, and receiving care[42]. In the context of this review, geographic accessibility primarily affects the second delay (reaching care) but frequently interact with other access dimensions. Accessibility and affordability interactions were common and are particularly evident in contexts where multiple visits are required for diagnosis, surgery and follow-up, thereby, increasing financial burden[30,32]. These findings suggest that improving accessibility of surgical hearing care in Africa requires more than reducing travel distance alone.

Financial burden was consistently identified as one of the most significant barriers to accessing surgical hearing care. Evidence from included studies demonstrates that middle ear surgeries like tympanoplasty and mastoidectomy for hearing loss caused by CSOM can exceed patient's/family monthly income, effectively rendering surgical interventions unaffordable for a large proportion of the population[33,36]. Even when surgical services are available, affordability can limit utilisation, contributing to unmet need. This economic constraint is particularly pronounced in the context of cochlear implantation, where costs extend beyond surgery to include ongoing device maintenance, follow-up care, and rehabilitation services[30,31]. Evidence from South Africa, similarly, highlights cumulative additional costs of CI use, knowledge of which is important for successful long-term device use[43]. These findings suggest that affordability barriers operate not only at the point of surgical access but can persist through continuum of care, with the potential of affecting long-term outcomes. While economic evaluations suggests that CI can be cost effective in some sub-Saharan African countries, this does not translate into affordability at the individual level[44]. This reflects a bigger limitation in applying cost-effectiveness frameworks in low-resource settings, where high upfront costs and insufficient financial protection limits access regardless of long-term societal benefit. Patients are often required to pay OOP where health

insurance coverage is limited and where there is minimal public funding for ENT services, further exacerbating inequities[3]. Although this review does not quantify rates of CHE for hearing loss surgery, wider global surgery literature demonstrates that surgical care in LMICs frequently results in CHE[14]. Within the context of hearing care, this burden is worsened by indirect costs, including transportation, loss of income and caregiver time, which may be steep for rural and low-income populations. As a result, service users may delay or forgo surgical treatment, contributing to disease progression and poorer outcomes.
Together, these findings suggest that improving access to surgical hearing care requires focus on underlying financial burden through health system reforms.

Sociocultural beliefs, stigma and limited awareness of hearing loss causes and consequences, play an important role in shaping healthcare seeking behaviours and engagement. They have been reported to contribute to delays in presentation and surgical care uptake. Some included studies frequently reported the use of alternative treatment methods. Commonly reported alternative interventions for ear discharge and deafness included the use of hot or cold oil, honey and various animal discharge[34,45]. Lasisi *et al.,* also provided evidence from Nigeria to demonstrate the extent to which misconceptions regarding the causes of ear disease and hearing loss may influence patterns of healthcare utilisation[45]. A majority of participants from a community-based focus group discussion believed ear discharge was caused from a woman breastfeeding a child while lying down, while others believed it was caused by a spiritual attack, dirt or "cold earth"[45]. Deafness was believed to be a "supernatural disease caused by enemies of victims" or as a punishment for a mother stealing a forbidden fruit during pregnancy, with consensus made amongst participants that it was impossible for certain types of drugs or prolonged labour to cause deafness[45]. These findings suggest that health-seeking behaviour is shaped by beliefs regarding causes of hearing loss. Where it is perceived to be attributed to supernatural causes, particularly in settings where formal

healthcare services are scarce, trust in traditional healers and alternative methods of treatment may be perceived as appropriate. Where specialist services are geographically inaccessible or expensive, reliance on traditional remedies may represent a pragmatic response rather than being solely a reflection of cultural beliefs. All this can lead to treatments themselves causing more harm than good, potentially resulting in more advanced disease at presentation and poorer outcomes. Furthermore, these findings suggest that acceptability barriers are not purely down to a lack of information. There are ideas of illness that are implanted within cultural frameworks which may affect how hearing loss is viewed. These cultural beliefs about illness may then be reinforced by limited access to accurate health information and education.

Parental decision making has been linked to acceptability in paediatric populations. A review by Ravi & Gunjawate (2020) highlighted that parental decisions about cochlear implantation are shaped by various factors that are interconnected, including perceived risks, benefits, expectations of outcomes and social influences, though no African studies were represented in this review[13]. Emerging evidence from African contexts emphasises on logistical and emotional challenges faced by families, including concerns about health risks associated with operations, long-term effects and support, educational outcomes and social integration, factors which may influence uptake of surgical interventions[31,46]. These findings suggest that acceptability barriers within paediatric hearing care predominantly come from family-decision making processes that extend beyond assessment of clinical benefit, and these perceptions can influence uptake of surgical interventions.

Stigma associated with hearing loss, particularly around the use of assistive devices may affect acceptability of surgical care. Hearing impairment treatment and rehabilitation have been reported to be perceived as being associated with social exclusion or misconceptions, discouraging individuals from seeking treatment or disclosing symptoms[1,26]. Given these

combined complex factors that may delay surgical management of hearing loss, improving acceptability requires community-level education, awareness initiatives and culturally appropriate counselling to support decision making.

Barriers related to accommodation were also prominent across included studies and represent a critical and often underexplored dimension of access. These barriers include delays in diagnosis and treatment, fragmented care pathways, and limited-service coordination and provision. Late presentation was notable in this review, with some studies reporting many patients presenting to specialist services with advanced ear disease or complications[33,34]. Delays in accessing hearing care are particularly harmful in paediatric populations. Evidence from South Africa demonstrates that children with profound hearing loss often experience delayed diagnosis and intervention, despite the knowledge that early intervention is critical for optimal developmental outcomes[47]. The absence of universal newborn hearing screening programmes in many African settings further exacerbates these delays, limiting identification and prompt referral[22]. This suggests that the consequences of accommodation barriers may be particularly significant in paediatric populations, where delays in diagnosis and management can adversely affect speech, language and cognitive development.
Delays between diagnosis and surgical intervention were described as a barrier within some included studies, particularly in cochlear implant pathways, where a combination of financial, logistical and administrative factors contribute to prolonged waiting times. There was, however, limited quantitative reporting of these delays across studies. A few studies reported objective measures such as time period before diagnosis, time from diagnosis to surgery, and proportion presenting with advanced disease or complication at the time of surgery[30,33,34]. One study reported a mean waiting time from diagnosis to CI surgery of 19.34 months and 39% of caregivers felt that there was a lack of prompt referral to CI specialists[30]. This suggests that delays can occur even after patients reach surgical care, and therefore, access

cannot be viewed at a single timepoint in this context. It should be assessed as a longitudinal process from symptom recognition to management and rehabilitation. The lack of reported quantitative data for measuring delays within accommodation limits the ability to fully evaluate the magnitude and impact of delays, efficiency and compare service delivery within surgical care pathways, therefore, reflecting a potential larger gap in the literature.

Accommodation barriers are seen to interact closely with other dimensions of access within surgical hearing care pathways in African settings. For example, delays in cochlear implantation programmes in Nigeria have been linked to service delivery constraints[48]. Similarly, studies of CI in SSA highlight how the organisation and delivery of care is dependent on workforce availability, infrastructure and external support[33,49]. Low surgical volumes reported in African tertiary centres further indicate systemic bottlenecks in service delivery, where limited capacity contributes to delays in care and reinforces constraints across multiple access dimensions[38,39].

Taken together, these findings suggest that in African health systems, accommodation barriers are stuck within wider structural healthcare challenges, including workforce shortages, financial limitations, and centralised service delivery, rather than functioning in isolation.

2.4.3 Facilitators and Emerging Solutions

This review highlights several facilitators and emerging strategies to improve access to surgical care for hearing loss in Africa. Notably, many of these approaches address multiple dimensions of access simultaneously, suggesting that integrated, system-level solutions are likely to be the most effective. This is particularly important given the interdependent nature of access barriers, where challenges across domains such as availability, affordability, and accessibility often interact and reinforce one another.

Training initiatives, including surgical mentorship programmes and international partnerships, were described as facilitators to service availability. While international partnerships can enhance surgical skills, concerns remain regarding sustainability and long-term improvement if local training systems remain weak. Evidence from Uganda demonstrated that repeated surgical teaching visits from North American ENT surgeons were associated with increased output of locally performed middle ear surgeries, including during absence of visiting surgeons[24]. This suggests that international partnerships may strengthen local workforce capacity through mentorship and skills transfer.

Although included studies have focused mainly on increasing surgical workforce capacity, EHC workforce expansion must include not only surgeons but also audiologists, speech therapists and rehabilitation professionals. Global evidence emphasises the importance of multidisciplinary training models to facilitate continuity of care across the surgical pathway[12]. Without parallel investment in these supporting roles, improvements in surgical capacity alone are unlikely to increase access and improve patient outcomes.

Persistent shortages of specialist ENT providers across many African settings have led to increasing interest in alternative workforce models. Task-sharing initiatives has emerged as a promising strategy to improve workforce capacity and surgical access in EHC services. These models can improve early identification of hearing loss, facilitate referral pathways and reduce delays in accessing specialist care. Task-sharing has been shown to address both availability and accessibility barriers through decentralisation of care in urban areas and reduction of reliance on highly specialised providers. For example, Mulwafu *et al.,* in 2019 demonstrated that training mid-level health workers to deliver middle ear surgery is a feasible and acceptable way to expand surgical service availability[27]. The study reports that endoscopic myringoplasty was performed by mid-level health workers in Malawi, with 83 procedures carried out and graft-taken rates of 73% at 6 weeks and 96 % at 3 months,

demonstrating that the service was effective in the setting[27]. This approach is supported by global health frameworks, including WHO task-shifting guidelines, which advocate for redistribution of tasks among health workers as a strategy to address workforce shortages and strengthen health systems in resource-limited settings[12,50].

Additionally, innovative outreach models like the use of mobile surgical units have been shown to be valuable in contexts where specialist ENT services are centralised in urban centres. Evidence from included studies suggests that mobile ear surgery initiatives can increase surgical volume and expand access by overcoming geographic inequities[28]. This means that outreach models may complement decentralised care strategies by strengthening referral pathways, potentially facilitating earlier identification of patients at the community level. By reducing travel distance and associated indirect costs, such models address key accessibility and affordability constraints simultaneously. A hearing health project in Uganda reported that the number of middle ear surgeries performed by local ENT surgeons increased by 24 -fold and the number of ENT residents admitted to training increased in correlation with international surgical visits over 6 years[24]. This suggests that outreach services like the implementation of visiting surgeons may extend beyond immediate provision of surgical services to build knowledge and skills of local providers in the long run. Despite these advantages, outreach-based models present important limitations. The episodic nature of outreach services may restrict continuity of care, particularly for conditions requiring long-term follow-up and rehabilitation, such as cochlear implantation. In addition, reliance on visiting surgical teams or external support may limit sustainability and reduce opportunities for local capacity building if not appropriately integrated into national health systems. These concerns are supported by global surgery literature that has highlighted poor sustainability of short-term surgical outreach programmes and visiting surgeon models[51]. Emphasis has increasingly shifted toward longitudinal partnerships and locally led workforce capacity

building, particularly relevant in hearing care where long-term follow-up and rehabilitation are essential for successful outcomes. For example, a local training-based outreach project in Egypt successfully led a low-cost campaigning programme over 39 months to improve sustainability of ear surgery provision through local workforce development[35]. This all implies that international outreach partnerships may be most effective when combined with local training systems rather than functioning as isolated interventions. There are, however, barriers to implementing local surgical training programmes. Evidence from Nigeria suggests that inadequate otologic surgical training is driven by limited access to equipment and expertise and underfunding of training programmes[37]. This reflects the need for structural and financial investment in training programmes, alongside workforce development for sustainable long-term expansion of surgical hearing care services in Africa.

Like the barriers to surgical hearing care identified in this review, the facilitators also seem to operate in an interdependent manner. Across included studies, strategies such as surgical training programmes, mobile outreach services, and task-sharing approaches were shown to influence multiple domains of access simultaneously, including availability, accessibility, and accommodation. For example, mobile ear surgery initiatives can improve geographic accessibility while also increasing surgical service availability. Task-sharing expands workforce capacity as well as strengthening referral pathways at the community level. Training increases workforce capacity and in turn surgical service provision. This is supported by evidence that found barriers influencing delays to surgical care are interlinked and potentially require coordinated, multi-component interventions to improve access[52]. These findings highlight that facilitators identified should not be viewed as standalone solutions, but rather as constituents of a broader, coordinated approach to strengthening access to surgical hearing care in Africa. Integrated strategies that address multiple

dimensions of access simultaneously are, therefore, likely to be more effective in overcoming the complex access constraints.

2.4.4 Comparison with High-Income Settings

Literature from high income countries (HICs) suggests that the main access constraint for hearing loss surgery is often related to efficacy and equity of referral, assessment and rehabilitation pathways rather than the absence of services. This contrasts with African settings where barriers are frequently reported to be related to limited workforce capacity, infrastructure, equipment and financing. According to the World Bank Group income classification, most countries in Africa are categorised as low- or lower-middle income[53]. Despite this, some barriers to surgical hearing care access are shared between Africa and HICs, although they differ in nature. One study from the United Kingdom found lower referral rates for cochlear implantation in lower socioeconomic areas and within ethnic minorities[54]. Another study from the US found that lower socioeconomic status was associated with increased likelihood of qualifying for CI but a decreased likelihood of undergoing the surgery, and those living in rural areas who qualify for CI were also less likely to receive the surgery in comparison to metropolitan candidates[55]. These findings suggest that some access challenges are universal, and greater service availability does not always guarantee or translate to better access. Factors such as socioeconomic status, geographic disparities and referral practices influence access even in well-resourced settings. Universal newborn hearing screening (UNHS) is considered standard care in many HICs and has been shown to promote early identification and intervention for children with hearing loss[56]. This has been a major facilitator to hearing loss surgery pathways in HICs and contrasts with many African settings where UNHS is not established and delayed diagnosis and referral to specialist care remain important challenges[57]. This implies that early

screening programmes for hearing loss may represent a transmittable lesson from HIC practices.

Another important facilitator in HIC settings that may be useful, especially to address accessibility barriers, is the use of remote consultations. This has shown potential to reduce travel burden and support long-term rehabilitation, particularly for CI users in rural populations[58,59]. Given this review identified geographic accessibility as a major barrier, telehealth-supported services, may be adaptable and useful in African settings to facilitate specialist follow-up, where technologically permissible. This has been trialled in Nigeria with case reports that found activation through telemedicine resulted in good speech, despite views that speech distortion is evident when cochlear implants are activated remotely[60].

The United Kingdom's National Health Service (NHS) provides an example of a publicly funded EHC service that reduces direct financial burden through commissioning hearing loss surgery, rehabilitation and long-term maintenance of devices like cochlear implants[61]. Nevertheless, studies have reported that indirect costs including travel requirements, time away from work and repeated follow-up appointments may still affect engagement with hearing care services in HICs[55]. This suggests that publicly funded systems and insurance coverage may reduce direct surgical costs but may not eliminate all affordability-related inequities in ENT surgical care access. While similar financing mechanisms can be adaptable in Africa to reduce OOP expenditure related to direct costs of hearing loss surgery, additional measures may be needed to address indirect costs.

While HICs share some access barriers to hearing loss surgery with African settings, including geographic and socioeconomic inequities, the extent of the problem and underlying causes differ. Interventions that have been successfully implemented in HICs may be transferable to African settings but may possibly require some adaptations. This will,

however, require consideration of feasibility in terms of workforce, infrastructure and funding availability.

2.4.5 Strengths and Limitations

A key strength of this review is the use of a conceptual framework to map out available evidence on barriers and facilitators to surgical access for hearing loss in Africa. This allowed for a structured and enhanced analytical depth of the interactions across access dimensions. Secondly, the focus on surgical care addresses a critical gap in literature, as existing research on EHC has largely prioritised prevention, screening and non-surgical interventions. By focusing on surgical care, the review contributes to a critical component of the hearing care pathway that is essential for managing not just advanced or complex disease but also causes of hearing loss that are easily managed by surgery. The inclusion of a broad range of study designs, alongside relevant grey literature further strengthens the review by incorporating diverse perspectives, including health system and policy-level insights that are often underrepresented in clinical studies. Finally, the focus on African settings enhances the contextual relevance of the findings, offering important insights into regions where the burden of hearing loss is high and access to surgical care remain limited.

Several limitations should be acknowledged. The overall quantity and quality of available evidence were limited, with a relatively small number of studies included and an uneven geographical distribution across African countries, restricting the strength of conclusions that can be drawn and generalisability of the findings. Many African countries had no published evidence but the absence of this does not necessarily correlate to the absence of barriers to access, and may rather reflect limited research capacity. Research concentration in Nigeria and South Africa may also reflect advances in academic infrastructure rather than burden of service provision, suggesting that the evidence is biased towards African countries with more

research capacity. In addition, unpublished service data, NGO reports, ministry-level audits and excluded conference abstracts, commentaries and editorials may contain important contextual information not captured in this review.

The sensitivity analysis demonstrated that the patterns seen in the barriers mapped to the different access dimensions remained unchanged following exclusion of high RoB studies, thereby strengthening the confidence in interpretation of these findings. In contrast, evidence associated with facilitators reduced after high RoB study exclusion. These were, however, comparatively underreported across the literature and this reflects publication bias rather than solely a limitation in methods.

Significant heterogeneity in study populations, methodologies, and reported outcomes limited comparability across studies and precluded quantitative synthesis. While workforce shortages, financial barriers and geographical inequities were frequently described, many studies lacked standardised reporting of indicators that would allow comparison across settings. For example, relatively few studies reported metrics for workforce density, travel burden, OOP costs, CHE, waiting times or time intervals along the surgical care pathway.

In addition, many studies did not explicitly examine access to surgical care, requiring interpretive mapping of findings onto the access framework, which may introduce a degree of subjectivity. Furthermore, the restriction to English-language publications may have resulted in the exclusion of relevant studies published in other languages. Given the linguistic diversity of Africa, this introduces a potential for language bias and may have led to underrepresentation of evidence from non-English speaking countries.

While this review has identified recurring barriers across African settings, there remains a need for context-specific evidence from individual countries and healthcare systems. Henry *et al.,* highlighted the importance of understanding the factors influencing access to surgical care beyond measures of surgical capacity alone[16]. The survey component of this thesis has

been designed to contribute evidence to this gap by exploring provider perspectives in Nigeria.

Chapter 3: ENT Provider Perspectives on Access to Hearing Loss Surgery in Nigeria: A Cross-Sectional Survey Study.

3.1 Aims, Objectives and Research Questions

The aim of this study is to explore ENT providers' perspectives on barriers to and solutions for improving access to surgical care for hearing loss in Nigeria.

Objectives:

- To describe hearing loss related service provision and workforce capacity in Nigeria.
- To identify perceived barriers to accessing surgical care for hearing loss in Nigeria.
- To identify priority interventions for improving access to surgical hearing care in Nigeria.

Research questions:

1. What barriers do ENT providers in Nigeria perceive as influencing access to surgery for hearing loss?
2. What aspects of workforce capacity influence access to surgical care for hearing loss in Nigeria?
3. What interventions do ENT providers in Nigeria who are involved in hearing loss care propose and prioritise to improve access to surgical hearing care?

3.2 Methods

3.2.1 Data collection

This is a cross-sectional survey study of ENT care providers in Nigeria, conducted as part of a mixed-methods investigation to evaluate and understand the practical barriers and potential solutions to improving access to surgery for patients with hearing loss in Africa.

The questionnaire consisted of multiple sections with 23 questions in total, taking approximately 10 minutes to complete. It included a combination of multiple-choice questions, Likert-scale items, and free-text responses. No previously validated survey instrument was used.

The survey was designed and reviewed in collaboration with an experienced ENT surgeon in Nigeria who was also the previous president of the Otorhinolaryngological Society of Nigeria (ORLSON), to ensure relevance to the Nigerian context. The full questionnaire is provided in *Appendix 3.*

3.2.2 Sample characteristics

The target population included ENT surgeons, ENT trainees (registrars/residents) and other ENT care providers. Participants were required to be currently practicing in Nigeria and be involved in EHC delivery. No other formal exclusion criteria were applied beyond this. A non-probability convenience sampling approach was used, and the survey was distributed to a WhatsApp group comprising of members of ORLSON.

3.2.3 Survey administration

The survey was administered using the online questionnaire platform, Google Forms. Participants accessed the survey via a shared electronic link, distributed to the ORLSON WhatsApp group. Data collection occurred over a period of 10 weeks, ending March 2026. Reminder messages were sent to the WhatsApp group at 3-week intervals, and the survey link re-shared on each occasion. To minimise duplicate participation, a single-response setting per device was applied to the survey link.

3.2.4 Ethical considerations

This study was approved by the Oxford Tropical Research Ethics Committee (OxTREC) (reference number: 2453262). Participation was voluntary and informed consent was

obtained electronically from each participant prior to survey completion. A participant information sheet and cover letter were also sent to the sample group prior to consenting, detailing a summary of the survey content, objectives, inclusion criteria, risks and benefits and data protection rights. The survey was conducted with assurances of confidentiality. No personal identifiable information was required for participation. Participants were however, given the option to provide an email address within the survey if they wished to receive acknowledgement of participation in future published work. All data were password protected and only accessible to the research team.

3.2.5 Statistical analysis

Data were analysed using descriptive statistical methods, including frequencies and percentages, to summarise participant characteristics and responses to survey items. Analysis was conducted using Microsoft Excel. Analyses were conducted on a per-item basis, with incomplete responses excluded from specific analyses. Open-ended responses were analysed thematically using manual coding of recurring themes. No missing data were observed for closed-ended questions. Missing data occurred only in voluntary open-ended items. These were analysed using available data only. Non-response bias could not be formally assessed as the survey was distributed via a professional network and characteristics of non-respondents were not available.

3.3 Results

3.3.1 Respondent characteristics

The survey was distributed to 337 members of ORLSON via a WhatsApp group. A total of 71 respondents completed the survey, producing a response rate of 21.1%, calculated as the number of completed responses divided by the total number of individuals invited. As the

survey link was distributed via a group platform and individual identifiable details were not collected, it was not possible to determine the number of individuals who viewed the survey but did not participate. Reasons for non-participation could, therefore, not be assessed.

3.3.2 Descriptive results

Most respondents were male (81.7%) with a mean age of 46.2 years (SD 8.7). Most of them were consultant ENT surgeons (69%) practicing in tertiary healthcare facilities (95.8%) and based in urban settings (87.3%). Participants represented a range of clinical experience, with a substantial proportion having more than five years of practice. *Table 12* summarises respondent characteristics.

Table 12: Characteristics of study participants

Characteristic	**Category**	**n (%)**
Gender	Male	58 (81.7)
	Female	13 (18.3)
	Other	0
Age, mean (SD), years		46.2 (8.7)
Age range, years		30–63
Professional role	Consultant	49 (69)
	ENT trainee	19 (26.8)
	Audiologist	1 (1.4)
	Other	2 (2.8)
Years of experience	<5 years	13 (18.3)
	5-9 years	17 (23.9)
	10-19 years	30 (42.3)
	≥ 20 years	11 (15.5)
Practice setting	Tertiary/teaching hospital	68 (95.8)
	Secondary/regional hospital	1 (1.4)
	District/ General hospital	1 (1.4)
	Military Hospital	1 (1.4)
	Private hospital/clinic	0
	Other	0
Location	Major city/metropolitan/urban	62 (87.3)
	Rural	1 (1.4)
	Both urban and rural	8 (11.3)

3.3.3 Availability of Hearing Loss-Related Services

Figure 10: Available hearing loss-related services at respondents' facilities

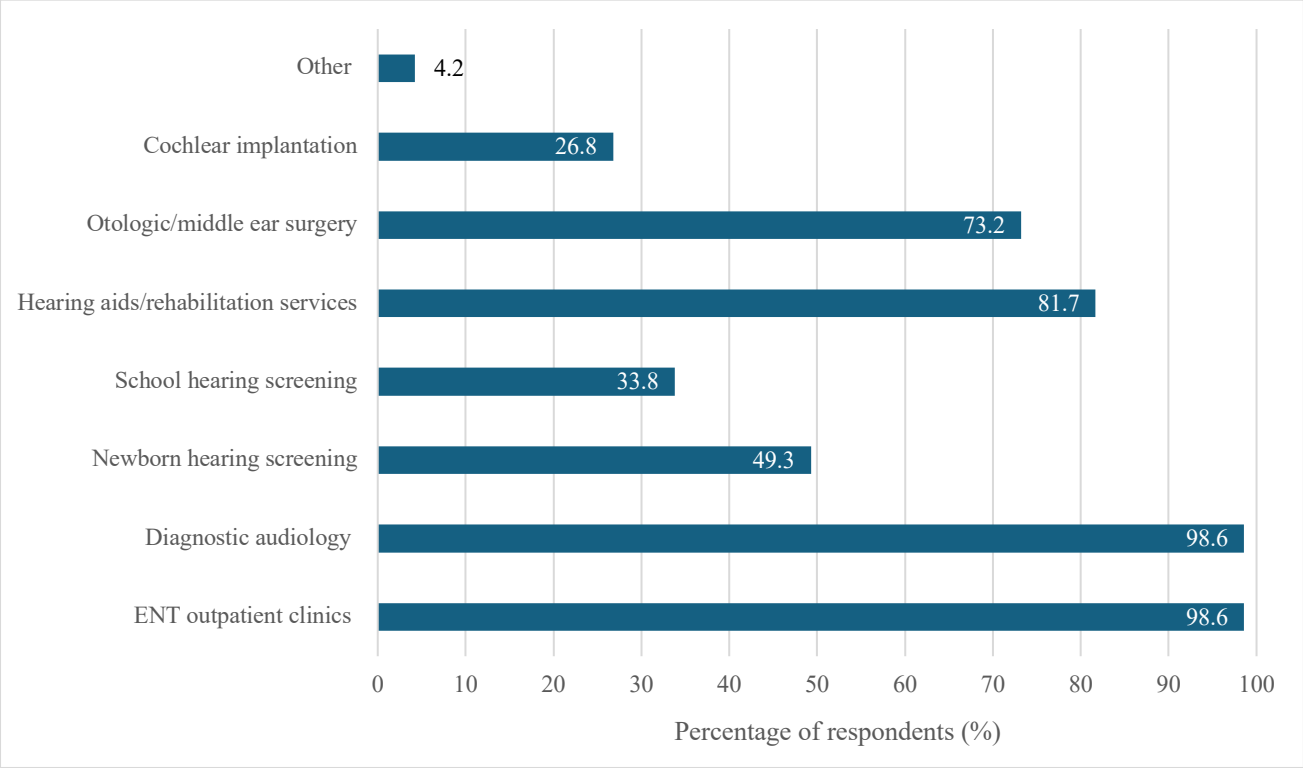


Figure 10 shows the hearing loss-related services reported to be routinely available at respondents' facilities. Nearly all respondents reported the availability of ENT outpatient clinics (98.6%) and diagnostic audiology services (98.6%). A large proportion of respondents also reported availability of hearing aids and rehabilitation services (81.7%) and middle ear surgery (73.2%). The availability of preventative screening measures was lower. Newborn hearing screening was available in 49.3% of facilities, and 33.8% reported availability of school hearing screening. Advanced hearing surgical services like cochlear implantation was more limited, with only 26.8% of respondents reporting its availability at their facilities.

3.3.4 Workforce and Referral Systems

Respondents were asked to rate the adequacy of ENT/otology workforce at their facility relative to patient need for hearing loss surgery on a scale of 1 (very poor) to 5 (excellent)

(Figure 11). A fair rating of 3 was the most common, selected by just over half (51%) of participants. This was also the median rating for perceived workforce adequacy. A quarter of the respondents gave a good rating of 4, while only 6% perceived it as excellent. A very poor rating was only considered by 1% of respondents.

Figure 11: Perceived workforce capacity ratings relative to patient need

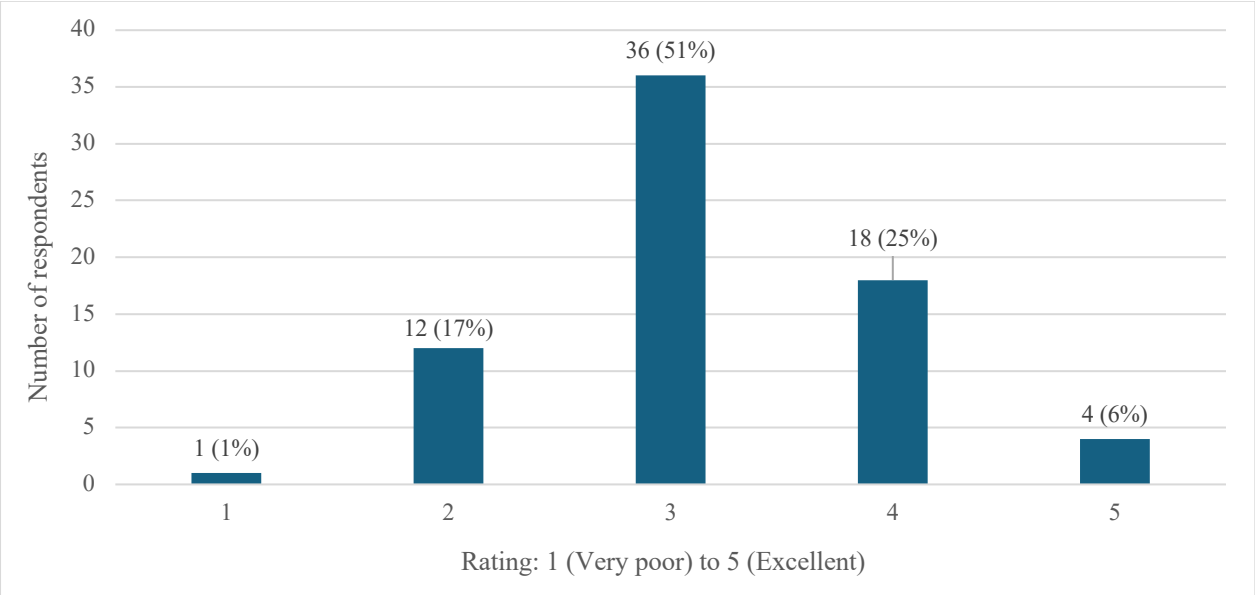
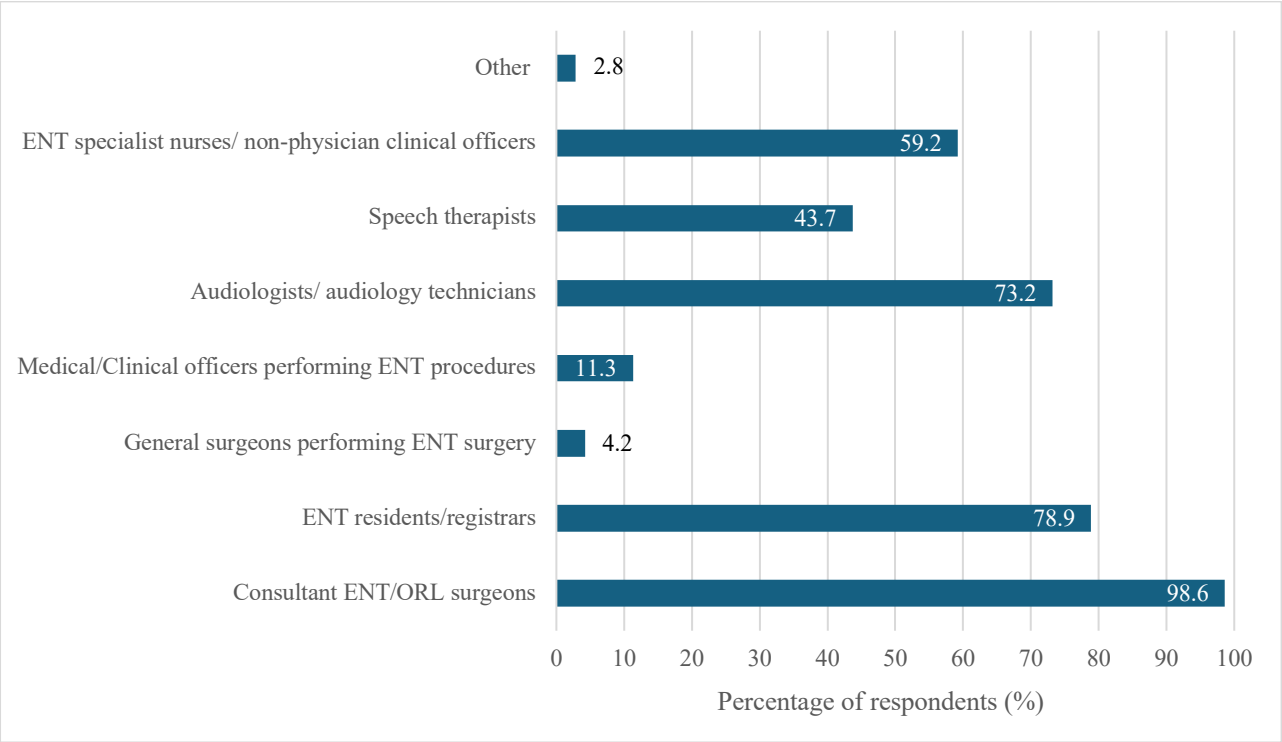


Figure 12 illustrates data about healthcare providers reported to be involved in the delivery of ear and hearing loss care at respondents' facilities. 98.6% of respondents reported involvement of ENT consultants and a large proportion (78.9%) reported ENT trainee involvement. Availability of other healthcare professionals like audiologists, speech and language therapists and nurse specialists were reported by 73.2%, 43.7% and 59.2% respectively. Few respondents reported involvement of physicians that were non-specialist providers. 11.3% reported clinical officers performed ENT procedures and 4.2% reported involvement of general surgeons in ENT care.

Figure 12: Multidisciplinary providers involved in ear and hearing-loss care at respondents' facilities



When asked whether their facilities received support from visiting ENT or otology specialists, including specialists from other hospitals or international teams *(Figure 13),* most respondents reported that they did. Approximately a third of respondents (29.6%) reported receiving support regularly and a further 35.2% reported support was received from other specialists occasionally, defined as once every 1-2 years.

Figure 13: Proportion of respondents reporting support from visiting ENT or otology specialists

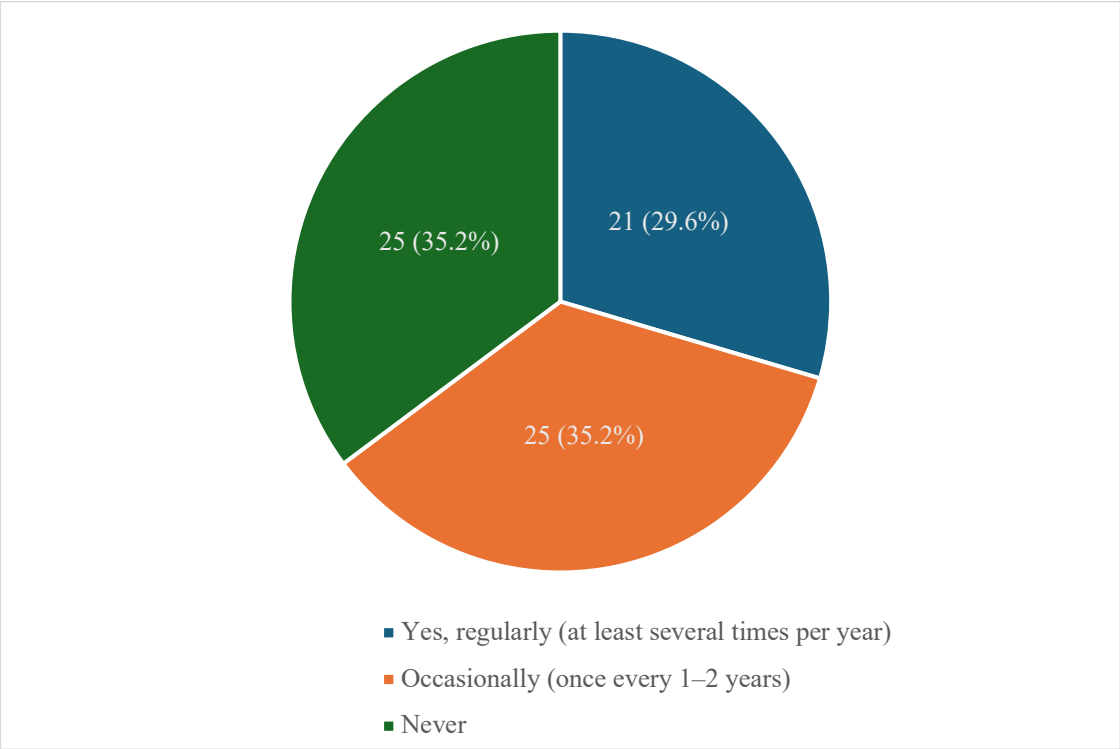
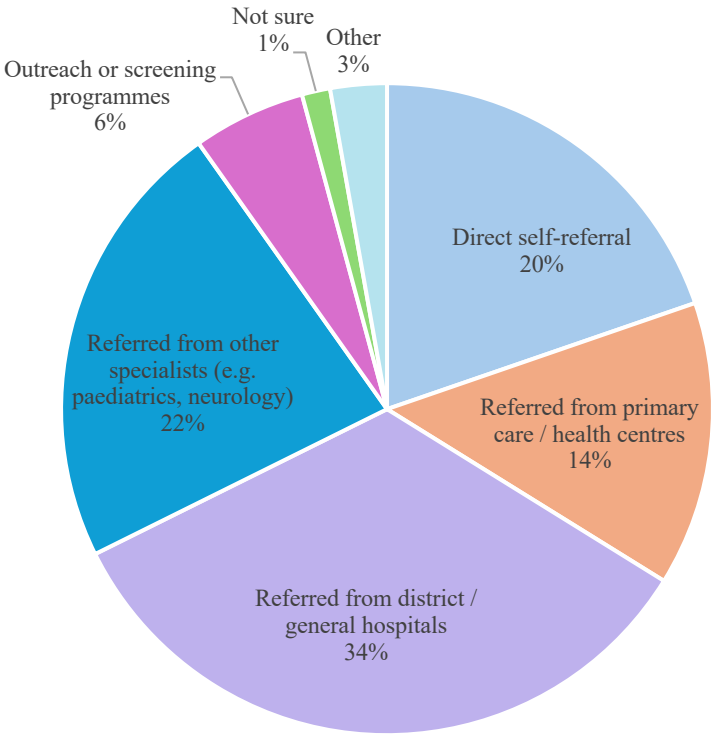


Figure 14 shows the reported referral pathways through which patients requiring surgical care for hearing loss typically reach the different facilities of the respondents. The most reported referral pathway was via district general hospitals (34%) followed by referrals from other medical specialists such as paediatricians and neurologists (22%). Direct self-referrals and referrals from primary healthcare centres were reported by 22% and 20% respectively. Only 6% of respondents reported that referrals through outreach or screening services were available.

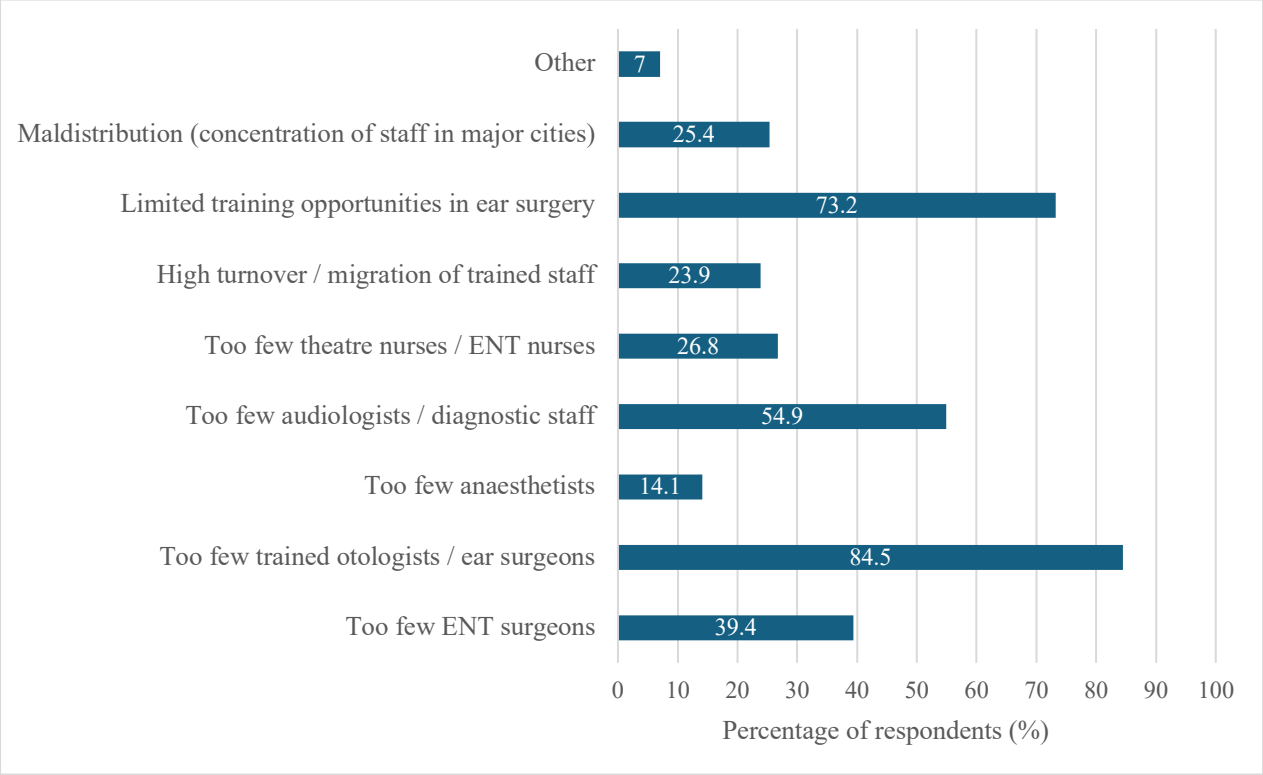
Figure 14: Typical referral pathways for patients requiring surgical care for hearing loss



3.3.5 Perceived Barriers to Accessing Surgical Hearing Loss Care

Respondents were asked about their perceptions of workforce-related barriers affecting access to surgical care for hearing loss in Nigeria. This is illustrated in *Figure 15*. The most frequently identified challenge was a shortage of trained otologists and ear surgeons, reported by 84.5% of respondents followed by limited otology surgery training opportunities (73.2%). Just over half of respondents (54.9%) reported a shortage of audiologists and diagnostic staff, and 39.4% reported shortage of ENT surgeons generally, was a barrier. Less frequently reported challenges included shortage of anaesthetists (14.1%), insufficient specialist nursing team staffing (26.8%), maldistribution of staff (25.4%), and poor staff retention with high turnover or migration of trained staff reported by 23.9% of respondents.

Figure 15: Perceived workforce barriers limiting access to surgical care for hearing loss



Participants' perceptions of barriers affecting access to surgical care for hearing loss in Nigeria were explored by asking them to rate the severity of potential barriers using a Likert-type response scale with four categories: 'not a barrier', 'minor barrier', 'moderate barrier', and 'major barrier'. An additional 'don't know' option was also provided. *Figure 16* presents the data graphically.

Financial barriers were the most significantly reported challenges. Direct cost of surgery was identified as a major barrier by 77.5% of participants and similarly, inadequate government support and funding was rated as a major barrier by 66.2% of respondents. Just over half of the participants (50.7%) rated availability of surgical equipment as a major barrier.

Other potential barriers were commonly reported as moderate. Indirect costs, long waiting times for surgery, and travel time and distance to healthcare facilities were rated moderate barriers by 36.6%, 38% and 36.6% of respondents, respectively.

Barriers related to service delivery were also identified. Availability of operating theatres,

post-operative follow-up and rehabilitation and referral pathways were amongst these, but they were generally classified as minor barriers or perceived as not a barrier. A small proportion of respondents, however, did consider them to be major barriers.

Psychosocial barriers appeared to be less impactful than financial and health-system barriers. More than half of the respondents (57.7%) perceived stigma associated with hearing loss as either minor barrier or not a barrier. Perceptions of fear of hospitals or surgery were more evenly split across response categories, although it was more likely to be rated as a minor (29.6%) or moderate (25.4%) barrier.

Figure 16: Perceived barriers to accessing surgical care for hearing loss among ENT providers in Nigeria

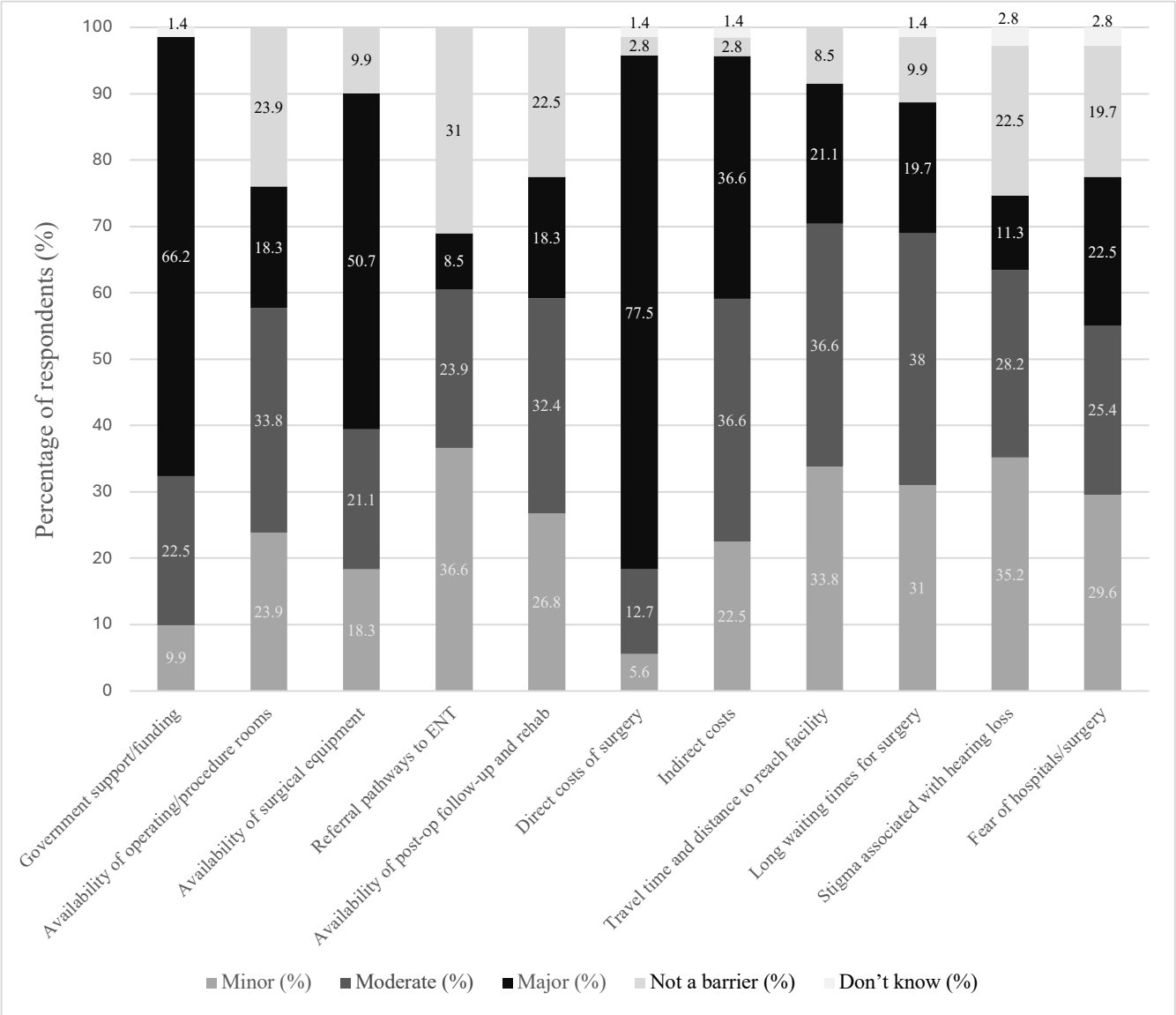


Table 13: Themes, percentages and illustrative quotes from additional barriers perceived by ENT providers through free-text responses (n = 37)

Theme	**n (%)**	**Illustrative quotes**
Cultural barriers	9 (24.3)	"cultural barrier e.g. permission of grandparents needed before care can be accessed"
		"...myths and cultural beliefs…"
Knowledge/awareness	7 (18.9)	"patient's lack of knowledge of availability of hearing loss rehabilitation facilities"
		"more awareness about ear surgery, many people felt ear surgery will worsen their condition"
Training	7 (18.9)	"retraining surgical skills, regular temporal bone dissections among residents to develop interest in otology"
		"limited training opportunities for doctors"
Equipment/infrastructure deficits	5 (13.5)	"theatre space availability in tertiary facilities is a major barrier i.e sharing suites with other specialties, no dedicated ENT theatre"
		"running a clinic with power outages and network failures…"
Acceptance	5 (13.5)	"fear of surgery by patients and relatives...prejudice in view of those whose close relatives and friends died from surgery or similar surgeries."
		"declined consent by caregivers"

Free text responses highlighted other barriers that were not fully captured by the pre-outlined survey options. Recurring themes were manually coded, thematically analysed and results are presented in *Table 13*.

Thirty-seven respondents left additional information in the free-text response for this section of the survey. From the analysis, five major themes were identified from the responses:

cultural barriers, patient's knowledge and awareness, workforce training, deficits in infrastructure, and patient's acceptance and perceptions of surgery.

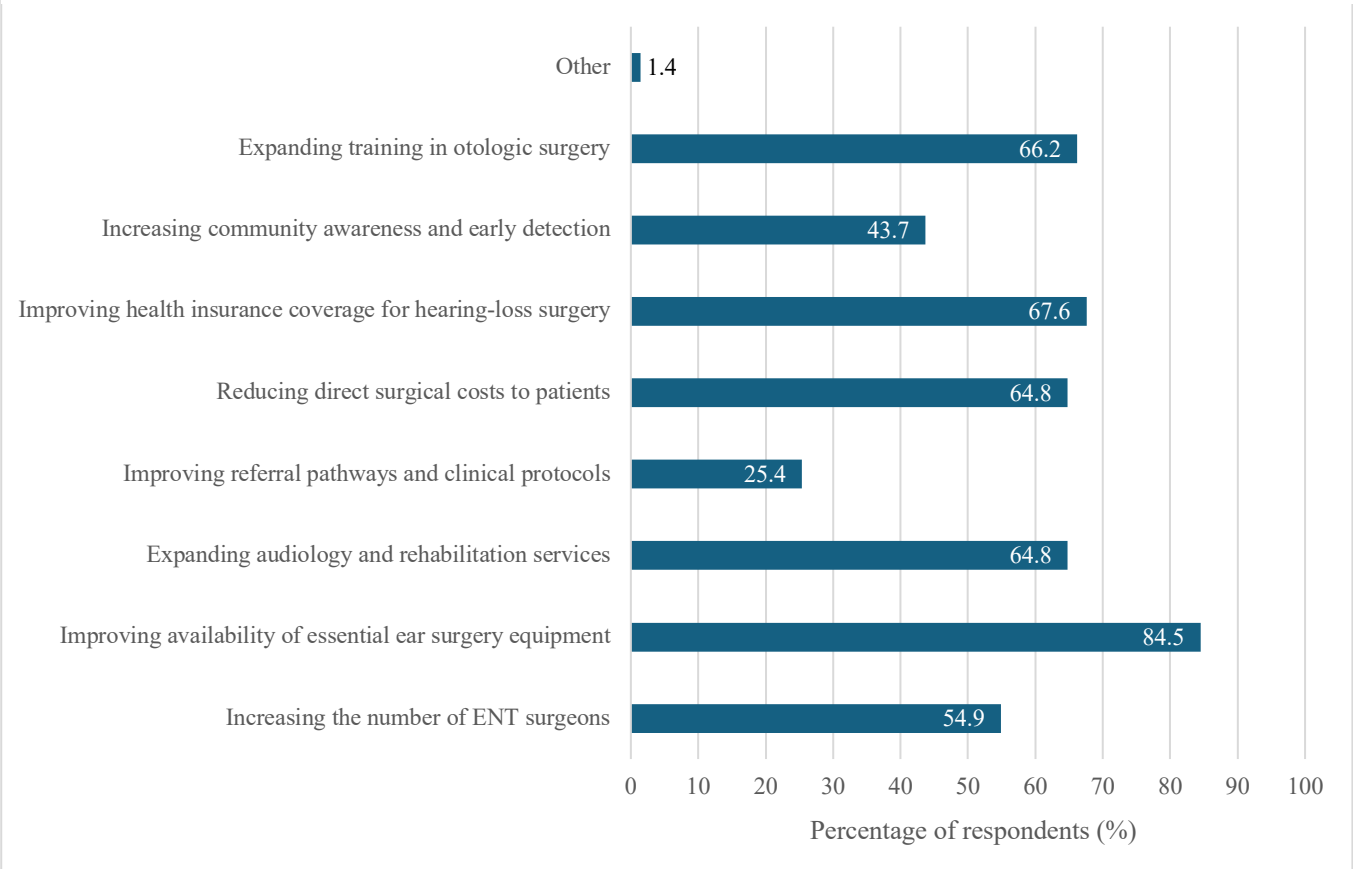
Cultural barriers were the most reported additional theme, identified by 24.3% of respondents. Family decision, myths and cultural beliefs were highlighted as contributors to surgical care access for hearing loss. Poor patient awareness and knowledge was the next most reported theme (18.9%), with limited knowledge on where to access care and misconceptions about ear surgery being reported.

Furthermore, the need for additional otologic surgical training and limitations in infrastructure and equipment were reported by respondents 18.9% and 13.5%, respectively. Acceptance of surgery by patients was also reported as a barrier with fear of surgical outcomes and refusal of consent by caregivers described as factors influencing access.

3.3.6 Proposed Interventions to Improve Access

Several priority interventions to improve access to surgical care for hearing loss were identified *(Figure 17).* Participants were asked to select up to three changes they perceived would most improve access to surgical care for hearing loss within their setting. The most frequently reported change was improving the availability of equipment for ear surgery (84.5%), followed by changes that address financial constraints like improving health insurance coverage (67.6%) and reducing direct surgical costs for patients (64.8%). Workforce related changes such as broadening of training in otologic surgery (66.2%) and expanding audiology and rehabilitation services (64.8) were also commonly reported. The least commonly reported changes were related to referral pathways, patient education and early diagnosis of hearing loss.

Figure 17: Perceived priority changes to improve access to surgical care for hearing loss



Additionally, participants were asked to provide a free-text response to a question asking what they would change, if they could, in their health system to improve access to surgical care for hearing loss. This section was completed by 55 participants, the responses were thematically analysed and presented in *Table 14*.

Four central themes emerged: financial support, workforce training, infrastructure and public health education and awareness. Funding was the most identified theme, reported by 43.6% of respondents who emphasised changes in health insurance coverage and subsidisation of hearing loss surgery to reduce OOP expenditure, particularly for procedures like cochlear implants. Specialist training of the available workforce was the next frequently reported proposed intervention (36.4%). Inadequacy of training, including catastrophic spending on training opportunities were highlighted, as well as need for additional otology-specific

training. 18 respondents (32.7%) described need for changes to infrastructure, facility and essential surgical equipment. Health education and awareness was the least common theme but nevertheless, four respondents highlighted the need for community education to increase awareness amongst the public and at government level.

Table 14: Themes, percentages and illustrative quotes from additional changes proposed by ENT providers through free-text responses (n =55)

Theme	**n (%)**	**Illustrative quotes**
Improve funding	24 (43.6)	"Health insurance coverage for hearing loss surgery, as paying out of pocket for healthcare causes serious financial distress and is not affordable for most patients."
		"Subsidizing or reducing the cost of cochlea implant surgery and other similar devices to become affordable by the larger poor citizens who're mostly affected."
Increased specialist training	20 (36.4)	"training & re-training (training is not adequate, largely due to self-funding inadequacies/catastrophic individual out-of-pocket spending on training)"
		"Approve training of more surgical otologist and diploma program in otology"
Better infrastructure	18 (32.7)	"Get cool devices like facial monitors and functional surgical instruments e.g. drills and burrs"
		"Facility upgrade and provision of necessary equipment for ear surgeries"
Educate/ improve awareness	4 (7.2)	"Create more awareness to the populace, there is low awareness and low health seeking behaviour towards ENT hearing care"
		"Government Attitude due to lack of knowledge"

3.4 Discussion

3.4.1 Summary of Findings

This survey explored perceptions of ENT providers on access to surgical care for hearing loss in Nigeria. Several challenges were identified including inadequacies in funding, infrastructure, equipment availability, workforce capacity and training, cultural and social constraints. While there appears to be significant involvement of ENT specialists in hearing care as reported by the cohort, access to specialist training opportunities in otology and specialist equipment remain limited in Nigeria. Although social barriers such as stigma and fear of surgery were not as influential as financial and health-system challenges, cultural beliefs and knowledge gaps were perceived as factors influencing access to surgical hearing care in this setting. Participants proposed priority areas for improvement. Amongst these were improvements in availability of ear surgery equipment, enhancement of otology training, and better funding mechanisms to reduce CHE for populations requiring advanced ear surgery, as well as for ENT specialists wanting to pursue otology training.

3.4.2 Interpretations

Direct costs of surgery and inadequate government support or funding were highlighted as the two biggest barriers to accessing surgical care for hearing loss in this survey. This was also reflected in the free-text responses emphasising inadequate insurance coverage and high cost of cochlear implantation. The findings are consistent with evidence from The World Report on Hearing (2021) which highlights affordability as an important element of hearing care access, noting that this remains an underfunded area in many settings despite its potential to prevent long-term disability[1]. The high cost of CI surgery has been identified as a major barrier to access in Nigeria within this context. Jesuyajolu *et al.,* highlighted the financial burden associated with CI surgery, including cost of device, operation, and post-op

rehabilitation[62]. This is particularly challenging because healthcare payments in Nigeria are mostly paid out-of-pocket and health insurance only covers 4% of the population and does not include advanced ear surgery like cochlear implantation[63]. It is, therefore, unsurprising that CI was the least reported EHC service available (26.8%) in this survey.

Indirect costs were identified as a major or moderate barrier by 73.2% of respondents. This survey suggests that ENT specialists and otologic services in Nigeria are concentrated in urban tertiary settings, and most referral pathways rely heavily on district general referrals. This implies that patients may incur non-medical costs when travelling long distances for specialist assessment and treatment. Similar concerns have been raised in Nigerian studies, where transportation to access healthcare services was reported as a barrier to timely hearing-loss care[64]. Studies on workforce coverage have also demonstrated geographic inequalities in hearing care provision due to rural-urban maldistribution of EHC providers[1,65]. Together, these factors may increase financial burden, delays in diagnosis and treatment, and may extend beyond surgical intervention.

Financial support was perceived as a priority for intervention in this survey. Both quantitative and qualitative findings suggest that respondents viewed financial support mechanisms important for improving access to surgical hearing care. Improved health insurance coverage and subsidisation of ear surgery were frequently proposed as priority interventions to decrease financial stress for care users. This aligns with recommendations from the World Report on Hearing, advocating for EHC to be integrated into national health financing frameworks to aid in decreasing the inequities in surgical care associated with affordability[1].

Challenges in workforce capacity were highlighted as a barrier to accessing surgical care for hearing loss. Although quantification of national estimates of the otology workforce in Nigeria is limited, shortage of trained otologists was the most common workforce barrier perceived by respondents. This is likely secondary to limited training opportunities, which

was the second most common workforce issue reported in the survey. Also, only 6% of respondents rated perceived workforce capacity to patient need as excellent. These findings are consistent with global workforce estimates that identified Africa as the region with the lowest ENT workforce density worldwide, with a clinician to population ratio of 0.18 per 100,000[65]. This suggests that improvements in surgical hearing care will require strategies to address clinical specialist gaps and training inadequacies, as implied by 66.2% of respondents perceiving expansion of otologic surgery training as a priority. This is further supported by some of the qualitative data. One respondent expressed the need to "…improve remuneration to enable young ones to join residency in ENT." This means that workforce limitations are multifactorial and financial barriers are not limited to service users or caregivers. The lack of funding is also a constraint linked to care providers that influences specialist capacity and drives poor surgical care access for hearing loss. Despite reported shortages in otology trained ENT clinicians, approximately two-thirds of respondents indicated that their facility received occasional support from visiting specialists. Over a third, however, reported never receiving visiting specialist support, suggesting that external outreach alone may be insufficient to tackle deficiencies in ear specialist workforce. Furthermore, this survey described shortage of audiologists and diagnostic personnel in Nigeria, with more than half of the respondents reporting that there are 'too few audiologists' and only one audiologist responded to the survey. At the same time, audiologists were the second most frequently reported group involved in EHC, after ENT consultants and registrars/trainees. This highlights the important role audiological services play in the delivery of EHC, simultaneously demonstrating their limited availability. While discussions regarding workforce capacity tend to focus on surgeon availability, surgical management of hearing loss involves a multidisciplinary team, and audiologists play a key role in the initial stage with diagnostic testing, initiation of probable non-surgical management e.g. hearing aid

provision and post-operative rehabilitation. This deficit in hearing care professionals is not only limited to the African context, similar workforce shortages have been identified globally, but particularly in LMICs[66]. This suggests that access to surgical intervention for hearing loss may not only be limited at one stage, but across the entire pathway from diagnosis to long-term care. The noticeable percentage of respondents (64.8%) who proposed expansion of audiological and rehabilitation services as a necessary intervention further suggests that improving non-surgical workforce in EHC should be a key future consideration as it may indirectly improve surgical care access.

Inadequate surgical equipment was identified as a major barrier to ear surgery access by over half of the participants and was the most frequently selected proposed intervention overall. Free-text responses highlighted concerns regarding limited access to specific ear surgery equipment, and need for facility upgrades and ENT-specific operating theatres. This is a key finding consistent with existing literature. A report from a multinational survey of ENT specialists identified substantial disparities in the availability of ear surgery equipment across LMICs, with essential equipment like otology drills, burrs, otoendoscopes, tympanomastoidectomy sets and CI equipment frequently reported as unavailable in these settings[40]. They argued that the high cost of specialty-specific equipment and lack of ENT infrastructure prioritisation contribute to these access challenges. These findings suggest that improving availability of common and essential otologic equipment should be considered a priority, particularly in resource-limited settings where surgically preventable hearing loss remains a problem. However, this may only be successful if awareness of this is made to policy makers for prioritisation, as suggested by one respondent in the survey who stated that "government attitudes due to lack of knowledge" need to be addressed.

Better infrastructure was highlighted as an additional barrier and as an area of focus for improvement. One respondent described challenges with running clinics with "power outages

and network failures." Similarly, a previous study assessing the surgical capacity of 41 private rural hospitals in Southern Nigeria found that only half of the surveyed hospitals had access to external electricity[16]. This is one of the physical systems issues highlighted in literature as needing improvement before advanced ear surgeries like cochlear implantation can be safely established in Nigeria[62]. This, together with the emphasis on equipment and infrastructure development as priority areas for improvement in this survey, suggests that even without other constraints like EHC workforce shortages, inequities in ear surgery access will arise. The lack of equipment would limit range and quality of EHC services that can be provided even if there was adequate manpower. Targeted investment in equipment, facilities and training personnel are recommendations that have been made for strengthening EHC services[1]. This should, therefore, be utilised to improve access to surgical care for hearing loss in Nigeria.

Although sociocultural factors were not perceived as strongly as other health-system and financial barriers, they remained important. The quantitative data from this survey showed that stigma was not perceived as a major barrier by most respondents and fear of surgery was generally rated a minor or moderate barrier. Within the free-text responses, however, cultural and social barriers were the most frequently identified additional barrier. This suggests that structured questionnaires may not fully capture sociocultural influences on surgical access in this context. Cultural beliefs, myths around surgery and family dynamics in decision making were described. Similar findings have been reported in Nigeria where delayed recognition and management of ear disease in children have been secondary to limited awareness amongst caregivers, and embarrassment in visiting healthcare facility[64,67]. This highlights ongoing challenges related to health-seeking behaviour which in turn contribute to reduced treatment uptake and poorer engagement with longitudinal care. Importantly, public awareness and education were identified by respondents as potential strategies for improving

access to care. Together, this suggests that improving access to surgical care in this context should involve community education initiatives that promote hearing health literacy and change social perceptions of hearing loss, as well as reduce misconceptions surrounding ear surgery.

3.4.3 Limitations

This study has several limitations. First, the survey utilised a convenience sampling approach through a professional WhatsApp group comprising of members of the ORLSON, which may have introduced some selection bias. Consequently, the findings may not fully reflect the views of all hearing care providers in Nigeria. Participation was voluntary, and this may have introduced non-response and self-selection bias, as individuals who chose to respond may differ systematically from non-responders and those with stronger views are more likely to participate. Whilst a response rate of 21% is modest, it is consistent with typical response rates described in survey literature of healthcare professionals, particularly in resource-challenged settings[68]. Although ORLSON is the main ENT professional body in Nigeria, it may not be fully representative of professionals involved in hearing care in the country. The sample is likely missing several groups. These may include ENT providers who are not members of ORLSON or not active on the WhatsApp platform and individuals working in remote areas with no digital access. Furthermore, the predominance of respondents from urban-tertiary settings limited the ability to explore geographic differences in access to care. This means that while the findings from this study may be useful and pragmatic, they should be interpreted carefully as they may not be generalisable to all settings within Nigeria, particularly rural environments where challenges may differ. Additionally, the cross-sectional nature of this study means that perspectives are only captured at one single point in time and changes in access overtime cannot be assessed.

Chapter 4: Conclusion

4.1 Summary

Hearing loss is a major cause of disability in Africa, and surgical interventions can reduce or prevent related disability. Barriers and facilitators affecting access to surgical care for hearing loss remain poorly defined. This thesis combined a systematic review and provider survey to examine the African evidence base and provide context-specific insights within Nigeria to offer a deeper understanding of factors influencing access to hearing loss surgery. The search for the systematic review ran from the year 2000 until the review start date, and a total of 17 studies were included, in which Nigeria was the most represented country.

The review findings demonstrate that barriers to surgical care for hearing loss in Africa are multifactorial and rarely occur in isolation. Factors influencing access in this context can be mapped to the definition of healthcare access described by Penchansky and Thomas in 1981; availability, accessibility, affordability, accommodation and acceptability.

Barriers relating to availability were the most frequently reported across the review and this was further highlighted in the survey study. Shortages of hearing specific workforce, including ENT surgeons and non-physicians like audiologists, inadequate equipment and workforce training were reported as challenges restricting service provision. Financial burden also emerged as a significant barrier to access within this thesis. Direct surgical costs, coupled with poor health insurance coverage, indirect expenses such as transportation, and long-term rehabilitation requirements for some surgeries all contributed to health inequities affecting access. These factors, however, appeared to be more evident within the survey study. A large proportion of survey respondents rated poor funding and cost of ear surgery as major barriers to ear surgery access, and improving insurance coverage was the second most proposed intervention. Although financial burden was overall perceived by survey

respondents as the most significant barrier to accessing care for hearing loss surgery, equipment availability was the most frequently proposed priority to improving access. This contrasts with the systematic review where availability barriers were more frequently reported in provider-focused studies. This suggests that providers may view service availability as playing a critical role in surgical access despite affordability concerns, and financial constraints may be underreported in published literature. Another access dimension that may similarly be underreported in literature compared to perceived importance in clinical practice is acceptability. Although it was the least reported access domain in the review, cultural barriers and public awareness were the most common qualitative theme related to barriers in the survey.

Geographical challenges were highlighted and were predominantly secondary to workforce distribution, with a higher concentration of hearing loss services within urban and tertiary centres, creating travel burden for rural populations. Efforts to decentralise EHC services, however, were among interventions described.

Findings from both the review and the survey suggest that addressing the barriers identified will likely require a multifaceted approach that addresses workforce and infrastructure constraints, financing demands and public engagement with healthcare. Evidence suggests that workforce training programmes, outreach services and international partnerships may improve access across multiple access dimensions. However, combined findings suggest that factors mapped to availability may underpin other barriers to access. Across the review, facilitators were highly concentrated within the availability domain. This was mirrored in the survey, where respondents consistently identified workforce shortages, specialist training opportunities and equipment availability as some of the highest priority areas for intervention.

4.2 Contribution to the Field

This thesis has shown that there is limited existing literature evaluating factors influencing access to surgical care for hearing loss across Africa, and it has comprehensively addressed an important gap in this field. Mapping the barriers and facilitators identified across the Penchansky and Thomas healthcare access framework enabled the provision of a comprehensive understanding of access in this context than would have been achieved through examining the factors independently. By combining a systematic review with a survey of ENT care providers in Nigeria, this thesis was able to validate evidence from existing literature with perspectives of those directly involved with the health system. An important contribution is the identification of health service availability as a cornerstone for addressing other access dimensions. Both studies demonstrated that deficits in EHC personnel, otology training and equipment, remain key issues to ear surgery access in Africa. Prioritising interventions to address these challenges may be required for successful improvements across other access dimensions.

Given the interconnected nature of the barriers identified in this research, interventions addressing multiple dimensions of access simultaneously through integrated approaches are more likely to lead to sustainable improvements in this field. Many of the proposed interventions, however, need sustainable financing and without addressing underlying funding limitations, improvements in EHC surgical services are unlikely to be successful. Addressing availability constraints should involve outreach programmes, international partnerships, task sharing, training initiatives and mobile surgical services. Strengthening infrastructure and service organisation may include decentralisation of EHCs and structured hearing screening and referral pathways. Longer term sustainable improvements in surgical EHC access will likely depend on wider health system reforms. Integration of EHC within national surgical planning frameworks, health insurance coverage for high-cost surgical

hearing interventions such as cochlear implants, and remuneration for otology specialist training should all be priorities.

4.3 Future work

Findings from this research are unlikely to be representative of all African settings and likely reflect only a snapshot of the complexity of constraints to accessing surgical care for hearing loss across Africa. The challenge doesn't seem to be the ability to study the problem but rather finding a better way to systematically capture the data. This presents a need for more varied research to capture both patient-centred and caregiver perspectives, as well as studies from underrepresented African countries and rural regions.

There is still a notable gap in the quantitative measurement of access and evaluation of intervention effectiveness. Future research would benefit from structured and inclusive data collection with broader geographical coverage across urban and rural facilities. This may include multi-country ENT surgical service audits, facility-based studies and mixed methods research to capture measurable barriers as well as lived experiences. Standardised reporting of access indicators including, travel burden, surgical treatment delays and OOP expenditures, reported with consistent metrics to quantitatively capture the surgical access burden, would improve comparability across settings and inform targeted policy and health system response. Furthermore, research evaluating interventions designed to improve access in this field should be prioritised, particularly those surrounding task-sharing and training initiatives, international partnerships and financing strategies.

Finally, future research should explore how barriers and facilitators to surgical care for hearing loss differ between paediatric and adult populations. This could help inform more targeted strategies for different populations across the life course. Building on the findings of this thesis, a potential doctoral research programme could combine this comparison with

implementation and evaluation of a health system intervention designed to improve access to surgical care for hearing loss in an African country.

Chapter 5: References

1. World Health Organisation. World Report on Hearing [Internet]. Geneva: World Health Organization; 2021. Available from: https://www.who.int/publications/i/item/world-report-on-hearing doi:10.4060/9789240020481 [Access 18/01/2026]

2. Haile LM, Kamenov K, Briant PS, Orji AU, Steinmetz JD, Abdoli A, et al. Hearing loss prevalence and years lived with disability, 1990-2019: Findings from the Global Burden of Disease Study 2019. The Lancet. 2021 Mar;397(10278):996–1009. doi:10.1016/S0140-6736(21)00516-X

3. World Health Organization Regional Office for Africa. Status report on ear and hearing care in the WHO African region [Internet]. Brazzaville, Republic of the Congo: World Health Organization, Regional Office for Africa; 2024. Available from: https://iris.who.int/handle/10665/379973 [Accessed 18/01/2026]

4. Olusanya BO, Neumann KJ, Saunders JE. The global burden of disabling hearing impairment: a call to action. Bull World Health Organ. 2014 May 1;92(5):367–73. doi:10.2471/BLT.13.128728

5. McDaid D, Park AL, Chadha S. Estimating the global costs of hearing loss. Int J Audiol. 2021;60(3):162–70. doi:10.1080/14992027.2021.1883197

6. Monasta L, Ronfani L, Marchetti F, Montico M, Brumatti L, Bavcar A, et al. Burden of disease caused by otitis media: Systematic review and global estimates. PLoS ONE. 2012 Apr;7(4). doi:10.1371/journal.pone.0036226

7. Van de Heyning P, Claes J, Brokx J, Declau F, Boudewyns A, Hamans E, et al. Surgical management of hearing impairment in audiological medicine. In: Luxon L, Furman JM, Martini A, Stephens D, editors. Textbook of Audiological Medicine: Clinical Aspects of Hearing and Balance. London: Martin Dunitz; 2003. p. 603–637

8. Zahnert T. Differenzialdiagnose der schwerhörigkeit. Dtsch Arzteblatt. 2011 Jun;108(25):433–44. doi:10.3238/arztebl.2011.0433

9. Sharma SD, Cushing SL, Papsin BC, Gordon KA. Hearing and speech benefits of cochlear implantation in children: A review of the literature. Int J Pediatr Otorhinolaryngol. 2020 Jun;133. doi:10.1016/j.ijporl.2020.109984

10. Wilson BS, Tucci DL, Merson MH, O'Donoghue GM. Global hearing health care: new findings and perspectives. The Lancet. 2017 Dec;390(10111):2503–15. doi:10.1016/S0140-6736(17)31073-5

11. Fagan JJ. Developing World ENT: A global responsibility. J Laryngol Otol. 2012 Jun;126(6):544–7. doi:10.1017/S0022215112000345

12. Bhutta MF, Bu X, de Muñoz PC, Garg S, Kong K. Training for hearing care providers. Bull World Health Organ. 2019 Oct;97(10):691–8. doi:10.2471/BLT.18.224659

13. Ravi R, Gunjawate DR. Parent reported barriers and facilitators towards cochlear implantation – A systematic review: Barriers and facilitators in cochlear implantation. Int J Pediatr Otorhinolaryngol. 2020 Sep;136. doi:10.1016/j.ijporl.2020.110163

14. Meara JG, Leather AJM, Hagander L, Alkire BC, Alonso N, Ameh EA, et al. Global Surgery 2030: evidence and solutions for achieving health, welfare, and economic development. The Lancet. 2015 Aug;386(9993):569–624. doi:10.1016/S0140-6736(15)60160-X

15. Penchansky R, Thomas JW. The concept of access: definition and relationship to consumer satisfaction. Med Care. 1981 Feb;19(2):127-40. doi: 10.1097/00005650-198102000-00001. PMID: 7206846

16. Henry JA, Windapo O, Kushner AL, Groen RS, Nwomeh BC. A survey of surgical capacity in rural southern Nigeria: Opportunities for change. World J Surg. 2012;36(12):2811–8. doi:10.1007/s00268-012-1764-0

17. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. BMJ. 2021 Mar;372. doi:10.1136/bmj.n71

18. Campbell S. A Filter to Retrieve Studies Related to Africa and African Countries from the Ovid EMBASE Database. Geoffrey Robyn Sperber Health Sci Libr Univ Alta 2018. 2018.

19. Haddaway NR, Grainger MJ, Gray CT. Citationchaser: A tool for transparent and efficient forward and backward citation chasing in systematic searching. Res Synth Methods. 2022 Jul;13(4):533–45. doi:10.1002/jrsm.1563

20. Veritas Health Innovation. Covidence systematic review software [Internet]. Melbourne, Australia: Veritas Health Innovation; 2025 [cited 2026 Jan 19]. Available from: https://www.covidence.org

21. Joanna Briggs Institute. JBI [Internet]. [cited 2026 Apr 16]. Critical Appraisal Tools. Available from: https://jbi.global/critical-appraisal-tools

22. Choffor-Nchinda E, Fokouo Fogha JV, Ngo Nyeki AR, Dalil AB, Meva'a Biouélé RC, Me-Meke GP. Approach and solutions to congenital hearing impairment in Cameroon: perspective of hearing professionals. Trop Med Health. 2022 Dec;50(1). doi:10.1186/s41182-022-00430-7

23. Mulwafu W, Ensink R, Kuper H, Fagan J. Survey of ENT services in sub-Saharan Africa: Little progress between 2009 and 2015. Glob Health Action. 2017 May;10(1). doi:10.1080/16549716.2017.1289736

24. Byaruhanga R, Rourke R, Awubwa M, Westerberg BD, Rolland JT, Vaccani JP. Increased frequency of visits improves the efficiency of surgical global health initiatives. J Otolaryngol - Head Neck Surg. 2013;42(JUNE). doi:10.1186/1916-0216-42-41

25. Lukama L, Kalinda C, Kuhn W, Aldous C. Availability of ENT Surgical Procedures and Medication in Low-Income Nation Hospitals: Cause for Concern in Zambia. BioMed Res Int. 2020;2020. doi:10.1155/2020/1980123

26. Orji F. A survey of the burden of management of chronic suppurative otitis media in a developing Country. Ann Med Health Sci Res. 2013;3(4):598–598. doi:10.4103/2141-9248.122126

27. Mulwafu W, Fagan JJ. Improving access to hearing care services and professionals in Africa through task sharing: The Malawian experience. East Cent Afr J Surg. 2019 Oct;24(2):78–81. doi:10.4314/ecajs.v24i2.1

28. Guntinas-Lichius O, Wittekindt C, Baier M, Manni JJ. Optimising the pre-treatment process before mobile ear surgery for chronic suppurative otitis media in Wolisso and Attat, Ethiopia. J Laryngol Otol. 2014;128(5):421–4. doi:10.1017/S002221511400098X

29. Fagan JJ, Jacobs M. Survey of ENT services in Africa: Need for a comprehensive intervention. Glob Health Action. 2009;2(1):1–7. doi:10.3402/gha.v2i0.1932

30. Bhamjee A, Roux T le, Schlemmer K, Perold J, Cass N, Schroeder K, et al. Parent-perceived challenges related to the pediatric cochlear implantation process and support services received in South Africa. Int J Pediatr Otorhinolaryngol. 2019 Nov;126. doi:10.1016/j.ijporl.2019.109635

31. Ibrahim AM, El-Gilany AH, Mohamed EWA, Farrag NS. Perceived benefits of cochlear implants by parents: expectations, decision-making process, and barriers to care. J Egypt Public Health Assoc. 2023 Dec;98(1). doi:10.1186/s42506-023-00132-w

32. Bako BB. The Challenges of Cochlear Implant Users in Jos, North Central Nigeria. Int J Otolaryngol Head Amp Neck Surg. 2022;11(04):175–92. doi:10.4236/ijohns.2022.114019

33. Adoga A, Nimkur T, Silas O. Chronic suppurative otitis media: Socio-economic implications in a tertiary hospital in Northern Nigeria. Vol. 4. 2010. p. 3–3. (Pan African Medical Journal).

34. Akinpelu OV, Amusa YB, Komolafe EO, Adeolu AA, Oladele AO, Ameye SA. Challenges in management of chronic suppurative otitis media in a developing country. J Laryngol Otol. 2008 Jan;122(1):16–20. doi:10.1017/S0022215107008377

35. El-Begermy MA, Deghady HA, El-Seidy N, Ezzat A, El-Begermy MM, AlAqel AW, et al. Save the hearing, an ear surgery training project program to combat deafness in developing countries. Egypt J Otolaryngol. 2020 Dec;36(1). doi:10.1186/s43163-020-00022-4

36. Evangelista S, Khoza-Shangase K, Bent J. Cochlear Implant Decisions in South Africa: Parental Views, Barriers, and Influences [Internet]. 2025. doi:10.3390/healthcare

37. Adobamen PROC. Tympanoplasty: Is exposure adequate for Otorhinolaryngology Residents in Nigeria? [Internet]. Vol. 18. 2011. p. 279–279. (The Nigerian Postgraduate Medical Journal). Available from: www.axon.esResconstructive

38. Salisu AD. Otology practice in a Nigerian tertiary health institution: A 10-year review. Ann Afr Med. 2010;9(4):218–21. doi:10.4103/1596-3519.70958

39. Sambo GU, Bakari A, Samdi MT, Mainasara GM, Yohanna J, Kirfi AM. Otologic surgeries in National Ear Care Centre, Kaduna, Nigeria: A 5 years review. Indian J Otol. 2015 Jul;21(3):190–3. doi:10.4103/0971-7749.159703

40. Srinivasan T, Cherches A, Seguya A, Pandey A, Fei-Zhang D, Nuss S, et al. Essential Equipment for Baseline Otolaryngology-Head and Neck Surgery Care: A Global Cross-Sectional Survey. Laryngoscope Investig Otolaryngol. 2025 Feb;10(1). doi:10.1002/lio2.70078

41. Ta NH. ENT in the context of global health. Ann R Coll Surg Engl. 2019;101(2):93–6. doi:10.1308/rcsann.2018.0138

42. Thaddeus S, Maine D. Too far to walk: Maternal mortality in context. Soc Sci Med. 1994 Apr;38(8):1091–110. doi:10.1016/0277-9536(94)90226-7

43. Kerr G, Tuomi S, Müller A. Costs involved in using a cochlear implant in South Africa. South Afr J Commun Disord Suid-Afr Tydskr Vir Kommun. 2012;59:16–26. doi:10.7196/sajcd.117

44. Emmett SD, Tucci DL, Smith M, Macharia kIsaac M, Ndegwa kSerah N, Nakku D, et al. GDP Matters: Cost Effectiveness of Cochlear Implantation and Deaf Education in Sub-Saharan Africa. Vol. 36. 2015. p. 1357–65. (Otol Neurotol).

45. Lasisi AO, Ajuwon AJ, Lasisi AO. Beliefs and perceptions of ear, nose and throat-related conditions among residents of a traditional community in Ibadan, Nigeria. 2002. p. 31–45. (Afr J Med med Sci).

46. Kanji A, Mirkin L, Casoojee A. Experiences of parents of children with cochlear implants in South Africa: an exploratory study. Disabil Rehabil. 2024;46(21):5044–51. doi:10.1080/09638288.2023.2297924

47. Le Roux T, Swanepoel DW, Louw A, Vinck B, Tshifularo M. Profound childhood hearing loss in a South Africa cohort: Risk profile, diagnosis and age of intervention. Int J Pediatr Otorhinolaryngol. 2015 Jan;79(1):8–14. doi:10.1016/j.ijporl.2014.09.033

48. Suleiman AO, Suleiman BM, Abdulmajid UF, Suleiman MR, Mustapha AY, Afolabi OA, et al. Paediatric cochlear implantation in north-western Nigeria case report and review of our challenges. Int J Pediatr Otorhinolaryngol. 2014 Feb;78(2):363–5. doi:10.1016/j.ijporl.2013.10.061

49. Kahinga AA, Abraham ZS, Mawala S, Liyombo E. Cochlear implantation and outcomes in a resource–limited setting: experience from Tanzania. South Sudan Med J. 2022 Jun;15(2):50–3. doi:10.4314/ssmj.v15i2.3

50. World Health Organization. Task Shifting - Global Recommendations and Guidelines [Internet]. Geneva; 2008. Available from: https://iris.who.int/handle/10665/43821

51. Sykes KJ. Short-Term Medical Service Trips: A Systematic Review of the Evidence. Am J Public Health. 2014;104:38–48. doi:10.2105/AJPH.2014

52. Mac Quene T, Smith L, Odland ML, Levine S, D'Ambruoso L, Davies J, et al. Prioritising and mapping barriers to achieve equitable surgical care in South Africa: a

multi-disciplinary stakeholder workshop. Glob Health Action. 2022;15(1). doi:10.1080/16549716.2022.2067395

53. World Bank. World Development Indicators [Internet]. [cited 2026 Jun 14]. The World by Income and Region. Available from: https://datatopics.worldbank.org/world-development-indicators/the-world-by-income-and-region.html

54. Swords C, Ghedia R, Blanchford H, Arwyn-Jones J, Heward E, Milinis K, et al. Socioeconomic and ethnic disparities associated with access to cochlear implantation for severe-to-profound hearing loss: A multicentre observational study of UK adults. PLoS Med. 2024 Apr;21(4 April). doi:10.1371/journal.pmed.1004296

55. Quimby AE, Venkatesh S, Corsten M, McDonald JT, Hwa TP, Bigelow DC, et al. Socioeconomic Status among Cochlear Implant Candidates and Association with Surgical Pursuance. JAMA Otolaryngol - Head Neck Surg. 2023 Oct;149(10):891–8. doi:10.1001/jamaoto.2023.2217

56. Edmond K, Chadha S, Hunnicutt C, Strobel N, Manchaiah V, ChristineYoshinaga-Itano. Effectiveness of universal newborn hearing screening: A systematic review and meta-analysis. J Glob Health. 2022;12. doi:10.7189/jogh.12.12006

57. Patterson RH, Suleiman O, Hapunda R, Wilson B, Chadha S, Tucci D. Towards universal access: A review of global efforts in ear and hearing care. Hear Res. 2024 Apr;445. doi:10.1016/j.heares.2024.108973

58. Carner M, Bianconi L, Fulco G, Confuorto G, Soloperto D, Molteni G, et al. Personal experience with the remote check telehealth in cochlear implant users: from COVID-19 emergency to routine service. Eur Arch Otorhinolaryngol. 2023 Dec;280(12):5293–8. doi:10.1007/s00405-023-08045-2

59. Cullington H, Kitterick P, Weal M, Margol-Gromada M. Feasibility of personalised remote long-term follow-up of people with cochlear implants: A randomised controlled trial. BMJ Open. 2018 Apr;8(4). doi:10.1136/bmjopen-2017-019640

60. Adoga SA, Nwaorgu OGB, Anthis J, Green JD. Our experience with cochlear implant surgery on Nigerians. Indian J Otol. 2014;20(3):134–9. doi:10.4103/0971-7749.136871

61. NHS England. NHS England [Internet]. NHS England; [cited 2026 Jun 14]. Specialised Ear Services. Available from: https://www.england.nhs.uk/commissioning/spec-services/npc-crg/group-d/specialised-ear-services/

62. Jesuyajolu D, Obuh O, Edeh E. Overcoming developing-world challenges in cochlear implantation: A Nigerian perspective. Ann Med Surg. 2023 Nov;85(11):5533–7. doi:10.1097/ms9.0000000000001318

63. Akinyemi, O.O., Owopetu, O.F., Agbejule, I.O. National Health Insurance Scheme: Perception and Participation of Federal Civil Servants in Ibadan. Vol. 19. 2021;19(1):49–55.

64. Ekere I, Adeyemo AA. Barriers to prompt diagnosis and management of children with hearing loss. Ibom Med J. 2024 Sep;17(3):584–90. doi:10.61386/imj.v17i3.523

65. Petrucci B, Okerosi S, Patterson RH, Hobday SB, Salano V, Waterworth CJ, et al. The Global Otolaryngology-Head and Neck Surgery Workforce. JAMA Otolaryngol - Head Neck Surg. 2023 Oct;149(10):904–11. doi:10.1001/jamaoto.2023.2339

66. Kamenov K, Martinez R, Kunjumen T, Chadha S. Ear and Hearing Care Workforce: Current Status and its Implications. Ear Hear. 2021 Mar;42(2):249–57. doi:10.1097/AUD.0000000000001007

67. Adegbiji WA, Olajide GT, Olatoke F, Olajuyin AO, Olubi O, Ali A, et al. Preschool children hearing impairment: Prevalence, diagnosis and management in a developing country. Int Tinnitus J. 2018 Jun;22(1):60–5. doi:10.5935/0946-5448.20180010

68. Cunningham CT, Quan H, Hemmelgarn B, Noseworthy T, Beck CA, Dixon E, et al. Exploring physician specialist response rates to web-based surveys. BMC Med Res Methodol. 2015 Apr;15(1). doi:10.1186/s12874-015-0016-z

Chapter 6: Appendices

Appendix 1: Systematic review screening guide

Appendix 2: Systematic review data extraction table

Appendix 3: Questionnaire