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REVIEW ARTICLE



Barriers to access to ear and hearing care services in low- and middle- income countries: A scoping review

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ABSTRACT

People living in low- and middle- income countries (LMICs) meet significant challenges in accessing ear and hearing care (EHC) services. We conducted a scoping review to identify and summarise such barriers, to recognise gaps in the literature, and to identify potential solutions. Reviewers independently screened titles, abstracts and full-text articles and charted data. We undertook thematic analysis of supply and demand side dimensions of access, and summarised findings mapped against the Levesque framework. Of 3048 articles screened, 62 met inclusion criteria for review. Across the five access dimensions, supply-side constraints were more frequently described, the most common being a shortage of EHC workforce or appropriate facilities, despite high demand. We identified a thin geographical spread of literature on barriers to accessing EHC services in LMICs, reflecting low availability of such services. LMICs face a diverse range of demand and supply side challenges including workforce, equipment and resource shortages, and challenges for the majority of the population to pay for such services. There is a need for many LMICs to develop health policy and programmes in EHC, including integration into primary care, scaling up the EHC workforce through increased training and education, and improving EHC literacy through public health measures.

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Barriers to access; hearing loss; ear disease; low- and middle- income countries; scoping review

Introduction

Hearing loss is experienced by more than 1.5 billion people globally, of whom at least 430 million have a need for care (World Health Organization, 2021b). An estimated 80% of the global burden of hearing loss lies within low- and middle-income countries (LMICs) where there is a lack of adequate services to meet the need (Kamenov et al., 2021; Wilson et al., 2017). Globally, it is estimated that over 400 million people would benefit from hearing aids, yet the large majority do not have access to them (Orji et al., 2020). Delayed or lack of access to ear and hearing care (EHC) can significantly impact a person's life, including in education, employment, finance, physical health, socialisation and mental health (Graydon et al., 2018). The global economic cost of unaddressed

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hearing loss was conservatively estimated to be US\$981 billion in 2019, mainly attributable to effects on quality of life and loss of productivity (McDaid et al., 2021). However, global profile raising of EHC has seen growing prioritisation of ear disease and hearing loss (World Health Organization, 2017), and holds promise for developing pathways in which hearing loss is no longer a burden, a focus of the current Lancet Commission on hearing loss (Wilson & Tucci, 2021).

Access to quality, timely and affordable EHC services are vital to improving the function, activity, participation, and quality of life of affected people, through reducing the prevalence and impact of hearing loss. There are, however, many challenges in establishing viable EHC services, and when they do exist, difficulties in optimising utilisation by those in need. The recent World Health Organisation (WHO) 'World Report on Hearing' highlighted challenges in developing EHC services in LMICs which include, but are not limited to, the rising prevalence of hearing loss associated with demographic and population trends, EHC literacy, social stigma, and health system issues such as a lack of clinical services, access to resources, data and indicators, governance and finance (World Health Organization, 2021b).

Strategies to improve access to EHC services for people living in LMICs should be informed by the perspective of both providers and those people in need of care. Therefore, identifying barriers to accessing EHC is critical for planning, policy development and building capacity for an integrated hearing care system that will address the needs of the population, but to date there has been no review of this topic. Measuring access to care is a challenging task, however several frameworks exist to help understand the range of factors involved. An increasingly recognised conceptual framework is that developed by Levesque and others (Levesque et al., 2013) which outlines five dimensions of accessibility that capture both supply- and demand-side determinants to the health seeking journey. On the supply (health system) side this includes: 1) Approachability; 2) Acceptability; 3) Availability; 4) Affordability; 5) and Appropriateness. On the demand side (individual, household, and population demand) this includes: 1) Ability to perceive; 2) Ability to seek; 3) Ability to reach; 4) Ability to pay; 5) and Ability to engage.

We undertook a scoping review to:

- (1) identify the published literature on barriers to accessing EHC services in LMICs and categorise these according to the Levesque framework
- (2) identify current gaps in the literature and suggest potential solutions to address barriers to EHC services informed by the included literature

Methods

Nature of review

We identified no existing or scheduled reviews on this topic in the Cochrane Library, Campbell Collaboration, International Prospective Register of Systematic Reviews, or grey literature. We conducted a scoping review following Arksey and O'Malley's methodological framework (Arksey & O'Malley, 2005) and in accordance with the PRISMA-ScR statement (Tricco et al., 2018). Eligibility criteria were:

- (1) *Population*:
 - People with hearing loss, deafness and/or ear disease, or their caregivers or;
 - People working in the field of EHC, including otolaryngologists, audiologists, speech and language pathologists, teachers of the deaf and primary health care workers;
- (2) *Setting*: Research undertaken in a LMIC, defined by World Bank country classification at the time of the study (World Bank, 2021) (including 47 countries from the African Region, 26 from the Americas, 21 from the Western Pacific, 20 from Europe, 15 from the Eastern Mediterranean, and 11 from South East Asia); separated into urban or rural setting

- (3) *Intervention*: Any programme to support EHC services including early hearing detection and intervention (EHDI), neonatal, paediatric, and adult screening or diagnostic hearing assessment, medical or surgical treatment of ear disease, aural rehabilitation including fitting of hearing aids and cochlear implants, hearing conservation, and deaf education. If the article described or evaluated barriers to EHC within results, it was included, even if that was not the primary aim.
- (4) *Comparator*: Studies with or without a comparator group were included.
- (5) *Outcomes*: service delivery metrics (e.g. breadth of service delivered, population included); types of barriers identified and categorised as demand-side or supply-side.
- (6) *Study design*: Original research articles of any design including qualitative, quantitative, or mixed methods. We excluded commentaries, opinion pieces, review articles, policy briefings, training needs assessments, study protocols and conference abstracts.
- (7) *Language*: No restrictions.

Information sources and search strategy

We searched the EMBASE, MEDLINE, Global Health, and CINAHL databases for articles published between January 2001 (the year the International Classification of Functioning, Disability and Health was officially endorsed) (World Health Organization, 2001) and 18 June 2020. We used snowball sampling of the reference list of included papers to identify additional studies, in addition to a grey literature search of websites of relevant government and service provider agencies (key-word strategy in Appendix 1). Identified studies were exported to EndNote (version X8.2) and then Covidence (Veritas Health Innovation, Melbourne, Australia). After removal of duplicates, independent review was undertaken of titles and abstracts to exclude publications not meeting inclusion criteria (two of CW, JOD, TB or MM), and subsequent full text review (two of CW, JOD or MM), with discrepancy resolved by discussion and a third reviewer when necessary.

Data extraction and synthesis

Data were extracted on the following parameters:

- (1) *Publication characteristics*: title, authors, year of publication, study design and setting, country of study, aim of study and methods of data collection.
- (2) *Characteristics of service delivery/intervention provided*:
 - a) Context: target population, number and sex of participants, geographic area, ear or hearing condition targeted, and clinical service provided
 - b) Inputs identified in the service delivery (e.g. personnel, medicines, surgeries, facilities/location, otological/audiological equipment)
 - c) Barriers to access, mapped to the Levesque framework (Levesque et al., 2013). Definitions extracted from the Levesque framework we used to map are described in Appendix 2.

Authors (CW and MM) reviewed data to identify key focus areas for review. Data were summarised and analysed using thematic analysis, with findings grouped into different service delivery models according to context, inputs and access dimensions outlined above. Potential solutions to improving access were summarised by the first author (CW) and underwent thematic analysis, with findings grouped according to access dimensions.

Ethics and dissemination

Ethical approval was not required as this study did not directly involve human subjects.

Results

Search results

The database search yielded 3042 results, with 6 additional studies included through grey literature or snowball sampling. After duplicates were removed 2320 studies remained. After screening abstracts 2095 studies were excluded and a further 163 after full text review, leaving 62 studies that met inclusion criteria (PRISMA flow chart, [Figure 1](#)). Included studies are tabulated and numbered in [Table 1](#), and from here on results are referenced according to this study number.

Characteristics of included studies

Studies were reported between 2007 and 2020, with two thirds published after 2014 ($n = 40$, 65%, [Figure 2](#)). Studies were conducted in the following WHO regions: Africa ($n = 32$, 52%), Eastern Mediterranean ($n = 12$, 19%), Western Pacific ($n = 8$, 13%), Americas ($n = 4$, 6%), and South East Asia ($n = 3$, 5%) ([Figure 3](#)), with the majority undertaken in South Africa ($n = 18$, 29%), India ($n = 11$, 18%) or Nigeria ($n = 9$, 15%). There were no studies from Europe. There were no studies reported in a language other than English.

57 of 62 studies described specific EHC services including early hearing detection and intervention ($n = 14$, 23%) (studies 1-14), newborn hearing screening (NHS) ($n = 8$, 12%) (studies 15-22), primary EHC ($n = 9$, 14%) (studies 23-31), otolaryngological and/or surgical care ($n = 9$, 14%) (studies 32-40), audiological care ($n = 8$, 12%) (studies 41-48), or aural rehabilitation in children

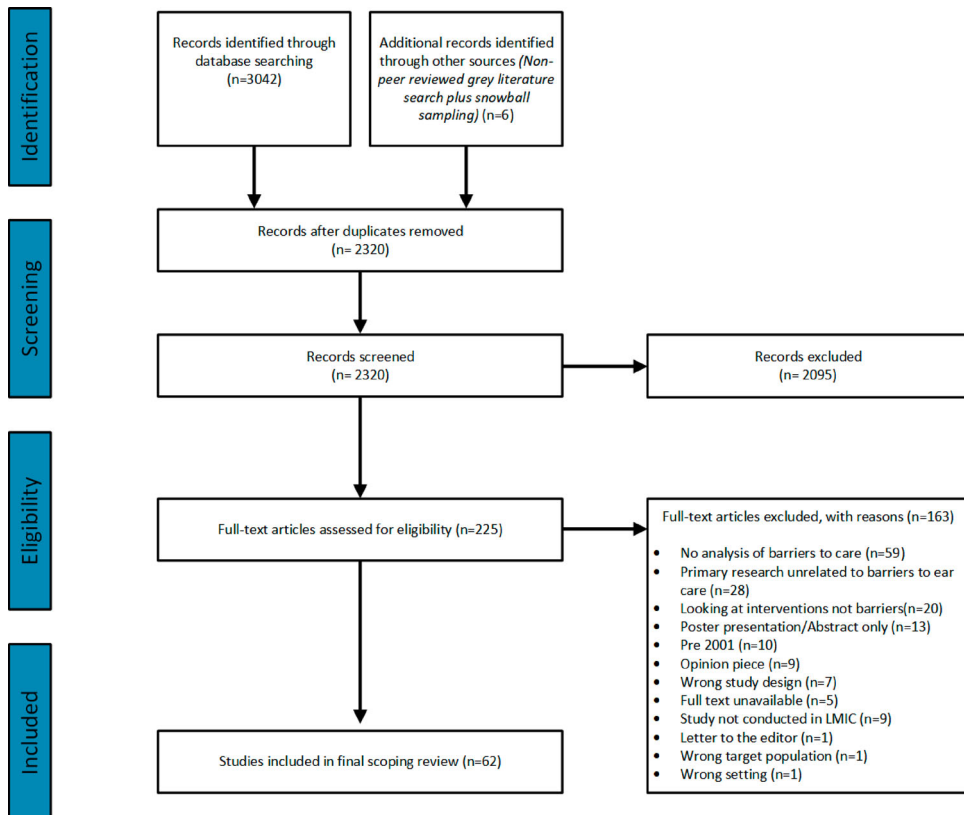


Figure 1. PRISMA diagram. A PRISMA diagram outlining the search strategy and study filtering process. LMIC, low-income and middle-income country; PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

Table 1. Key components of the 62 included studies by clinical service category of the EHC pathway.

Study number	First author, year	Country	Aim of study	Study Design	Target Group	Setting	Access dimensions identified
Early Hearing Detection and Intervention							
1	Baum et al. (2019)	Malawi	To explore the feasibility and acceptability of an intervention to improve uptake of referrals for children with ear disease or hearing loss	Mixed Methods	Families of children with hearing loss	Ear and hearing outreach camps, Rural	Supply and Demand
2	Chary et al. (2012)	India	To find out the average delay in identifying the impairment and the reasons leading to non-rehabilitation	Cross sectional study	People with hearing loss	Tertiary hospital, Urban & Rural	Supply and demand
3	Joubert and Githinji (2014)	South Africa	To determine the availability of information pamphlets on hearing and hearing loss in children at public hospitals in the Gauteng Province of South Africa	Review/ Audit	Hospital Audiology Departments	Public hospital audiology departments, Urban & Rural	Supply
4	Khoza-Shangase (2019)	South Africa	To explore factors compromising early intervention (EI) service delivery to hearing impaired children in South Africa, as expressed by their caregivers	Qualitative	Primary Caregivers	Hearing centre, Urban	Supply and Demand
5	Merugumala et al. (2017)	India	This qualitative study explored barriers to accessing appropriate hearing services in one city in southern India.	Cross sectional study	Primary caregivers	Clinic, Urban & Rural	Supply and Demand
6	Ogunkeyede et al. (2017)	Nigeria	This study assessed the experiences of parents/caregivers with hearing impaired children, in accessing otological health care services in Nigeria	Cross sectional study	Primary caregivers	Primary schools for hearing impaired children, Urban & Rural	Supply and Demand
7	Olusanya et al. (2007)	'Developing countries'	This article investigates the initiatives and progress towards early detection of infants with hearing loss in developing countries against the backdrop of the dearth of epidemiological data from this region	Cross sectional study	Providers (Physicians, ENTs, Audiologists)	Urban & Rural	Supply and Demand
8	Petrocchi-Bartal and Khoza-Shangase (2014)	South Africa	This study aimed to determine the hearing screening procedures and protocols as well as referral protocols in use at maternal child women's health (MCWH) immunisation clinics in South Africa	Qualitative	Providers (Primary Health care nurses)	Primary health care immunisation clinics, Urban & Rural	Supply
9	Ravi et al. (2016)	India	To assess knowledge and attitude regarding infant hearing loss amongst mothers in India	Cross sectional study	Mothers/ Primary caregivers	Rural tertiary care hospital, Rural	Supply and Demand
10		Libya		Qualitative			

(Continued)

Table 1. Continued.

Study number	First author, year	Country	Aim of study	Study Design	Target Group	Setting	Access dimensions identified
	Sambah et al. (2020)		To collect and interpret narrative and observational data from Audiologists and ENT doctors' experiences of delays in the identification and management of congenital hearing loss (CHL) in Libya		Providers (Audiologists, ENT Doctors)	Public hospitals, Urban & Rural	Supply and Demand
11	Suniti (2018)	India	To determine age of suspicion, diagnosis, intervention, and outcome in a representative group of deaf children in West Bengal, India	Cross sectional study	Primary caregivers	Elementary and Specialist schools, Urban & Rural	Supply and Demand
12	Swanepoel & Almec, 2008	South Africa	To investigate maternal knowledge and attitudes of hearing loss amongst a South African sample.	Qualitative	Primary Caregivers	Regional immunisation clinic, Urban	Demand
13	Theunissen & Swanepoel, 2008	South Africa	To determine the current status of early detection and intervention services for infants with hearing loss in South African public sector hospitals	Cross sectional study	Providers (Audiologists, Speech Pathologists)	Public hospitals, Urban & Rural	Supply
14	Wong et al. (2019)	Malaysia	To assess the knowledge and attitude of childhood hearing loss among mothers and mothers-to-be	Cross sectional study	Mothers and mothers-to-be	One hospital and 2 health centres Urban & Rural	Demand
Newborn Hearing Screening							
15	Graham et al. (2019)	South Africa	To understand mother's knowledge, attitude, and practice of permanent childhood hearing impairment.	Qualitative	Mothers-to-be	Ante-natal clinics, Rural	Supply and Demand
16	Gupta et al. (2015)	India	To report experience of implementing universal newborn hearing screening (UNHS) in a tertiary care neonatal unit, identify risk factors associated with failed two-step automated auditory brainstem response (AABR) screen and evaluate cost of AABR	Cohort study	Newborns eligible for NHS	Tertiary Hospital, Urban	Supply and Demand
17	Jatto et al. (2018)	Nigeria	To determine the knowledge and perceptions of mothers of newborn children on hearing screening	Cross sectional study	Mothers	Hospital, Rural	Supply and Demand
18	Kanji et al. (2010)	South Africa	To determine the follow-up return rate for a hearing screening programme implemented as part of a very low birth weight project	Cross sectional study	Primary caregivers	Tertiary Hospital, Urban	Supply and Demand
19	Kanji and Krabbenhoft (2018)	South Africa	To determine the factors influencing audiological follow-up of high-risk	Qualitative	Primary caregivers of at-risk infants	Secondary level public hospital, Urban & Rural	Supply and Demand

20	Martinez Wbaldo and Torres Lagunas (2016)	Mexico	infants in a risk-based newborn hearing screening programme This study describes the process of the programme from the epistemological perspective of women whose children participated in it, evaluating it under the support of the constructivist-respondent model in search of aspects that can help explain its results	Qualitative	Primary caregivers	Hospital Clinic, Urban & Rural	Supply and Demand
21	Scheepers et al. (2014)	South Africa	To investigate caregiver reasons for screen refusal and follow-up default in two private health care hospital based UNHS programmes	Mixed Methods	Primary caregivers	Private Hospitals, Urban & Rural	Supply and Demand
22	Tanon-Anoh et al. (2010)	Cote d'Ivoire	To investigate the feasibility of neonatal hearing screening in newborn babies in Abidjan, Cote d'Ivoire	Cross sectional study	Newborns undergoing NHS	Healthcare centres and teaching hospitals, Urban & Rural	Supply and Demand
Primary Ear and Hearing Care							
23	Bright et al. (2017)	Malawi	Assess the uptake of and barriers to referrals to ear and hearing services for children in Thyolo District, Malawi	Mixed Methods	Primary caregivers	Community based ear camp, Urban & Rural	Supply and demand
24	Holt et al. (2018)	Pacific Islands	The aim of this study was to assess key informant views on the relative priority, process and potential benefits and challenges of establishing a dedicated otitis media and hearing health strategy or service within the Pacific region.	Qualitative	Providers/Key informants	Urban & Rural	Supply and Demand
25	Khan et al. (2018)	South Africa	To determine primary health care nurse's experiences, practices, and beliefs regarding hearing loss in infants	Mixed Methods	Providers (Nurses)	Primary healthcare clinics Urban & Rural	Supply and demand
26	Mukara et al. (2017)	Rwanda	To evaluate parents and caregivers knowledge and care seeking practices for ear infections in children under five in Gasabo district in Kigali, Rwanda	Cross sectional study	Primary caregivers of children aged <5	Community based (villages), Urban & Rural	Supply and demand
27	O'Donovan et al. (2020)	Uganda	This qualitative study used photovoice to explore the views and experiences of CHWs in the Seeta Nazigo Parish of Mukono District in the delivery of ear and hearing care in the community.	Qualitative	Community Health workers delivering EHC	Community Urban & Rural	Supply and Demand
28	Poole et al. (2016)	Nepal	To investigate the knowledge, attitudes, beliefs, and practices of both affected and unaffected residents of Pokhara, Nepal, regarding CSOM and hearing impairment.	Cross sectional study	Individuals with CSOM or HI	Community based (villages), Urban & Rural	Supply and demand

(Continued)

Table 1. Continued.

Study number	First author, year	Country	Aim of study	Study Design	Target Group	Setting	Access dimensions identified
29	Roy et al. (2012)	Bangladesh	To report on the burden and outcome of episodes of acute otitis media (AOM) based on awareness of AOM and compliance to referral by community health workers (CHWs) in rural children aged under 2 in Bangladesh	Cohort study	Newborn babies	Community Population based cohort, Rural	Demand
30	Srikanth et al. (2009)	India	To study knowledge, attitudes, and practices of caregivers with respect to risk factors of otitis media in a rural South Indian Community.	Qualitative	Caregivers	Day care Centres, Urban & Rural	Demand
31	Villarreal et al. (2017)	Panama	To estimate the proportion of primary caregivers who went to a healthcare facility when they suspected that their child aged 6 to <30 months was having an AOM episode during the past 6 months and to assess what factors influenced their decision.	Cross sectional study	Primary caregivers	Healthcare Facilities, Urban	Demand
Otolaryngology/Surgical Care							
32	Afolabi et al. (2011)	Nigeria	To estimate the incidence of ototopical self-medication, conditions, and reasons for its use, patient's information sources, and type of drugs used	Qualitative	Patients with otological problems who practice self-medication with ototopical agents	State Specialist Hospital Outpatient and ENT Departments Urban	Supply and demand
33	Ahmed et al. (2018)	Nigeria	To establish the size and nature of the gap between practice and best practice in the diagnosis and management of OME at the hospital. i.e. Identify barriers to best clinical practice (and implement strategies to overcome barriers)	Program evaluation /Audit	Key stakeholders working in Hospital	Public Teaching Hospital Urban	Supply and demand
34	Akinpelu et al. (2008)	Nigeria	To determine the prevalence of chronic suppurative otitis media and associated complications	Cohort study	New patients attending with CSOM	University Teaching Hospital Urban & Rural	Supply and Demand
35	Ambett et al. (2009)	India	To determine the causes of delay in diagnosis and treatment of Indian patients with vestibular schwannomas	Cohort study	Patients with vestibular schwannoma	Non-government Hospital Urban & Rural	Supply and demand
36	Mulwafu et al. (2017)	Sub-Saharan Africa: Burundi, Cameroon, D.R.C., Ethiopia, Ghana, Guinea Conakry, Kenya, Lesotho, Madagascar, Malawi, Mali, Nigeria, Rwanda, South Africa, Senegal, Sudan, Swaziland,	To determine the current status of ear, nose, and throat (ENT), audiology, and speech therapy services in sub-Saharan Africa	Cross sectional study	Providers (ENT surgeons)	Sub-Saharan African health system Urban & Rural	Supply

37	Olajide et al. (2018)	Tanzania, Togo, Uganda, Zambia, Zimbabwe Nigeria	To determine the prevalence of topical eardrop self-medication practices among respondents attending the ENT Clinic of a Federal Teaching Hospital, Ido Ekiti, Nigeria	Cross sectional study	Patients attending ENT Department of Federal Teaching Hospital	Public Hospital Urban & Rural	Supply and demand
38	Orji (2013)	Nigeria	The survey aims to examine the extent to which health care facilities in Nigeria are equipped to address the management challenges of CSOM	Cross sectional study	Providers (practicing ENT surgeons)	Public health institutions Urban & Rural	Supply
39	Rakesh and Panchal (2018)	India	To analyse the health seeking behaviour of patients of Suppurative Otitis Media (SOM) presenting to a tertiary care hospital in Surat city	Cross sectional study	Patients attending outpatient department, diagnosed with SOM	Hospital Urban & Rural	Supply and demand
40	Salisu (2010)	Nigeria	To describe the pattern of otology practice over a 10-year period in Aminu Kano Teaching Hospital in northern Nigeria	Mixed Methods	Patients with otologic conditions attending Teaching Hospital	Teaching Hospital Urban & Rural	Supply and demand
Audiological Care							
41	Ali et al. (2017)	Malaysia	Explore audiologic management of adults with hearing loss from point of view of audiologists in context of the WHO ICF	Cross sectional study	Private and Public sector audiologists in Malaysia	Audiologists in Malaysia Urban & Rural	Supply
42	Dawood et al. (2019)	South Africa	The aim of this study was to describe the preparedness, perspectives and practices of audiologists who manage adult patients with tinnitus	Quantitative	Audiologists and Speech Pathologists in South Africa	Health Professions Council of South Africa participants Urban & Rural	Supply and Demand
43	Kuschke et al. (2018)	South Africa	To determine the duration of time from meningitis diagnosis to audiology referral. A second objective was to determine the prevalence and severity of meningitis-related sensorineural hearing loss (SNHL) at Red Cross War Memorial Children's Hospital (RCWMCH), a paediatric tertiary hospital in Cape Town, South Africa (SA)	Case report	Children diagnosed with unspecified meningitis	Hospital Urban	Supply
44	Moroe and Khoza-Shangase (2018)	South Africa	This study was conducted to explore the scope of practice for occupational audiologists in the mining industry and the audiologist's involvement in hearing conservation programmes in South African mines. Additionally, this study investigated the	Qualitative	Occupational audiologists working in the mining sector	Mining sector Urban	Supply and Demand

(Continued)

Table 1. Continued.

Study number	First author, year	Country	Aim of study	Study Design	Target Group	Setting	Access dimensions identified
45	Patel et al. (2014)	India	mining industry's role in the audiologist's involvement, and assessed the audiologist's levels of preparedness for working in occupational audiology To detect the age of suspicion, identification, intervention, and treatment seeking behaviour of children with hearing loss	Cross sectional study	Children with hearing impairment	Hospital ENT Outpatient Department Urban & Rural	Supply and demand
46	Pillay and Serooe (2019)	South Africa	The aims were to determine perspectives of audiologists with regard to traditional healing in South Africa (SA) and to document if and how the audiologist engages with traditional healing in practice	Cross sectional study	Audiologists working in Gauteng	Community of audiologists Urban & Rural	Supply and demand
47	Sanders et al. (2015)	Pacific Island Nations	To estimate HI prevalence and identify available hearing services in some Pacific countries, Cook Islands, Fiji, Niue, Samoa, Tokelau, Tonga	Quantitative	Pacific Island Nations	Pacific Islands, Urban & Rural	Supply and Demand
48	Swanepoel and Clark (2019)	Resource constrained environments	To discuss challenges to hearing care in remote and resource-limited settings	Case report		Remote or resource constrained environments Urban & Rural	Supply and Demand
Rehabilitation							
49	Amri et al. (2019)	Malaysia	To examine paediatric amplification practices, with an emphasis on hearing aid verification using probe microphone measurement, among audiologists in Klang Valley, Malaysia	Qualitative	Paediatric audiologists working in private or public	Public and private audiology centres	Supply
50	Bhamjee et al. (2019)	South Africa	To determine and describe parent-perceived challenges related to the paediatric cochlear implantation process and support services received	Qualitative	Primary caregivers of paediatric CI recipients	Cochlear Implant Clinics Urban & Rural	Supply and Demand
51	Teixeira and Joubert (2014)	South Africa	To determine the availability of audiological equipment and clinical protocols used by audiologists in Gauteng for paediatric audiological assessment and hearing aid fitting	Cross sectional study	Audiologists working within public/private audiology departments	Private and Public Audiology Departments Urban & Rural	Supply
52	Dev et al. (2018)	India	To study parental perspectives on rehabilitation services offered for	Mixed Methods			Supply and Demand

			paediatric CI users at a non-profit organisation in India		Primary caregivers of children who attended for CI and auditory-verbal therapy	Hospital based hearing centre Urban	
53	Li et al. (2016)	China	To determine the factors that impact early cochlear implantation in Chinese children	Mixed Methods	Paediatric (>15yo), with profound loss, with CI	Hospital ENT Department Urban & Rural	Supply and Demand
54	Borg and Ostergren (2015)	Bangladesh	To describe sources of awareness, types of providers and costs of assistive technologies among users of hearing aids and wheelchairs	Qualitative	Users of assistive technology	Community Urban & Rural	Supply and demand
55	He et al. (2018)	China	To investigate the prevalence and associated factors of hearing aid acquisition in Chinese older adults	Cross sectional study	Hearing aid users, aged 65+	Community Urban/Rural	Supply and Demand
56	Makhoba and Joseph (2016)	South Africa	To describe audiologists' practices and views on aural rehabilitation services for adults	Qualitative	Providers (Audiologists)	Members of an Audiology associations Urban	Supply and Demand
57	Moreo and Vazzana (2019)	South Africa	To explore reasons why elderly people diagnosed with presbycusis and fitted with hearing aids stop using hearing aids post fitting	Qualitative	65 + y/o hearing aid users	Aged care facility Urban	Supply and Demand
Perspectives, knowledge, and attitudes							
58	Kaspar et al. (2017)	Solomon Islands	To investigate parental knowledge and attitudes among parents in the Solomon Islands	Qualitative	Primary caregivers	Three child welfare clinics and community outpatient departments Urban	Demand
59	Lopez-Vazquez et al. (2009)	Mexico	To evaluate the attitude and knowledge of hearing loss in a group of physicians	Cohort study	Graduate medical practitioners selected for residency	New residents grouped into specialty areas Urban	Supply
60	Gupta et al. (2010)	India	To investigate awareness related to hearing loss in the community, and generate an evidence base for formulating various messages to be incorporated in information, education, and communication (IEC) materials for dissemination in the community	Qualitative	Stake holders (doctors, clinicians, health workers, patients, schoolteachers, residents, and parents of HI children)	Focus groups in community Urban & Rural	Supply and Demand
61	Omondi et al. (2007)	Kenya	To determine the level of parental awareness of childhood HI and its relationship to the level of access to and	Cross sectional study	Primary caregivers of children who did not pass school hearing screening	School community in Kisumu District,	Supply and demand

(Continued)

Table 1. Continued.

Study number	First author, year	Country	Aim of study	Study Design	Target Group	Setting	Access dimensions identified
62	Pedroso and Goncalves (2016)	Brazil	use of ambulatory health services for ear care To analyse the perception and knowledge of health professionals working in Curitiba's primary care health network regarding the compulsory notification of NIHL in SINAN (National Notifiable Diseases Information System)	Cohort study	Professional nurses, physicians, and audiologists in primary care in the city	Western Kenya Urban & Rural Community - Curitiba municipal health primary care network Urban	Supply and Demand

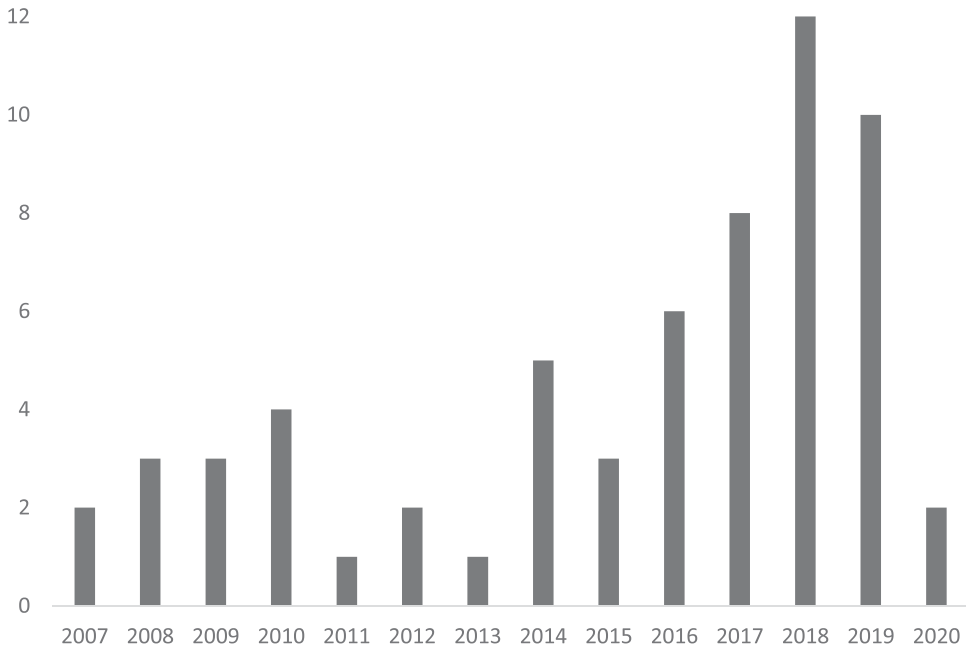


Figure 2. Included studies by year of publication.

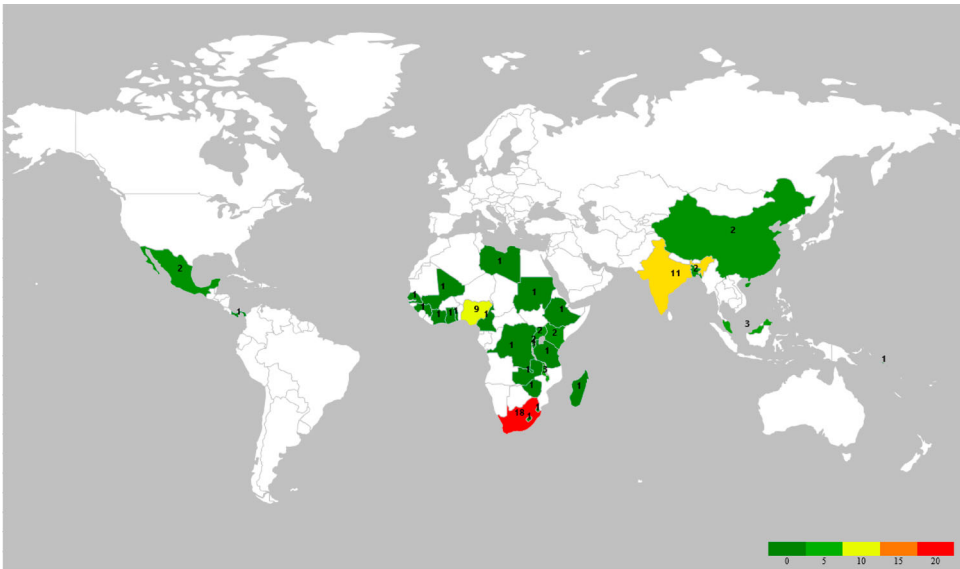


Figure 3. Location of studies. A choropleth map highlighting the location of each study.

($n = 5$, 8%) (studies 49-53), and adults ($n = 4$, 6%) (studies 54-57). The remaining five studies discussed barriers to access from perceptions, knowledge, attitudes or practices of providers, referrers, or users of EHC services (studies 58-62). Studies reported the perspective of parents or caregivers of people with hearing loss or ear disease ($n = 22$, 35%), providers involved in delivery of EHC services ($n = 19$, 31%), people with hearing loss or ear disease ($n = 15$, 24%), and community stakeholders/key informants ($n = 7$, 11%). Studies included delivery of care in urban ($n = 54$, 24%), rural ($n = 5$,

8%), or mixed urban and rural regions ($n = 41$, 66%). Conditions discussed were hearing loss affecting children ($n = 30$, 48%) (studies 1-17,18-23,43,45,46,58-61) and adults ($n = 5$, 8%) (studies 41,44,46,59,62), otitis media ($n = 14$, 23%) (studies 23-31,33,34,37-39), deafness ($n = 4$, 6%) (studies 11,15,25,60), tinnitus ($n = 1$, 2%) (study 42), surgical treatment of cholesteatoma ($n = 1$, 2%) (study 40), and vestibular schwannoma ($n = 1$, 2%) (study 35).

Access dimensions

Extracted dimensions and abilities of access to care are summarised in Appendix 3. Across the 62 included studies, availability/ability to reach was the most common dimension described ($n = 45$, 73% / $n = 21$, 34%), followed by approachability/ability to perceive ($n = 16$, 26% / $n = 40$, 65%) and appropriateness/ability to engage ($n = 39$, 63% / $n = 15$, 24%). Other access dimensions were less often described, affordability/ability to pay ($n = 28$, 45% / $n = 20$, 32%) and acceptability/ability to seek ($n = 15$, 24% / $n = 12$, 19%). Supply-side constraints ($n = 58/62$, 94%) were more frequently described than demand-side ($n = 52/62$, 84%).

Availability and ability to reach EHC services

25 studies (40%) described a lack of trained and available personnel which covered a range of EHC services: EHDI (studies 8,10,11,13), NHS (studies 16,22), primary EHC (studies 23,27), audiological care (studies 41,42,47,48,56), rehabilitation (studies 49-51,57), and otolaryngology/surgical care (studies 32-36,38,40). 21 studies (34%) (studies 8,11,13,18,19,23,25,27,32,35,36,38,40-42,47-49,51,57,61) reported a lack of appropriate equipment, resources or testing materials and 17 (27%) (studies 1,4,7,15,19,21,23,26,27,32,33,37,40,48,49,60,62) reported high demand for the EHC services, leading to a long waiting time. Five studies focused on primary ear and hearing disease where problems reported included a shortage of equipment and resources (including medicines) to diagnose and treat ear disease, an inadequate referral system, long waiting time and inadequate communication in providers relaying information to patients (studies 23,25-28). One study on perspectives of community healthcare workers in delivering EHC in a community in Uganda described non-availability of screening equipment, such as otoscopes, tympanometers and pure tone audiometers, an inadequate supply of medications, as well as unsafe and ineffective EHC practices by inadequately trained local health centre staff (study 27).

A further 14 studies (23%) reported a lack of appropriate testing facilities/conditions in a number of LMICs (studies 1,2,10,11,20,35-37,39-41,45,57,62). An unequal distribution of healthcare providers offering EHC services amongst rural or urban regions was reported in 9 studies (15%) (studies 7,10,11,32,36,37,42,48,53). A range of other sub-themes included a lack of adequate NHS services, high cost of specialised equipment, or costs associated with servicing or calibration of equipment. Regarding availability of aural rehabilitation services, 10 studies (16%) reported a lack of, or poor-quality hearing aids, a lack of ear moulds or a lack of follow up (studies 6,11,28,32,34,40,44,47,56,61). One study in Nigeria, for example, reported most participants discontinued use of faulty hearing devices due to a lack of local service/maintenance points (study 40).

Geographical location was described as both a supply-side barrier to EHC service delivery in four studies (availability) (studies 5,23,39,54), and as a demand-side barrier (patient's ability to reach) 'distance to travel to the facility' in 13 studies (studies 4,5,11,18,19,23,26,27,47,48,53-55). For example, one study examining challenges to early cochlear implantation for children living in China, found living in a rural community delayed age of implantation (study 53). Similarly, a study examining knowledge and care seeking practices for children with ear infections in Rwanda concluded that compared to urban areas, those living in rural areas had a higher risk of delayed presentation, practicing medical pluralism, or developing complications (study 26). A lack of occupational flexibility was a sub-theme in 12 studies (studies 1,4,5,7,15,19,21,23,31,44,45,60). For example, three studies from South Africa reported difficulties in caregivers reaching NHS

programmes due to conflicting work commitments, long distance to travel to the facility, or inadequate transport (studies 15,19,21).

Approachability and ability to perceive

Nine studies mentioned health providers lack of knowledge about EHC services, or about the scope of practice of audiologists, as a barrier to accessing EHC services (studies 6,13,21,25,36,42,44,59,60). For example, one study investigated the experiences, practices and beliefs of primary health care nurses regarding hearing screening practices and views on hearing loss in infants in the eThekweni District of KwaZulu-Natal, South Africa, and found only 40% of nurses provided parent's and/or caregivers with feedback about their child's hearing loss, and 51% provided information about hearing loss, counselling or early hearing detection and intervention services (study 25). Another study investigating community perceptions in New Delhi, India, found very low levels of awareness of early diagnostic audiology services amongst health workers and other health professionals, as well as poor knowledge of causes of hearing loss amongst teachers, parents and caregivers (study 60). Similarly, medical doctors in Mexico demonstrated a lack of understanding on the incidence and disabling nature of hearing loss, and confusion around the role that audiologists have in diagnosis (study 59).

Four studies described a lack of awareness of the symptoms or disabling impact of hearing loss in the general population (studies 6,10,38,41), and a further four described a lack of public awareness resources on EHC (studies 3,5,17,20). One study from Nigeria described the lack of audiological services despite the majority of children presenting to a community health centre or their general medical practitioner with hearing loss (study 6). Similar studies in Nigeria (study 38), Libya (study 10) and Malaysia (study 41) mentioned a lack of public knowledge and awareness of hearing loss.

Regarding ability to perceive, common themes identified were a lack of knowledge about ear disease, hearing loss, or available EHC services, an acceptance of traditional beliefs or treatments, and a preference for self-treatment. One study examining knowledge and attitudes among parents in the Solomon Islands, found low awareness of certain risk factors for hearing loss (e.g. only 28% ($n = 42/150$) believed babies could be born with hearing loss) and over half (56%, $n = 84/150$) held beliefs in supernatural causation of hearing loss in children (study 58). Another study describing practices amongst respondents attending an ENT Clinic at a teaching Hospital in Nigeria, found a high percentage self-medicating, with readily accessible ototoxic over-the-counter medications, including chloramphenicol and gentamycin ear drops (study 37).

Appropriateness and ability to engage

Studies reported multiple examples of challenges EHC providers face in meeting needs of service users in LMICs. 18 studies described an EHC workforce that lacks the training, skills and knowledge to service demand (studies 4,6,11,13,20,23,32,33,35,36,40-42,44,45,49,57,62). For example, one study in Nigeria reported primary health care workers having poor knowledge of otological conditions or ability to carry out basic distraction tests of hearing, that may have led to children with hearing loss not being referred to a specialist (study 6). A study examining audiologists views and practices on adult aural rehabilitation in South Africa, described a lack of adequate tertiary training for audiologists in providing wireless microphone systems, auditory training, psychosocial adjustment counselling, frequent communication partner training and speech reading training (study 57). A cross sectional survey of audiologists in Malaysia, reported that they felt their training had not prepared them for counselling and managing adults with hearing loss (study 41), and there was poor availability of speech testing materials and real-ear measurement protocols to verify fitting of hearing aids, despite availability of equipment. A lack of audiology and speech pathology training programmes was also mentioned in a multi-country study in sub-

Saharan Africa (study 36), and a South African study reported concerns about ensuring family-orientated approaches to rehabilitation were included within training programmes (study 57).

Poor communication between EHC health professionals and users, or a lack of patient centred care, was another sub-theme described in 16 studies (studies 2,4,7,11,20,21,23,25,40,44,50,53,55,56,60,62). A study from West Bengal, India described that the chief complaint of caregivers of hearing-impaired children was a lack of follow up services for post-fitting hearing aid adjustment or counselling, and that 66% of children had discarded their devices within 12 months (study 11). A breakdown in communication between audiologists and parents, or caregivers of newborns undergoing hearing screening in South Africa, led to default on hearing screening follow up (study 21). The two remaining major sub-themes were an inadequate referral system, described in 15 studies (studies 4,6-8,10,13,20,23,26,35,42,43,45,61,62), and a lack of evidence-based protocols or standardised procedures, described in eight studies (studies 13,18,24,33,41,42,49,51).

The ability of users to engage with EHC services fell within three main sub-themes: 11 studies reported EHC service users held a lack of belief in the medical process, experienced poor motivation or poor follow-up attendance (studies 4,5,15,18, 21,23,27,29,55,61,62). A study examining low uptake of referrals for EHC for children in Malawi described a number of barriers experienced by caregivers resulting in poor attendance, including procedural challenges, fear and uncertainty about the hospital and a lack of available services (study 23). Other studies examining caregiver's willingness to engage with facilities offering NHS was reflected in a perception that the results were unreliable (studies 15,21), and poor attendance for follow up re-screening (study 18).

Another sub-theme was lack of compliance to treatment protocols or rehabilitation, found in five studies (studies 2,9,29,53,57). For example, parental barriers impacting early cochlear implantation of children in China included poor attendance to appointments to evaluate implant candidacy (study 53). Low uptake of hearing aids was reported in rural India due to social stigma, where only 54% (119/219) of mothers interviewed stated they would allow their child to wear hearing aids if diagnosed with hearing loss (study 9). A study in Bangladesh, where caregivers of children under two years old were asked about awareness of acute otitis media and uptake of referral, reported that not many visited a doctor due to the absence of acute symptoms, despite encouragement and referral by community health workers (study 29).

Affordability and ability to pay

Financial barriers included direct costs associated with EHC service provision, where 14 studies described cost of consultations, hospital or surgical fees (studies 4,6,27,28,34), diagnostic investigations (studies 5,6,10,11,21,22,35,61), treatments or medicines (studies 27,32,34), and unspecified EHC costs (studies 26,28,39), and a further 9 studies described direct costs of aural rehabilitation, which included cost of hearing aids (studies 6,38,40,54,55,57), cochlear implants (studies 50,52,53), or device maintenance (study 50). For example, one paper in Nigeria found unaffordable costs as well as the non-availability of hearing aids a challenge in managing hearing deficits in children with CSOM (study 38). Indirect costs of transportation, accommodation or food, were found in seven studies (studies 1,4,5,23,27,34,50), and opportunity costs associated with time spent seeking EHC in five studies (studies 4,23,32,50,57). Financial constraints, or low household income impacting ability to pay for EHC related expenses, were reported in 16 studies (studies 4,5,10,19,22,23,26,31,34,37,39,40,45,50,53,61). One study in Libya described how family financial circumstances delayed diagnosis and intervention, as audiological services were limited in the public sector, but expensive in the private sector (study 10). Similarly, in Uganda another study described how socioeconomic deprivation often meant community members did not prioritise ear disease amongst competing health needs or lacked financial capacity to attend regional ENT hospitals for specialist treatment (study 27).

Six studies described a lack of financial support for EHC services (studies 20,24,42,50,53,54). For example, one study based in South Africa, reported only 9% ($n = 7/82$) of cochlear implant users

were covered through public funding and most parents were financially unable to meet associated costs (study 50). A lack of, or high cost of, health insurance was also a barrier mentioned in five studies (studies 6,7,26,50,53). Two studies reported direct costs of hearing screening as a barrier, where health insurance did not cover costs, or a lack of inclusion of NHS within a hospital birthing package (studies 21,22).

Acceptability and ability to seek

A lack of cultural sensitivity of those practicing EHC was described in four studies based in South Africa (studies 3,25,46,57). One such study examined audiologists perspectives on the role of traditional healing and described reluctance of providers to converse about such aspects, citing a lack of cultural sensitivity to accommodate cultural and religious beliefs (study 46). On the demand side, however, audiologists reported delayed healthcare seeking due to insufficient knowledge of ear disease, or local acceptance of traditional beliefs or treatments that contradicted audiological practice. A lack of available, readable or high quality educational materials provided by public hospitals in the Gauteng Province of South Africa was also found to be a barrier (study 3), and language barriers were cited in two studies: one on a lack of tinnitus questionnaires translated into the local language in South Africa (study 42), and another on lack of access to sign language for hearing impaired children in West Bengal, India (study 11).

The corresponding ability to seek were cultural or family influence in decision-making reported in seven studies (studies 6,7,26,50,53). Stigma relating to childhood hearing loss (studies 4,10), chronic discharging ears (studies 34,38), or hearing aid up take (studies 9,54) was also reported in six studies, and a number of studies mentioned fear of hospital (studies 1,5,23), or of surgery (studies 1,6,35,53,58), impacting acceptance of EHC health seeking.

Appendix 4 summarises recommended solutions extracted from included studies, mapped against the Levesque access dimensions.

Discussion

Summary of evidence

This review includes 62 studies in 33 LMICs and highlights a diverse range of barriers to accessibility of EHC services when mapped against the Levesque framework ([Figure 4](#)), for both health system/provider (supply-side) and patient related (demand-side) perspectives. Some dimensions and abilities were represented more than others. Demand-side access challenges were more frequently described in the initial stages of the healthcare seeking journey, and this imbalance may relate to the attention placed on assessing patients' ability to recognise their healthcare needs, which relies upon their health literacy, health beliefs, confidence and expectations, whereas the corresponding dimensions of approachability and acceptability are more difficult to measure directly, and therefore cited less often (Cu et al., 2021). Conversely, the remaining three supply-side dimensions of availability, affordability, and appropriateness were often described towards the end of the healthcare seeking journey. Assessing access at the point of care frequently incorporates studies focused on quality, adequacy and coordination, but demand-side characteristics, such as patient adherence and empowerment (ability to engage), is reported far less often (Cu et al., 2021).

The majority of studies were published after 2014, which suggests growing interest in this area. However, the breadth and depth of research is thin, with significant gaps identified. There was uneven geographical spread of studies amongst LMICs, with very few studies from the WHO regions of South East Asia and the Americas, and no studies from Europe, but this may in part be explained by differing numbers of LMICs in each of these regions. We found only nine papers on barriers to the provision of aural rehabilitation and eight papers on barriers to newborn hearing screening programmes in LMICs, which is surprising given global inequity in access to these

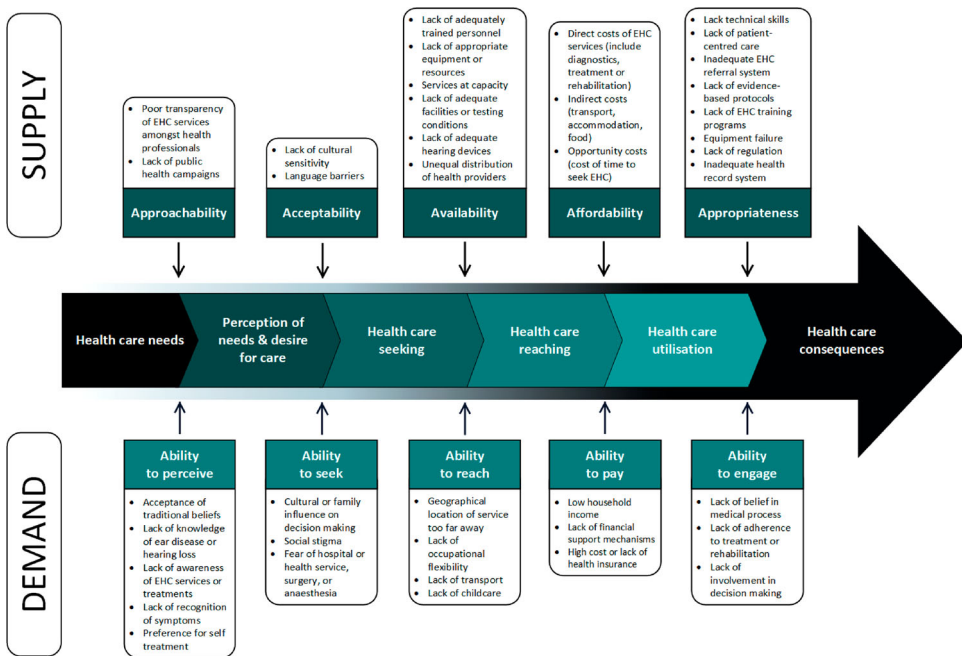


Figure 4. Identified barriers to accessing ear and hearing care services in LMICs identified in studies, mapped against the components of the Levesque et al. (2013) framework.

services (Neumann et al., 2020), and likely reflects low availability of health facilities that offer EHC services in these regions. The World Report on Hearing (World Health Organization, 2021b) emphasised significant service gaps for aural rehabilitation in LMICs, including factors that limit access to hearing aid uptake, such as high cost, lack of human resources and services, and low awareness of hearing loss and associated stigma.

Potential solutions to improving access to EHC services in LMICs

Scaling up the EHC workforce

Whilst the literature describes numerous barriers to access to EHC services in LMICs, the most prominent included limited availability of personnel trained in EHC and a lack of equipment and physical resources, including high-quality low-cost hearing aids. Ideal EHC services require a multidisciplinary team of professionals including audiologists, otolaryngologists, family paediatricians, speech and language therapists, technicians, healthcare workers, educators, and social workers amongst others, from primary through to tertiary care. Evidence on global numbers and distribution of such providers remains weak. Gaps in availability of EHC professionals has recently been compared between World Bank regions, with reports of more than a 50-fold difference between some countries in the African and European regions (Kamenov et al., 2021). Within countries, there is also evidence of disparity in the rural-urban distribution of professionals and services (World Health Organization, 2021b).

The literature we reviewed proposed some solutions to address this shortage in EHC workforce cadres, which included protocols for task-shifting or task-sharing activities of primary or mid-level health workers. Several studies also raised the idea of utilising trained community health workers (CHWs), or clinical officers, for screening and treatment of ear disease in rural and remote areas. CHWs can be strong advocates in raising community awareness and promoting participation in screening programmes or mobile ear camps and should be considered a key component of the

EHC workforce in recognition of their influence in the communities they serve, although their effectiveness is still poorly evidenced (Kane et al., 2021; O'Donovan et al., 2019). To improve geographical access, alternative service delivery models, incorporating use of satellite clinics and mobile technologies, such as tele-medicine/tele-audiology, can provide additional capacity (Bhutta, 2018). There is, however, a need to invest in scaling up practical and clinical training, covering all levels of the EHC workforce, focused on effective and sustainable strategies that cater to the local context. For example, training offered in rural or remote district hospitals and health centres, where providers and their communities are located, will contribute to ensuring retention and avoidance of brain drain to major cities or abroad, which can otherwise result in a catastrophic diminution of available care (Bhutta, 2018; Kligerman et al., 2020).

Enabling access to affordable emergent technologies, resources, and hearing aids

Accurate assessment of hearing loss has traditionally required expensive audiological equipment, operated by highly trained health professionals in a sound-treated environment, which is prohibitive for health facilities operating under budgetary constraints with competing health priorities. Increased investment in novel, mobile, low-cost eHealth solutions can increase accessibility when delivered by decentralised services at the point of care (Swanepoel, 2020). Products utilising eHealth and mHealth technologies, such as mobile-based automated audiometry (Bright et al., 2019) enable non-specialists to administer hearing tests. Alternative otoscopy products have also emerged, including the solar-powered ArcLight (Balfour et al., 2021) (a low-cost alternative to traditional otoscopes) and video-otoscopes, such as the TympaHealth (TYMPA Health, 2016), Cupris (Schuster-Bruce et al., 2020) and hearScope (Yancey et al., 2019) (with potential to incorporate artificial intelligence and asynchronous support via remote review of captured images to assist diagnosis). Where there is still a lack of infrastructure and equipment, low-cost alternatives to technological solutions should be considered, for example, using the whispered hearing test as a screening tool for hearing loss (O'Donovan et al., 2019).

Modelling suggests that less than 3% of the need for hearing aids is being met in LMICs (Humphreys, 2013), which has advanced the case for investing in hearing assistive technologies and is a focus of the ATSCALE2030 Initiative (ATSCALE2030, 2018). The unmet need has been driven by a lack of awareness, stigma, lack of political will, limited investment and demand and supply side market barriers (ATscale & AT2030, 2020). Several low-cost hearing devices have been developed (e.g. the ALIMCO digital hearing aid – ALIMCO = Artificial Limbs Manufacturing Corporation of India) (ALIMCO, 2021), alongside a number of novel technologies including a solar powered open fit hearing aid, the Solar Ear (Solar Ear, 2020), hearables, and self-fitted or pre-programmable hearing aids. However, many such devices vary in performance, confirming the need to establish product quality standards and fitting guidelines, that must coexist with adequate procurement, ongoing servicing, battery supply and counselling support (McMahon et al., 2021).

Improving access to training and education

Some studies highlighted solutions for improving skills and knowledge of the EHC workforce, which mainly focused on provision of education and training through the establishment of formal training centres and implementation of evidence-based protocols and guidelines. Training should be context specific and matched to needs, incorporating local knowledge to address potential misconceptions, and accommodating cultural and religious beliefs. Importantly, training programmes should not compromise quality, and to ensure retention of the workforce incorporate appropriate supervision to ensure recipients remain competent, motivated and satisfied (O'Donovan, 2021). For example, a programme for CHWs in rural Uganda that combined a training workshop, in-person and digital blended learning approaches, case-based learning and remote supervision (O'Donovan et al., 2021) could be emulated in other contexts. To address the issues of patient-provider communication barriers, providers can participate in communication skills training to improve engagement with services, ensuring a person-centred approach.

Improving EHC literacy

The literature made suggestions for improving EHC literacy in the community through a number of public health strategies (Appendix 4), including educational campaigns to increase awareness of risk factors, and to improve perception of EHC services or treatments available. These activities could also raise awareness of, and reduce stigma (World Health Organization, 2021b). Educational campaigns aimed at all levels of the health system could also strengthen knowledge of risk factors, encourage prompt referrals for EHD programs, and ultimately improve community buy-in.

Investing in EHC

LMICs have limited capacity to fund health services and build capacity to prioritise EHC. People living in LMICs also lack ability to pay for such services without suffering financial hardship. There is a need to create fiscal space within government budgets to finance EHC-specific programmes. Funding can be aimed towards supporting integration of EHC into existing primary health and community-based models of care and linked to efficient referral pathways (World Health Organization, 2012, 2021b). The WHO urged policy makers to consider integration of EHC within national health care plans (World Health Organization, 2021a), however epidemiological studies of prevalence and burden of disease, or research measuring effectiveness of context-specific interventions may be necessary to build the evidence to rally government support. Importantly, evidence on validating the estimated financial return on investment into the EHC sector will help compel governments to invest in sustainable health financing and solutions for social protection (McMahon et al., 2021).

Future directions

There is under-representation of studies from LMICs reporting barriers to accessing EHC, and future research should aim to broaden geographical scope. Studies incorporating global, national or community surveys could help identify a more diverse range of dimensions or abilities of access to EHC within and between countries: only 15 studies (24%) represented views of those with hearing loss and just 5 (8%) described barriers to EHC from rural regions. One solution could be participatory research, where stakeholders with hearing loss are included and central to studies. More work is also needed on other demand-side constraints, including stigmatising attitudes on ear disease and hearing loss, and EHC literacy, which have been identified as key challenges (World Health Organization, 2021b).

The limited evidence-base on effective management practices, different service provision models and context-specific service provision is also an area for expansion (Khoza-Shangase, 2019). Interventions at a global level to improve access to screening and rehabilitation through integration of EHC within the health system and reduction of out-of-pocket costs will also improve access to available services. Evidence-based protocols and research, such as the cost-effectiveness of interventions, have previously been documented to skew towards High-income countries (HICs) (Djoutsoop et al., 2021), and improving representativeness should also be a focus for future efforts, preferably with such efforts conducted in areas where such services are most needed, and including the engagement of local communities.

The global EHC community needs to build coalitions between HIC and LMIC institutions to quantify the burden of ear disease, inform health policy, guide practice in low-resource settings, and identify innovative solutions. An example of this is the [Global OHNS Initiative](#), which aims to address some of these barriers through a partnership model (Global OHNS Initiative).

Strengths and limitations of this study

Although we performed a comprehensive search of research databases, our grey literature search was less exhaustive, and so we may have missed some studies. Because we focused on literature reporting from LMICs, we did not capture data from resource limited settings within HICs, such

as indigenous communities or remote locations. Finally, we did not assess included studies for quality.

Conclusion

We identified a relatively thin geographical spread of literature on barriers to accessing EHC in LMICs. The supply-side dimensions of ‘availability’ and ‘appropriateness’ were described more frequently than demand-side dimensions, which included a lack of adequately trained EHC workforce, equipment and resource shortages, an uneven distribution of EHC services in rural regions, and financial barriers around direct and indirect costs associated with delivery of services. Barriers describing the patients’ ability to perceive, to reach and to pay for health care services, including poor knowledge about ear disease and available EHC services, cultural factors such as social stigma, and an inability to pay for EHC services, were prevalent dimensions on the demand-side. There is a need to design and implement health policy and programmes based on proposed solutions, which include incorporating EHC within the primary care and community-based health system, scaling up the EHC workforce through training and education, and improving EHC literacy through public health measures.

Our findings will be of interest to researchers, through highlighting gaps in evidence, and to policy makers and stakeholders involved in the provision of EHC services.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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References

- Afolabi, O. A., Ehalaiye, B. F., Fadare, J. O., Abdur-Rahman, A. B., & Ehalaiye, D. N. (2011). Survey of otological self medication among patients attending ENT and family medicine departments in a Nigerian hospital. *European Journal of General Practice*, 17(3), 167–170. <https://doi.org/10.3109/13814788.2011.565323>
- Ahmed, A., Kolo, E., Aluko, A., Abdullahi, H., Ajiya, A., Bello-Muhammad, N., Raji, H., & Tsiga-Ahmed, F. (2018). Diagnosis and management of otitis media with effusion in a tertiary hospital in Kano: a best practice implementation project. *JBI Database of Systematic Reviews and Implementation Reports*, 16(10), 2050–2063. <https://doi.org/10.11124/JBISRIR-2017-003717>
- Akinpelu, O. V., Amusa, Y. B., Komolafe, E. O., Adeolu, A. A., Oladele, A. O., & Ameye, S. A. (2008). Challenges in management of chronic suppurative otitis media in a developing country. *Journal of Laryngology & Otology*, 122(1), 16–20. <https://doi.org/10.1017/S0022215107008377>
- Ali, A., Hickson, L., & Meyer, C. (2017). Audiological management of adults with hearing impairment in Malaysia. *International Journal of Audiology*, 56(6), 408–416. <https://doi.org/10.1080/14992027.2017.1305515>
- Ambett, R., Rupa, V., & Rajshkhar, V. (2009). Analysis of causes for late presentation of Indian patients with vestibular schwannoma. *Journal of Laryngology & Otology*, 123(5), 502–508. <https://doi.org/10.1017/S0022215108003575>
- Amri, N. A., Quar, T. K., & Chong, F. Y. (2019). Meeting the best practice for hearing Aid verification in children: Challenges and future directions. *American Journal of Audiology*, 28(4), 877–894. https://doi.org/10.1044/2019_AJA-18-0156
- Arksey, H., & O'Malley, L. (2005). Scoping studies: Towards a methodological framework. *International Journal of Social Research Methodology*, 8(1), 19–32. <https://doi.org/10.1080/1364557032000119616>

- Artificial Limbs Manufacturing Corporation of India (ALIMCO). (2021). Retrieved October 13, 2021, from https://www.alimco.in/content/854_1_BehindTheEarHearingAidDigital.aspx.
- ATSCALE2030. (2018). The Global Partnership for Assistive Technology. <https://atscale2030.org/>.
- ATscale & AT2030. (2020). *Product narratives*. <https://atscale2030.org/product-narratives>.
- Balfour, K., McCarthy, A., Hey, S. Y., Kousha, O., Singano, E., Mulwafu, W., ... Blaikie, A. (2021). Comparative evaluation of a low-cost solar powered otoscope with a traditional device among health care workers in Malawi. *Laryngoscope Investigative Otolaryngology*, 6(4), 839–843. <https://doi.org/10.1002/lio2.601>
- Baum, A., Mulwafu, W., Phiri, M., Polack, S., & Bright, T. (2019). An intervention to improve uptake of referrals for children with Ear disease or hearing loss in Thyolo District, Malawi: Acceptability and feasibility. *International Journal of Environmental Research and Public Health*, 16(17), 3144. <https://doi.org/10.3390/ijerph16173144>
- Bhamjee, A., Roux, T. L., Schlemmer, K., Perold, J., Cass, N., Schroeder, K., ... Vinck, B. (2019). Parent-perceived challenges related to the pediatric cochlear implantation process and support services received in South Africa. *International Journal of Pediatric Otorhinolaryngology*, 126, 109635. <https://doi.org/10.1016/j.ijporl.2019.109635>
- Bhutta, M. (2018). Models of service delivery for ear and hearing care in remote or resource-constrained environments. *The Journal of Laryngology & Otology*, 133(1), 39–48. <https://doi.org/10.1017/S0022215118002116>
- Borg, J., & Ostergren, P. O. (2015). Users' perspectives on the provision of assistive technologies in Bangladesh: Awareness, providers, costs and barriers. *Disability and Rehabilitation: Assistive Technology*, 10(4), 301–308. <https://doi.org/10.3109/17483107.2014.974221>
- Bright, T., Mactaggart, I., Kim, M., Yip, J., Kuper, H., & Polack, S. (2019). Rationale for a rapid Methodology to assess the prevalence of hearing loss in population-based surveys. *International Journal of Environmental Research and Public Health*, 16(18), 3405. <https://doi.org/10.3390/ijerph16183405>
- Bright, T., Mulwafu, W., Thindwa, R., Zuurmond, M., & Polack, S. (2017). Reasons for low uptake of referrals to ear and hearing services for children in Malawi. *PLoS ONE*, 12(12), e0188703. <https://doi.org/10.1371/journal.pone.0188703>
- Chary, G., Manjunath, M. K., Channakeshava, T. A., & Shadab, M. D. (2012). Factors influencing delayed presentation of congenitally hearing impaired children in rural India. *Indian Journal of Otolaryngology and Head & Neck Surgery*, 64(4), 330–332. <https://doi.org/10.1007/s12070-011-0389-1>
- Cu, A., Meister, S., Lefebvre, B., & Ridde, V. (2021). Assessing healthcare access using the levesque's conceptual framework—a scoping review. *International Journal for Equity in Health*, 20(1), 1–14. <https://doi.org/10.1186/s12939-021-01416-3>
- Dawood, F., Khan, N. B., & Bagwandin, V. (2019). Management of adult patients with tinnitus: Preparedness, perspectives and practices of audiologists. *South African Journal of Communication Disorders*, 66(1), 621. <https://doi.org/10.4102/sajcd.v66i1.621>
- Dev, A. N., Lohith, U., Pascal, B., Dutt, C. S., & Dutt, S. N. (2018). A questionnaire-based analysis of parental perspectives on pediatric cochlear implant (CI) re/habilitation services: A pilot study from a developing CI service in India. *Cochlear Implants International*, 19(6), 338–349. <https://doi.org/10.1080/14670100.2018.1489937>
- Djoutsop, O. M., Mbougo, J. V., & Kanmounye, U. S. (2021). Global head and neck surgery research during the COVID pandemic: A bibliometric analysis. *Annals of Medicine and Surgery*, 68, 102555. <https://doi.org/10.1016/j.amsu.2021.102555>
- Global OHNS Initiative. The Global Otolaryngology - Head and Neck Surgery Initiative. Retrieved August 15, 2021, from <https://www.globalohns.org>.
- Graham, C., Seeley, J., Gina, A., & Saman, Y. (2019). Mapping the content of mothers' knowledge, attitude and practice towards universal newborn hearing screening for development of a KAP survey tool. *PLoS ONE*, 14(2), e0210764. <https://doi.org/10.1371/journal.pone.0210764>
- Graydon, K., Waterworth, C., Miller, H., & Gunasekera, H. (2018). Global burden of hearing impairment and ear disease. *The Journal of Laryngology & Otology*, 133(1), 18–25. <https://doi.org/10.1017/S0022215118001275>
- Gupta, N., Sharma, A., & Singh, P. P. (2010). Generating an evidence base for information, education and communication needs of the community regarding deafness: A qualitative study. *Indian Journal of Community Medicine*, 35(3), 420–423. <https://doi.org/10.4103/0970-0218.69275>
- Gupta, S., Sah, S., Som, T., Sakkena, M., Yadav, C. P., Sankar, M. J., ... Paul, V. K. (2015). Challenges of implementing universal newborn hearing screening at a tertiary care centre from India. *Indian Journal of Pediatrics*, 82(8), 688–693. <https://doi.org/10.1007/s12098-015-1688-4>
- He, P., Wen, X., Hu, X., Gong, R., Luo, Y., Guo, C., ... Zheng, X. (2018). Hearing aid acquisition in Chinese older adults with hearing loss. *American Journal of Public Health*, 108(2), 241–247. <https://doi.org/10.2105/AJPH.2017.304165>
- Holt, E., McCool, J., Nosa, V., & Thorne, P. (2018). Development of an otitis media strategy in the pacific: Key informant perspectives. *New Zealand Medical Journal*, 131(1475), 69–76.
- Humphreys, G. (2013). Technology transfer aids hearing. *Bulletin of the World Health Organization*, 91(7), 471. <https://doi.org/10.2471/BLT.13.020713>
- Jatto, M. E., Ogunkeyede, S. A., Adeyemo, A. A., Adeagbo, K., & Saiki, O. (2018). Mothers' perspectives of newborn hearing screening programme. *Ghana Medical Journal*, 52(3), 158–162. <https://doi.org/10.4314/gmj.v52i3.9>

- Joubert, K., & Githinji, E. (2014). Quality and readability of information pamphlets on hearing and paediatric hearing loss in the Gauteng Province, South Africa. *International Journal of Pediatric Otorhinolaryngology*, 78(2), 354–358. <https://doi.org/10.1016/j.ijporl.2013.12.018>
- Kamenov, K., Martinez, R., Kunjumen, T., & Chadha, S. (2021). Ear and hearing care workforce: Current status and its implications. *Ear and Hearing*, 42(2), 249–257. <https://doi.org/10.1097/AUD.0000000000001007>
- Kane, S., Radkar, A., Gadgil, M., & McPake, B. (2021). Community health workers as influential health system actors and not “just another pair of hands”. *International Journal of Health Policy and Management*, 10(8), 465–474. <https://doi.org/10.34172/ijhpm.2020.58>
- Kanji, A., Khoza-Shangase, K., & Ballot, D. (2010). Hearing screening follow-up return rate in a very low birth weight project: A retrospective record review. *South African Journal of Child Health*, 4(4), 95–99.
- Kanji, A., & Krabbenhoft, K. (2018). Audiological follow-up in a risk-based newborn hearing screening programme: An exploratory study of the influencing factors. *South African Journal of Communication Disorders - die Suid-Afrikaanse Tydskrif vir Kommunikasieafwykings*, 65(1), 1–7. <https://doi.org/10.4102/sajcd.v65i1.587>
- Kaspar, A., Newton, O., Kei, J., Driscoll, C., Swanepoel, W., & Goulios, H. (2017). Parental knowledge and attitudes to childhood hearing loss and hearing services in the Solomon Islands. *International Journal of Pediatric Otorhinolaryngology*, 103, 87–92. <https://doi.org/10.1016/j.ijporl.2017.10.003>
- Khan, N. B., Joseph, L., & Adhikari, M. (2018). The hearing screening experiences and practices of primary health care nurses: Indications for referral based on high-risk factors and community views about hearing loss. *African Journal of Primary Health Care & Family Medicine*, 10(1), 1–11. <https://doi.org/10.4102/phcfm.v10i1.1848>
- Khoza-Shangase, K. (2019). Early hearing detection and intervention in South Africa: Exploring factors compromising service delivery as expressed by caregivers. *International Journal of Pediatric Otorhinolaryngology*, 118, 73–78. <https://doi.org/10.1016/j.ijporl.2018.12.021>
- Kligerman, M. P., Lamour, S., Okerosi, S., Alkire, B., Xu, M., Patterson, R., Fagan, J., ... Ibekwe, T. (2020). Challenges facing otolaryngologists in low- and middle-income countries during the COVID-19 pandemic. *International Journal of Pediatric Otorhinolaryngology*, 138, 110322. <https://doi.org/10.1016/j.ijporl.2020.110322>
- Kuschke, S., Goncalves, N., & Peer, S. (2018). Hearing outcomes in children with meningitis at Red Cross War Memorial children’s hospital, Cape Town, South Africa: A silent crisis. *South African Medical Journal*, 108(11), 944–946. <https://doi.org/10.7196/SAMJ.2018.v108i11.13067>
- Levesque, J.-F., Harris, M. F., & Russell, G. (2013). Patient-centred access to health care: Conceptualising access at the interface of health systems and populations. *International Journal for Equity in Health*, 12(1), 18. <https://doi.org/10.1186/1475-9276-12-18>
- Li, W., Dai, C., Li, H., Chen, B., & Jiang, Y. (2016). Factors impacting early cochlear implantation in Chinese children. *European Archives of Oto-Rhino-Laryngology*, 273(1), 87–92. <https://doi.org/10.1007/s00405-015-3492-1>
- Lopez-Vazquez, M., Berruecos, P., Lopez, L. E., & Cacho, J. (2009). Attitude and knowledge of hearing loss among medical doctors selected to initiate a residency in Mexico. *International Journal of Audiology*, 48(3), 101–107. <https://doi.org/10.1080/14992020802355882>
- Makhoba, M., & Joseph, N. (2016). Practices and views of audiologists regarding aural rehabilitation services for adults with acquired hearing loss. *South African Journal of Communication Disorders*, 63(1), 1–10. <https://doi.org/10.4102/sajcd.v63i1.155>
- Martinez Wbaldo, M. D., & Torres Lagunas, M. L. (2016). Qualitative aspects of the process of neonatal hearing screening program in Mexico evaluated from the parental perspective. *Medwave*, 16(11), 6798. <https://doi.org/10.5867/medwave.2016.11.6798>
- McDaid, D., Park, A.-L., & Chadha, S. (2021). Estimating the global costs of hearing loss. *International Journal of Audiology*, 60(3), 162–170. <https://doi.org/10.1080/14992027.2021.1883197>
- McMahon, C. M., Nieman, C. L., Thorne, P. R., Emmett, S. D., & Bhutta, M. F. (2021). The inaugural World Report on hearing: From barriers to a platform for change. *Clinical Otolaryngology*, 46(3), 459–463. <https://doi.org/10.1111/coa.13756>
- Merugumala, S. V., Pothula, V., & Cooper, M. (2017). Barriers to timely diagnosis and treatment for children with hearing impairment in a southern Indian city: A qualitative study of parents and clinic staff. *International Journal of Audiology*, 56(10), 733–739. <https://doi.org/10.1080/14992027.2017.1340678>
- Moroe, N., & Khoza-Shangase, K. (2018). Management of occupational noise induced hearing loss in the mining sector in South Africa: Where are the audiologists? *Journal of Occupational Health*, 60(5), 376–382. <https://doi.org/10.1539/joh.2018-0020-OA>
- Moroe, N., & Vazzana, N. (2019). The disuse of hearing aids in elderly people diagnosed with a presbycusis at an old age home, in Johannesburg, South Africa: A pilot study. *African Health Sciences*, 19(2), 2183–2188. <https://doi.org/10.4314/ahs.v19i2.43>
- Mukara, K. B., Waiswa, P., Lilford, R., & Tucci, D. L. (2017). Knowledge and care seeking practices for ear infections among parents of under five children in Kigali, Rwanda: A cross-sectional study. *BMC Ear, Nose and Throat Disorders*, 17(1), 7. <https://doi.org/10.1186/s12901-017-0040-1>
- Mulwafu, W., Ensink, R., Kuper, H., & Fagan, J. (2017). Survey of ENT services in sub-Saharan Africa: Little progress between 2009 and 2015. *Global Health Action*, 10(1), 1289736. <https://doi.org/10.1080/16549716.2017.1289736>

- Neumann, K., Euler, H. A., Chadha, S., & White, K. R. (2020). A survey on the global status of newborn and infant hearing screening. *Journal of Early Hearing Detection and Intervention*, 5(2), 63–84. <https://doi.org/10.26077/a221-cc28>
- O'Donovan, J. (2021). Training for Community Health: Bridging the global health care gap. *Approaches to Community Health Worker Training and Supervision*. Oxford University Press. <https://doi.org/10.1093/oso/9780198866244.001.0001>
- O'Donovan, J., Namanda, A. S., Hamala, R., Winters, N., & Bhutta, M. F. (2020). Exploring perceptions, barriers, and enablers for delivery of primary ear and hearing care by community health workers: A photovoice study in Mukono District, Uganda. *International Journal for Equity in Health*, 19(1), 62. <https://doi.org/10.1186/s12939-020-01158-8>
- O'Donovan, J., Nakku, D., Nyanzi, D., Nakasagga, E., Hamala, R., Namanda, A. S., ... Bhutta, M. F. (2021). Training, supervision, and performance of community health workers in the delivery of ear and hearing care to 321 community members in rural Uganda. *Clinical Otolaryngology*, 1–7. <https://doi.org/10.1111/coa.13815>
- O'Donovan, J., Verkerk, M., Winters, N., Chadha, S., & Bhutta, M. F. (2019). The role of community health workers in addressing the global burden of ear disease and hearing loss: A systematic scoping review of the literature. *BMJ Global Health*, 4(2), 001141. <https://doi.org/10.1136/bmjgh-2018-001141>
- Ogunkeyede, S. A., Adebola, S. O., Salman, A., & Lasisi, A. O. (2017). Childhood hearing loss; a need for primary health care. *International Journal of Pediatric Otorhinolaryngology*, 94, 117–120. <https://doi.org/10.1016/j.ijporl.2017.01.013>
- Olajide, T. G., Aremu, K. S., Esan, O. T., Dosunmu, A. O., & Raji, M. M. (2018). Topical ear drop self-medication practice among the Ear, nose, and Throat patients in Ido Ekiti, Nigeria: A cross - sectional study. *Annals of African Medicine*, 17(2), 70–74. https://doi.org/10.4103/aam.aam_28_17
- Olusanya, B. O., Swanepoel de, W., Chapchap, M. J., Castillo, S., Habib, H., Mukari, S. Z., ... McPherson, B. (2007). Progress towards early detection services for infants with hearing loss in developing countries. *BMC Health Services Research*, 7(1), 14. <https://doi.org/10.1186/1472-6963-7-14>
- Omondi, D., Ogol, C., Otieno, S., & Macharia, I. (2007). Parental awareness of hearing impairment in their school-going children and healthcare seeking behaviour in Kisumu district, Kenya. *International Journal of Pediatric Otorhinolaryngology*, 71(3), 415–423. <https://doi.org/10.1016/j.ijporl.2006.11.007>
- Orji, A., Kamenov, K., Dirac, M., Davis, A., Chadha, S., & Vos, T. (2020). Global and regional needs, unmet needs and access to hearing aids. *International Journal of Audiology*, 59(3), 166–172. <https://doi.org/10.1080/14992027.2020.1721577>
- Orji, F. (2013). A survey of the burden of management of chronic suppurative otitis media in a developing country. *Annals of Medical and Health Sciences Research*, 3(4), 598–601. <https://doi.org/10.4103/2141-9248.122126>
- Patel, H. C., Mohua, M., Anjali, M., Rahul, P., Kantharia, S. L., & Chaudhary, I. M. (2014). Health seeking behavior among parents of children with hearing loss: A cross sectional study. *National Journal of Community Medicine*, 5(1), 33–37.
- Pedroso, H. C., & Goncalves, C. G. (2016). Primary care health professionals' perception and knowledge on notification of noise-induced hearing loss in Curitiba - Parana. *Codas*, 28(5), 575–582. <https://doi.org/10.1590/2317-1782/20162015264>
- Petrocchi-Bartal, L., & Khoza-Shangase, K. (2014). Hearing screening procedures and protocols in use at immunisation clinics in South Africa. *South African Journal of Communication Disorders*, 61(1), 9. <https://doi.org/10.4102/sajcd.v61i1.66>
- Pillay, D., & Serooe, T. (2019). Shifting and transforming the practice of audiology: The inclusion of traditional healing. *South African Journal of Communication Disorders*, 66(1), 1–9. <https://doi.org/10.4102/sajcd.v66i1.635>
- Poole, N. F., Skilton, M. K., Martin, T. C., & Smith, M. C. (2016). Knowledge, attitudes, beliefs and practices related to chronic suppurative otitis media and hearing impairment in Pokhara, Nepal. *Journal of Laryngology & Otology*, 130(1), 56–65. <https://doi.org/10.1017/S0022215115002996>
- Rakesh, K., & Panchal, A. J. (2018). Health seeking behaviour in patients of suppurative otitis media in Surat City. *National Journal of Community Medicine*, 9(9), 735–739.
- Ravi, R., Yerraguntla, K., Gunjawate, D. R., Rajashekhar, B., Lewis, L. E., & Guddattu, V. (2016). Knowledge and attitude (KA) survey regarding infant hearing loss in Karnataka, India. *International Journal of Pediatric Otorhinolaryngology*, 85, 1–4. <https://doi.org/10.1016/j.ijporl.2016.03.012>
- Roy, E., Hasan, K. Z., Richards, J. L., Haque, A. K. M. F., Siddique, A. K., & Sack, R. B. (2012). Burden and outcome of acute otitis media in children aged under 2 in rural Bangladesh. *South African Journal of Child Health*, 6(4), 118–122. <https://doi.org/10.7196/sajch.486>
- Salisu, A. D. (2010). Otolary practice in a Nigerian tertiary health institution: A 10-year review. *Annals of African Medicine*, 9(4), 218–221. <https://doi.org/10.4103/1596-3519.70958>
- Sambah, I., Zhao, F., & El-Lishani, R. (2020). The professional's experience with causes of delay in the diagnosis and management of children with a congenital hearing loss in Libya. *International Journal of Pediatric Otorhinolaryngology*, 128, 109687. <https://doi.org/10.1016/j.ijporl.2019.109687>

- Sanders, M., Houghton, N., Dewes, O., McCool, J., & Thorne, P. R. (2015). Estimated prevalence of hearing loss and provision of hearing services in Pacific Island nations. *Journal of Primary Health Care*, 7(1), 5–15. <https://doi.org/10.1071/HC15005>
- Scheepers, L. J., Swanepoel de, W., & Roux, T. (2014). Why parents refuse newborn hearing screening and default on follow-up rescreening—a South African perspective. *International Journal of Pediatric Otorhinolaryngology*, 78(4), 652–658. <https://doi.org/10.1016/j.ijporl.2014.01.026>
- Schuster-Bruce, J., Shetty, P., O'Donovan, J., Mandavia, R., Sokdavy, T., & Bhutta, M. (2020). Comparative performance of prediction model, non-expert and tele-diagnosis of common external and middle ear disorders using a cohort of 85 patients from Cambodia. *Authorea Preprints*, <https://doi.org/10.1111/coa.13695>
- Solar Ear. (2020). Solar Ear. <https://solarear.com.br/products/>
- Srikanth, S., Isaac, R., Rebekah, G., & Rupa, V. (2009). Knowledge, attitudes and practices with respect to risk factors for otitis media in a rural South Indian community. *International Journal of Pediatric Otorhinolaryngology*, 73(10), 1394–1398. <https://doi.org/10.1016/j.ijporl.2009.06.024>
- Suniti, C. (2018). State of deaf children in West Bengal, India: What can be done to improve outcome. *International Journal of Pediatric Otorhinolaryngology*, 110, 37–42. <https://doi.org/10.1016/j.ijporl.2018.04.025>
- Swanepoel, D., & Almec, N. (2008). Maternal views on infant hearing loss and early intervention in a South African community. *International Journal of Audiology*, 47(Suppl 1), S44–S48. <https://doi.org/10.1080/14992020802252279>
- Swanepoel, D., & Clark, J. L. (2019). Hearing healthcare in remote or resource-constrained environments. *Journal of Laryngology & Otology*, 133(1), 11–17. <https://doi.org/10.1017/S0022215118001159>
- Swanepoel, D. W. (2020). Ehealth technologies enable more accessible hearing care. *Seminars in Hearing*, 41(02), 133–140. Thieme Medical Publishers. <https://doi.org/10.1055/s-0040-1708510>
- Tanon-Anoh, M. J., Sanogo-Gone, D., & Kouassi, K. B. (2010). Newborn hearing screening in a developing country: Results of a pilot study in Abidjan, Cote d'ivoire. *International Journal of Pediatric Otorhinolaryngology*, 74(2), 188–191. <https://doi.org/10.1016/j.ijporl.2009.11.008>
- Teixeira, L., & Joubert, K. (2014). Availability of audiological equipment and protocols for paediatric assessment and hearing aid fitting in Gauteng, South Africa. *South African Journal of Communication Disorders*, 61(1), 8. <https://doi.org/10.4102/sajcd.v6i1i.58>
- Theunissen, M., & Swanepoel, D. (2008). Early hearing detection and intervention services in the public health sector in South Africa. *International Journal of Audiology*, 47(Suppl 1), 23–29. <https://doi.org/10.1080/14992020802294032>
- Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., ... Straus, S. E. (2018). PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. *Annals of Internal Medicine*, 169(7), 467–473. <https://doi.org/10.7326/M18-0850>
- TYMPA Health. (2016). The Tympa System. <https://www.tympahealth.com/the-tympa-system/>
- Villarreal, I., Turner, R., Jo, H., Park, J., Gemmen, E., Pircon, J. Y., ... Hausdorff, W. P. (2017). Healthcare-seeking behaviour of primary caregivers for acute otitis media in children aged 6 months to ≤ 30 months in Panama: Results of a cross-sectional survey. *BMC Pediatrics*, 17(1), 3. <https://doi.org/10.1186/s12887-016-0760-1>
- Wilson, B. S., & Tucci, D. L. (2021). Addressing the global burden of hearing loss. *The Lancet*, 397(10278), 945–947. [https://doi.org/10.1016/S0140-6736\(21\)00522-5](https://doi.org/10.1016/S0140-6736(21)00522-5)
- Wilson, B. S., Tucci, D. L., Merson, M. H., & O'Donoghue, G. M. (2017). Global hearing health care: New findings and perspectives. *The Lancet*, 390(10111), 2503–2515. [https://doi.org/10.1016/S0140-6736\(17\)31073-5](https://doi.org/10.1016/S0140-6736(17)31073-5)
- Wong, Y. A., Mukari, S. Z. S., Harithasan, D., & Mazlan, R. (2019). Knowledge and attitude on childhood hearing loss among mothers and mothers-to-be in urban and rural areas in Malaysia. *International Journal of Pediatric Otorhinolaryngology*, 124, 79–84. <https://doi.org/10.1016/j.ijporl.2019.05.040>
- World Bank. (2021). World Bank Country and Lending Groups. World Bank Data Help Desk. Retrieved May 31, 2021 from <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>.
- World Health Organization. (2001). *International classification of functioning, disability and health: ICF*.
- World Health Organization. (2012). *Community-based rehabilitation: Promoting ear and hearing care through CBR*. <https://apps.who.int/iris/bitstream/handle/10665/339376/9789241504706-eng.pdf?sequence=1>.
- World Health Organization. (2017). WHA70.13: 17th World Health assembly. https://apps.who.int/gb/ebwha/pdf_files/WHA70/A70_R13-en.pdf?ua=1.
- World Health Organization. (2021a). *Integrated people-centred ear and hearing care: Policy brief*. <https://apps.who.int/iris/bitstream/handle/10665/339957/9789240021594-eng.pdf?sequence=1>.
- World Health Organization. (2021b). *World report on hearing*. World Health Organization. <https://www.who.int/publications/i/item/world-report-on-hearing>.
- Yancey, K. L., Cheromei, L. J., Muhando, J., Reppart, J., Netteville, J. L., & Jayawardena, A. D. (2019). Pediatric hearing screening in low-resource settings: Incorporation of video-otoscopy and an electronic medical record. *International Journal of Pediatric Otorhinolaryngology*, 126, 109633. <https://doi.org/10.1016/j.ijporl.2019.109633>