Integration of ear and hearing care services in low and middle-income health systems: a systematic review and qualitative synthesis

SUBMITTED IN PARTIAL FULFILMENT FOR THE DEGREE MASTER OF PUBLIC HEALTH (HEALTH SYSTEMS), SCHOOL OF PUBLIC HEALTH AND FAMILY MEDICINE, UNIVERSITY OF CAPE TOWN

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Target journal: Global Health Action[1]

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Carmen de Kock[2]

Abstract

Hearing loss is a global public health burden and mostly affects those living in low and middle-income countries (LMICs). Hearing loss is expected to significantly increase without public health interventions. One approach to address ongoing challenges is the World Health Organisation's recommendation for the integration of ear and hearing care (EHC) services into healthcare packages. However, little is known about EHC integration approaches particularly in LMICs additionally, these approaches have not been investigated through a health systems lens. This qualitative review aimed to describe the various approaches to the EHC service integration in LMICs and to identify enabling and constraining factors. We conducted a qualitative synthesis to describe the factors influencing EHC service integration experiences. We reviewed 850 records and included 17 studies, with a focus on LMICs, using adaptations of the Valentijn integration and World Health Organization EHC frameworks. Our investigation showed that most integration approaches in LMICs were at micro or individual level. Enabling factors for integration of EHC services were training, mentorship, collaboration, technology, inclusion of EHC in healthcare packages and investment in EHC services. Barriers were challenges with training, facilities and equipment, policy implementation and resourcing of EHC services. We further described factors influencing healthcare seeking behaviour and the use of integrated EHC services such as access and ability to pay, referrals systems, and communication and awareness. This study describes the complex nature of EHC integration and ways to support integration. Key considerations are the level of integration, training to address workforce issues and factors influencing service utilisation as we work towards health system strengthening.

Key words: Ear and hearing care, integration, low-and middle-income countries

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[1] Instructions for authors are in Appendix 5.

[2] For the purpose of this thesis, the student is the sole and first author of this review.

Introduction

Hearing loss has a significant impact on global public health and affects the quality of life of vulnerable communities living with an 'invisible disability' [1]. Hearing loss (HL) affects approximately 1.5 billion people with a predicted 1.5-fold increase in the next few decades due to an ageing global population, noise-induced and ototoxic hearing loss, common ear infections and other causes [1]. Yet, many causes of HL are preventable, especially in children younger than 15 years, through public health measures such as immunisation, adequate referral systems, health promotion and education [2–6].

Approximately 80% of people with moderate to higher levels of HL live in low and middle-income countries (LMICs), adding pressure to healthcare systems that are already severely under resourced [1,6,7]. A recent study which evaluated the ear and hearing care (EHC) workforce in 141 countries over the past 10 years, showed that most LMICs have access to less than one audiologist per million people compared to more than 10 audiologists per million people in most high-income countries (HICs) [8]. EHC services in LMICs are also fragmented, often provided by limited specialised healthcare workers and not incorporated into national healthcare packages [1]. Therefore, for many people living in LIMCs, EHC services are not easily accessible. Integrating EHC services into healthcare packages could improve access, equity, quality of care, acceptability of services and efficiency [9–17]. Service integration becomes relevant to, and necessary for, health system strengthening when it has a long-term impact on health services leading to a more improved and responsive health system [10]. The nature, level and approach to integration of services varies across healthcare interventions and settings [9,18]. However, such integration can be understood as entailing managerial or operational changes to health systems that seek to bring together stakeholders or processes through inputs, organisational arrangements, management at operational level and the delivery or organisation of service functions towards improving efficiency and quality of care to achieve health system goals [15,17]. Considering the burden of disease, lack of EHC services and potential impact of integration on EHC services, the World Health Organisation (WHO) has encouraged countries to emphasise HL as a global public health priority and recommends the integration of EHC into universal health coverage [1].

To date, no in-depth systematic review has reviewed experiences of EHC integration. Most studies have focussed on issues such as health service delivery, the effect of audiological treatment on quality of life and social impact,

technology and telehealth applications, or early intervention approaches [19–27]. This study, therefore, aims to conduct a systematic review and qualitative synthesis of literature published on the integration of ear and hearing care into health systems by addressing the question, "What approaches to integration of ear and hearing services have been implemented in LMICs and what factors have influenced these experiences?". In addressing this question, the review will purposefully adopt a systemic lens, recognising the health system as a complex, dynamic system comprising of interconnected building blocks [11,13] and interconnected hardware and software [28]. We will describe the approaches to the integration of ear and hearing healthcare services, determine the factors influencing the integration of EHC services into health systems and identify the lessons that can be learnt for future EHC integration efforts.

Methods

We explored the review question through a qualitative systematic review approach. Such an approach addresses broad questions and aids in guiding evidence-based decision making using proven scientific methodologies and allowing for comparison across countries, contexts and time to highlight patterns which can be considered for relevance and generalisability [29–31]. This review approach has also been useful in exploring the barriers and facilitators of other areas of service delivery [29].

Article identification

The search strategy was developed by the lead author with the guidance of the librarian services at the Faculty of Health Sciences, University of Cape Town, South Africa. The databases searched included PubMed, Scopus, Web of Science, EBSCO, Cochrane library and Google Scholar. Search terms or keywords were generated from the research question using Medical Subject Headings (MeSH) terms such as public health or delivery of healthcare, integrated, systems integration, health services research, ear and hearing care services or audiological services, developing countries or lower income countries including LMIC names according to the World Bank combined with Boolean search strategies [32]. The literature search was initially conducted from July to August 2022 and updated in January 2024. The identified articles were exported to Endnote (v.20.4).

Article selection

The eligibility criteria are depicted in Box 1. The systematic review process followed methods previously described by Moher [33]. These steps entailed database searching for articles by the lead author (CDK) using predetermined key terms, removing duplicates and screening the abstracts and text of remaining articles for their relevance (CDK) [33]. Finally, included articles underwent a full text review (CDK) with discrepancies resolved by discussions (CDK and supervisor, LG) and those that did not meet the inclusion criteria were excluded from the study. Given concerns about what criteria to use for the appraisal of qualitative literature [34], we opted not to implement a quality checklist but only included published peer-reviewed articles.

Box 1

Inclusion criteria:

- Articles available in English language.
- Open-access journals or journals accessible through the University of Cape Town.
- All study design types were included.
- Articles from low-and-middle-income countries or those with a focus on low- and middle-income countries.
- Studies from 2017, when the WHA passed a resolution on the prevention of deafness and hearing loss, until 2024.

Exclusion criteria:

- Not in English.
- In high-income country.
- Not retrievable.
- Published before 2017.
- Article did not describe ear and hearing care and integration.
- Articles that did not undergo a peer-review process.

Data extraction, analyses and synthesis

The author extracted data to an Excel sheet from the methods and results sections of included articles using a data extraction form (Appendix 3, Table 1). Conceptual frameworks have been shown to be valuable in aiding health system researchers to frame and extract relevant information from empirical research [35]. We explored integration using two relevant frameworks to support a comprehensive overview of the EHC integration:

1. The Valentijn integration framework describes the dimensions and level of integration while considering the relationships amongst stakeholders [16].
2. The WHO framework for EHC (Figure 1), which builds on the original WHO Health System building blocks framework, was used to assist in identifying system factors influencing integration [1].

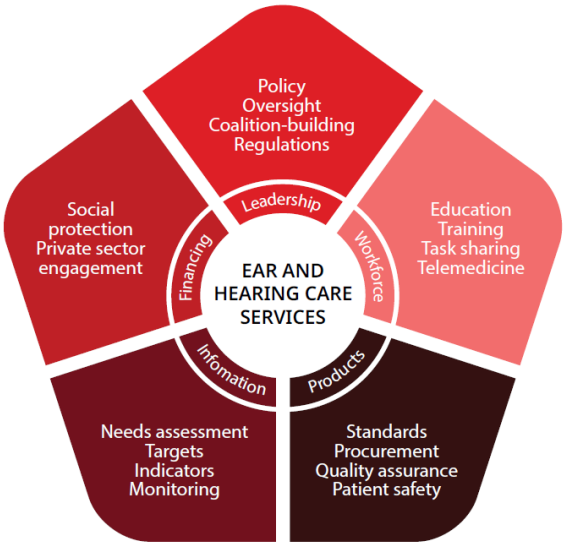

Figure 1. Health system building blocks and possible enablers of integration for EHC services [1]

CDK conducted the data extraction and LG conducted data extraction of a sample of articles as quality control. Rigorous thematic analysis has been found to be a trustworthy approach to data analysis and synthesis, allowing rich, in-depth interpretation of data [36]. The data extraction form, based on the frameworks, supported thematic analysis of the approaches to integration and barriers/enablers. However, we also applied an inductive thematic analysis approach, driven by the data [35], to develop subcodes within the main themes, as well as to identify additional factors influencing the experiences reported.

Rigour

The search strategy and data management process were reproducible, and implementation of data collection was transparent as it used a predefined data extraction table, which also evolved through inductive sub-coding. The research approach included reflection during the data extraction and analysis process to ensure that the methods are appropriate for the research question [37]. Given the review approach, key findings should be broadly generalizable across country settings [37]. The protocol was reviewed and approved by the Departmental Research Committee, School of Public Health, University of Cape Town, South Africa. The study did not require further ethical approval as it did not directly involve human subjects (Appendix 4).

Defining integration approaches

Building from our definition of integration, as presented in the introduction, we applied various concepts of integration in this review to better understand the experiences examined, recognising complexities in the nature, level, and approaches to integration. Integration can, first, be considered at three levels namely micro, meso and macro [16]. At micro level, the aim is to support the provision of care to individuals; at meso level, to offer care for specific populations who have the same disease or conditions; and at macro level, to offer care for entire populations [9]. Figure 2 summarises the approaches to integration that may be used within and across these levels.

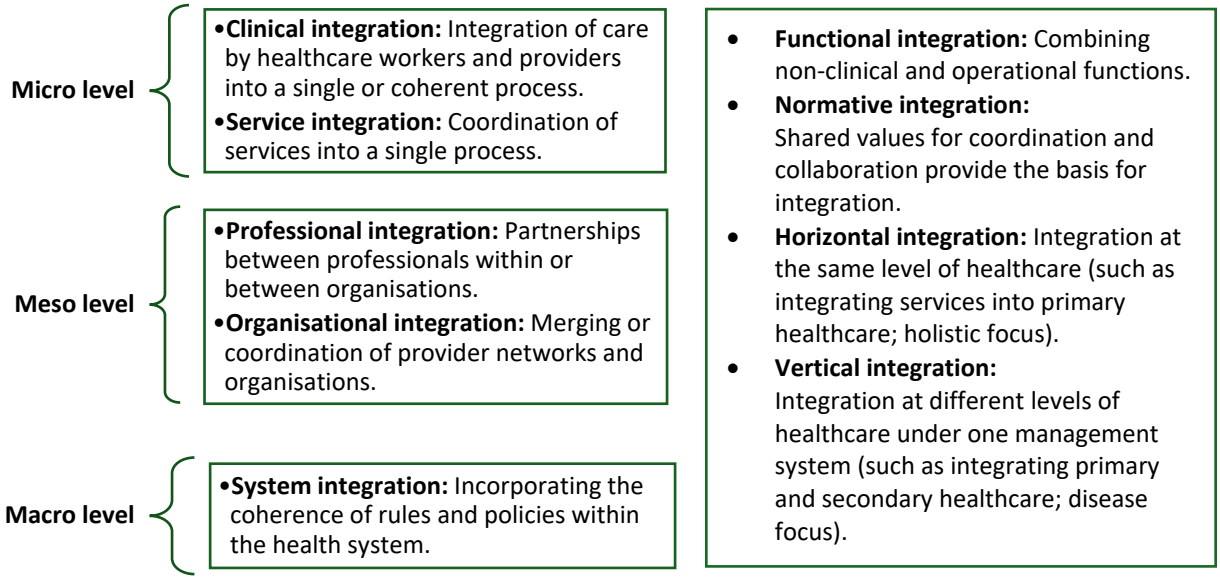

Figure 2. Summary of integration approaches [9,16,38,39]

At the micro level, clinical integration refers to the coordination of services provided to individual patients according to their needs (Figure 2). This is often known as person-based care [16]. Meso level integration is based on organisational and inter-organisational relationships, as well as professional partnerships, that enable comprehensive service delivery to a defined population [16]. At the macro level, system integration is described as a people-centred approach that acknowledges the multiple needs of the population and involves the coordination of services to meet those needs [9,16]. Normative and functional integration approaches are two approaches that can connect the different levels of integration as they facilitate coherence and support both formal and informal coordination of services [16]. Functional integration involves the coordination of key support functions for service delivery such as finance, human resources, information management, etc. occurring at micro level (clinical integration), meso level (professional and organisational integration) and macro level (system

integration) [16]. On the other hand, normative integration emphasises coordination based on shared mission, vision, goals and values at all levels of integration [16]. Another relevant concept is horizontal integration, which entails establishing connections among organisations, networks or groups within a health system, usually at similar levels of care (holistic approach). Vertical integration, meanwhile, involves connecting different levels of care and is often seen as a disease focussed approach [9,39,40].

Results

Search results

Database searches yielded 850 articles in total, 243 duplicates were removed, 334 articles were excluded by date and 1 article was not retrievable. After full text review of 272 articles, only 17 articles met the inclusion criteria (PRISMA flowchart, Figure 3). The included studies are tabulated in Table 2 (Appendix 3).

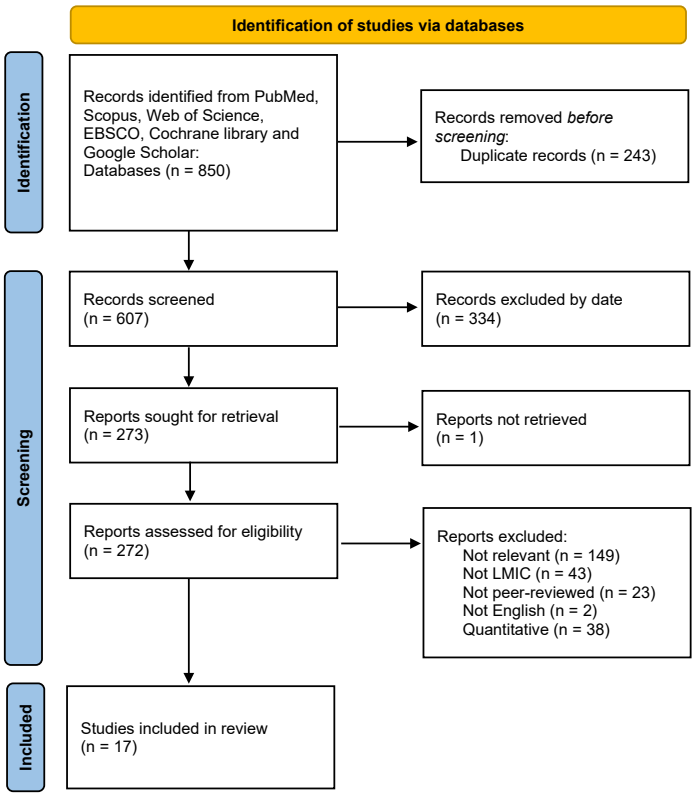

Figure 3. PRISMA diagram illustrating the searching strategy. LMIC: low- and middle-income country, PRISMA: Preferred Reporting Items for Systematic Reviews and Meta Analyses

Description of articles

This review included only seventeen peer-reviewed articles of which five were scoping reviews, four reported qualitative studies, four reported quantitative studies, three reported mix-method studies, and one, a cross-sectional descriptive study (Table 2, Appendix 3). Most studies investigated some form of integration in LMICs or had a strong focus on LMICs, describing healthcare interventions focused on delivering EHC services in rural or low-resource settings in countries such as India, Peru, South Africa, Malawi, Nigeria, Ghana, Uganda and Cambodia. These interventions are innovative ideas, practices, objects, or institutional arrangements including organisational, financial, and procedural changes to pre-existing interventions [41].

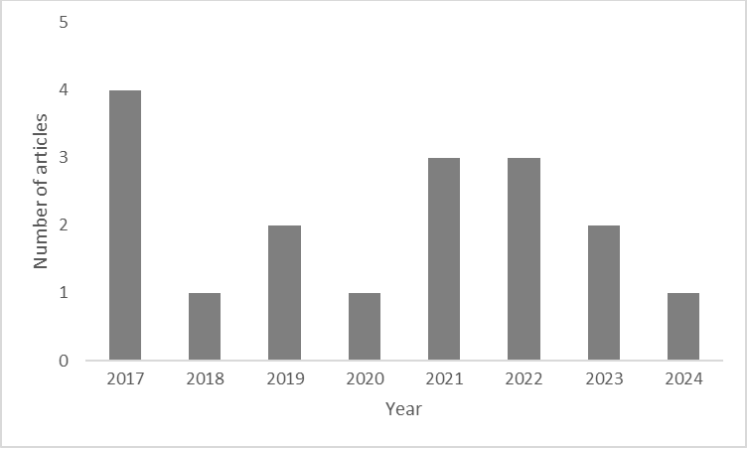

Figure 4. Summary of articles by year of publication.

The articles selected for this review were grouped according to year of publication in Figure 4. Most articles were published in 2017 which coincides with the publication of the World Health Assembly report on the Prevention of deafness and hearing loss, the event chosen as the start date for the review itself [27]. The annual number of papers published dipped subsequently but recovered to 3 in both 2021 and 2022. In 2021, the WHO published the landmark report 'World Report on Hearing' [1] reflecting increased research interest in EHC.

Approaches to integration of ear and hearing healthcare services

Table 3 indicates that most papers report EHC integration experiences at the micro level, with no experiences reported at the macro level. At the micro level, service integration was the most reported approach to

integration, followed by clinical and professional integration. These experiences are discussed further in the next sections.

Table 3. Summary of identified integration approaches

APPROACHES TO INTEGRATION	LEVEL OF INTEGRATION	
	Micro level	**Meso level**
CLINICAL INTEGRATION	1; 4; 12; 16	
SERVICE INTEGRATION	1; 2; 6; 11; 14; 15	
PROFESSIONAL INTEGRATION		5; 7
NORMATIVE INTEGRATION		7
ORGANISATIONAL INTEGRATION		2; 7
FUNCTIONAL INTEGRATION		
SYSTEM INTEGRATION		

Note: Numbers in table indicate paper reference

Integration at micro level

At micro level, four papers presented studies illustrating clinical integration through task shifting or sharing [42–45], a workforce intervention recommended by the WHO to address healthcare worker shortages [1]. Two of these papers considered integration through the inclusion of community health workers (CHWs). This cadre usually offered a wider range of healthcare services, to which EHC was added after they had received specialised training – in Uganda, to conduct hearing screening [44] and in Malawi, to support referral management [45]. In Uganda, CHWs' new role in EHC screening meant this service was incorporated into community-based programmes (reflecting a horizontal integration approach) [44]. In Malawi, in contrast, referral management by CHWs (at community level) to tertiary facilities reflected a vertical approach [45]. The studies conducted by Waterworth et.al [43]and O'Donovan et.al [42] also reported clinical integration approaches that entailed integrating CHWs into EHC services such as screening and treatment of ear disease., through task shifting and-sharing.

Six papers reported studies illustrating service integration at the micro level with two studies describing vertical approaches and four studies describing horizontal approaches (Table 3). Furthermore, two of the papers reported interventions to improve access to EHC services: using tele-audiology (remote provision of audiological services by specialists) in India [46] and smartphone technology to conduct hearing screening in South Africa [47]. The latter study showed that the implementation of community-based hearing screening performed by

CHWs using advanced technology was as effective as hearing screening conducted by specialised healthcare workers (HCWs) [47]. A second South African study evaluated a vertical integration approach that entailed screening infants at risk of hearing loss and determining the factors which influenced follow-up attendance at specialised facilities by the high-risk patients [48]. Yet another study in South Africa considered service level integration through implementing hearing screening programmes targeting the elderly to evaluate the prevalence of hearing loss in this population and effect on quality of life [49]. Hearing screening and counselling conducted by trained CHWs was successfully incorporated into community screening services in India [42]. One paper reported an evaluation of the integration of EHC services at community level using tele-audiology by CHWs and audiologists in India, intended to address service delivery challenges in rural communities [46]. Another paper reported an experience of integration, from two regions in Ghana, focussing on new-born hearing screening (NBHS) services and using tele-audiology in hospital settings, comparing it to conventional [50]. This study demonstrated improved access to EHC for rural populations through integrating tele-audiology.

Integration at meso level

Only three papers examined meso level integration, mostly focusing on professional approaches to integration (Table 3).

In India, organisational integration efforts between schools and HCWs facilitated the successful implementation of remote hearing screening programmes at schools by trained audiologists [46]. Professional integration in the rural villages of Cusco, Peru involved a diverse group of HCWs from the medical, dental, and audiology fields providing clinical services [51]. These CHWs and HCW teams had shared values (normative integration) and worked towards the common goal of providing quality and sustainable EHC services [51]. The same paper illustrated organisational integration for EHC services, through partnerships between the local Peruvian health professionals and/or government and the nonprofit organisation, Idaho Condor Humanitarian, bringing together the expertise and experience of these partners to support integration [51]. Interprofessional collaboration was found to assist with improving access to EHC services in India, as CHWs could deliver services to rural areas using tele-audiology with the support of hearing care specialists such as audiologists who could review results obtained by CHWs [52].

Factors enabling integration of ear and hearing care services

We describe the key themes identified from the included papers that enabled or facilitated integration of EHC services, linking them to the health system building blocks identified in Figure 1, whilst also considering the level of integration using the EHC service delivery framework [1]. The dominant strategies enabling EHC integration were training, collaboration, mentorship, technology, inclusion of EHC in healthcare packages and investment (Figure 5).

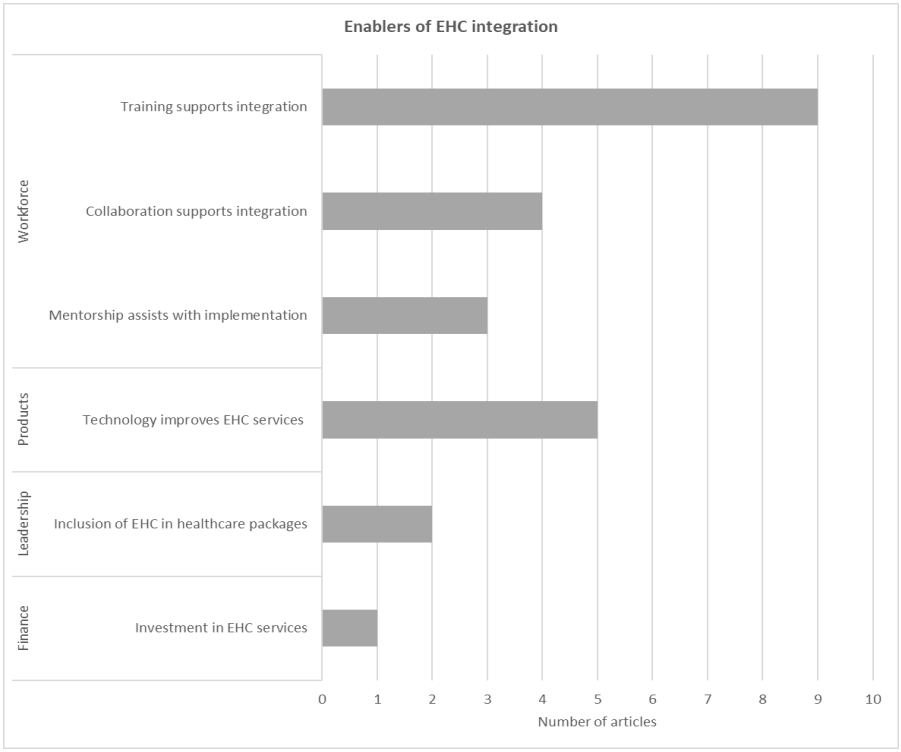

Figure. 5 Distribution of enablers mapped to the WHO framework [1]

Workforce

Training supports integration

The continuous shortage of skilled HCWs is a major challenge in many LMICs. One of the approaches to address this shortage is training CHWs to conduct specialised services such as hearing screening [43,45,52]. The micro-level integration strategy of task shifting or sharing is, thus, enabled by offering CHWs specialised training to conduct these services, also affecting the quality and coverage of services [44]. However, it should be noted that the inclusion of CHWs in the implementation of EHC services at community levels does not replace specialised HCWs at secondary and tertiary levels [1].

Several papers offered experiences on how to conduct or strengthen training of CHWs using in-person, online or blended approaches [42,44–46,52]. Four micro level studies involved focussed training programmes aimed at achieving desired health outcomes, such as improved access to hearing screening aligned to the needs of communities [42,44,45,50]. CHWs in India enabled integration through training using a targeted six-week programme to expand EHC services which covered fitting hearing aids and providing counselling [42]. A Ugandan study approached training using hybrid methods which consisted of a short two-day in-person programme followed by remote supervision of CHWs using technology such as WhatsApp [44]. Only one study in Malawi used the standardised WHO Basic and Intermediate training modules on Primary Ear and Hearing Care to train CHWs in basic EHC services which aim to relieve the service delivery burden on secondary and tertiary levels [45]. In Ghana, the implementation of community-based hearing programmes conducted under the supervision of specialised HCWs showed to be useful [50]. A study in Cambodia described how non-governmental organisations and public hospitals have addressed the gap in specialised training for HCWs to enable task sharing and expand services which includes hearing screening and treatment [53]. These papers described various approaches to training CHWs which resulted in addressing workforce challenges and expanding EHC service delivery particularly in underserved communities.

Mentorship assists integration

As previously stated, training of local HCWs (and CHWs) can address EHC staff shortages especially in rural communities. However, retaining skilled staff in rural settings is another challenge facing the health system as this feeds directly into sustainability of EHC services. Mentorship of staff can be seen as a system software enabler of integration, going beyond training, which supports staff retention, and enables skilled staff to implement services effectively. For instance, in Uganda, CHWs were trained and then further supported remotely using technology, thereby providing continuous support for trained staff at micro level and supporting more effective implementation [44]. Another study showed that the micro level approach which includes continuous supervision and guidance of HCWs by specialised HCWs beyond training programmes supports retention as well as the competency of trainees [43]. Furthermore, adapting training to include mentorship and supervision improved staff morale as HCWs were more motivated and satisfied when support measures were in place [43]. Similarly, Eubank et al. [52], argued that training programmes can benefit from including feedback mechanisms in community-based assessment programmes.

Collaboration supports integration

The health system in low-resource settings is already under tremendous pressure with high burdens of disease and limited resources for effective service delivery. One way to tackle this was identified in four papers that described collaborative efforts between stakeholders towards integration in low-resource settings. Collaborative efforts between stakeholders, particularly communities and professionals, act as system software enablers of EHC integration through creating formal and informal partnerships. For instance, Indian partnerships at micro and meso level between HCWs and staff at schools facilitated the successful implementation of remote hearing screening programmes at schools and consequently parents accepted EHC services as it was supported by the schooling system [46]. This approach leveraged the existing trust between the schools and communities. Two other studies highlighted that professional collaboration between specialised HCWs such as audiologists or ear, nose and throat (ENT) specialists and local HCWs (e.g., CHWs) at both micro and meso level was crucial to ensure that integration of services was implemented at community level [44,51]. In India, the implementation of remote audiological services at meso level through the collaborative efforts of CHWs and specialised HCWs focussed on increasing access to hearing screening in communities, resulting in improved quality of care, accessibility, and better screening outcomes [52].

Products

Technology improves EHC services

As discussed in previous sections, technology has had a great impact on the way EHC is conducted in LMICs. For instance, advances in technology have shifted the requirement for specialised equipment and reduced the need for specialised screening facilities improving EHC service delivery in low-resource settings [46]. The use of technology at micro level in India has greatly improved capturing of health information, triaging of patients and the referral process, impacting quality of care in low-resource settings [46]. Other micro level approaches in South Africa addressed the lack of infrastructure using low-cost alternatives to replace expensive hearing screening devices such as variation in sound for hearing assessment [47]. This study also showed that whilst improvements in mobile technology allowed screening in spaces with environmental noise, implementing screening in community settings was still challenging [47]. Most technologies require some form of internet connectivity but equipment which does not require internet for data capturing can be considered in resource-limited settings, as demonstrated in Peru [51]. The South African study showed that CHWs required minimal

training to conduct hearing screening using mobile technology [47]. This has improved the cost-effectiveness of EHC, quality of care and accessibility. Most CHWs perceived mobile applications as user-friendly and efficient, as described in India [46,47]. Implementation of EHC services using technology at community-level reduced travel time to clinics and was positively perceived by patients [46]. Furthermore, remote screening has the added advantage that it uses environments that are familiar to patients and caregivers which aids in patient satisfaction and acceptance [46].

A particular approach noted in Ghana was telemedicine initiatives that connect audiological hubs in different regions [50]. These hubs can serve as collaborative centres for telemedicine to coordinate communication and guidance between specialised HCWs and CHWs improving service delivery and referral systems by linking surrounding healthcare facilities and healthcare professionals [50,54]. Thus, establishing a centre of excellence for EHC at a national level in support of service delivery and quality of care in all communities might be an effective option for LMICs in future.

Leadership

Leadership and governance are broadly judged as essential to ensure that health systems develop equitable access to all services, including EHC, through combining effective oversight, coalition-building and regulation, while considering implementation and accountability [1].

Inclusion of EHC in healthcare package

Although no papers explicitly identified leadership and governance issues, two papers, unusually, raised issues that reflect on leadership and governance [50,51]. Given both that leadership and governance include setting overall policy frameworks for healthcare and that the WHO encourages the inclusion of EHC services at primary level, the inclusion of NBHS in primary care in Ghana and Peru appears to reflect positive leadership and governance (1). In the Peruvian context the importance of NBHS programmes for equitable access to EHC was highlighted through a meso level integration approach assisting with organised service delivery through interprofessional integration [51]. In Ghana, the effectiveness of including NBHS in primary care packages at micro level was shown by using alternative service delivery methods such as telemedicine to address coverage and equitable access [50].

Finance

Investment in EHC services

Health priorities in LMICs rarely favour conditions like hearing loss, which are not life-threatening, and the failure to prioritise health influences investment in EHC services with consequences for the access and availability of EHC services [45]. Only one micro level study highlighted that prioritising EHC services through investment could enable integration of EHC into existing primary health and community-based services supported by an efficient referral pathway [43]. The study noted that sustainability initiatives such as monetary incentives can be used to improve staff retention in rural areas [43].

Barriers to integration of ear and hearing healthcare services

Although the WHO EHC framework focuses on enablers of integration, the framework also proved useful in identifying potential barriers to integration, factors which hindered integration approaches. The similarity of identified barriers across included papers suggests that other LMICs are also likely to face similar challenges to integration (Figure 6). Shortage of workforce was the most prominent barrier followed by limited facilities and equipment, high cost of EHC services and challenges with policy implementation.

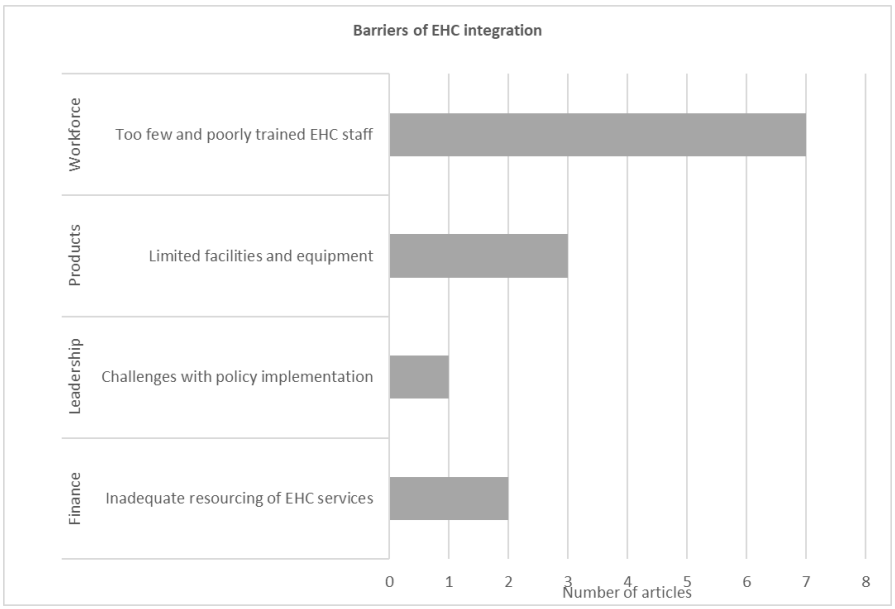

Figure. 6 Distribution of barriers mapped to the WHO framework [1]

Workforce

Too few and poorly trained EHC staff

HCWs are the cornerstone of any health system. Several studies highlighted human resource challenges to integration that included shortages of skilled staff and insufficient training of HCWs [42,43,45,46,54,55]. For instance, micro level integration was only possible at the Korle-Bu Teaching Hospital located in the Greater Accra Region, which offers EHC services for infants, due to the general lack of skilled HCWs in Ghana [50]. In Malawi, micro level integration showed that HCWs often allocate time to other services, rather than EHC [45].

Although training of CHWs can assist with addressing HCW shortage, this approach has its limitations [54]. O'Donovan et.al. [42] described challenges due to the variability in training approaches in LMICs. In the Indian setting, micro level integration approaches highlighted the practical and logistical challenges with training CHWs in telemedicine to conduct community-based hearing screening [46]. The COVID-19 pandemic led to a rapid shift to telemedicine globally, which posed implementation challenges for HCWs such as adequate training and adapting to telemedicine [55]. Furthermore, issues around the quality of training were highlighted elsewhere. These included access to resources, training materials and trainers for CHW training programmes as well as appropriate assessments to determine the competency and effectiveness of training programmes [42–44]. The scope of training modules may also not be adequate. For example, audiologists in Malaysia felt that their training was inadequate as they were not prepared to counsel and manage patients with hearing loss [43]. Consequently, the lack of supporting services such as counselling was highlighted by caregivers of hearing-impaired children as a contributing factor for the rejection of hearing devices and low acceptance [43].

Products

Limited facilities and equipment

Factors such as lack of resources can influence a country's ability to implement integration approaches. In South Africa, for example, although there is an Integrated School Health Policy which requires that each student is screened for hearing when entering school, this is not being implemented due to lack of equipment and infrastructure, as well as too few trained personnel [47]. India has a similar approach to hearing screening at

schools, but this system has also experienced setbacks to implementation for instance connectivity issues in remote areas for telemedicine and logistics (e.g. provide space, staff and facilitate screening) with conducting hearing screening at schools [46]. One study in Malawi described that HCWs identified a lack of equipment to do proper diagnosis, limited medication and supporting structures for staff as major constraints in providing much needed EHC services [45].

Leadership

Lack of leadership generates policy challenges for the implementation of integration.

Challenges with policy implementation

Only one study explicitly identified as a challenge, the lack of policy relating to universal NBHS [56]. In the South African setting the lack of mandatory neonatal and infant hearing screening programs, due to priority being given to infectious diseases, results in late diagnosis and delayed interventions [56]. Nonetheless, the lack of health system leadership was a commonly identified integration challenge [43,47,50,51,54,56].

Finance

Inadequate resourcing of EHC services

Availability of funds plays a significant role in the range of services that a healthcare system can provide. Only two studies addressed this issue for EHC services. The lack of continued funding for community-based EHC services at micro level in India was judged as negatively influencing hearing screening, interventions and follow-up rates [46]. A study, from South Africa, reported an evaluation of low-cost options for hearing screening, using technology or mobile screening devices to improve access and integration of services [47]. However, these cost-effective hearing screening techniques require continued funding from governments to be effective.

Healthcare seeking behaviour: factors impacting the use of integrated EHC services

Looking beyond the health system factors highlighted in Figure 1, we include the theme of 'healthcare seeking' in our findings. It was identified, through inductive analysis of the literature reviewed, as a critical factor

influencing the reported experiences of integration - and so is relevant to our review question. Although not part of the WHO framework it adds value in understanding the factors influencing the utilization of integrated services, shedding further light both on the health system and additional issues which need to be considered with integration approaches. A range of factors were identified as positively or negatively influencing patients' decisions to use existing or newly integrated EHC services.

Access and ability to pay

The geographical location of healthcare facilities can be a major stumbling block for integration as many specialised facilities are located far from rural communities with challenging terrains and limited transport options [43,45]. Micro level studies in South Africa investigating the challenges with NBHS implementation and follow-up rates identifying lack of transport, funds for transport and distance to the facility as key barriers [43,57]. Two other South African studies described challenges with transport costs, dependence on unreliable public transport and distances to healthcare facilities as a major obstacle to access EHC services [58,59]. For low-income households' additional expenses such as out-of-pocket (OOP) payments for medical costs can deter patients from actively seeking healthcare. In Nigeria, inaccessibility of EHC services were described by caregivers of hearing-impaired children due to the high cost of hospital care [54]. A micro level study in South India showed that although more than 80% of mothers were willing to pay for children to be screened for hearing, only 24% could afford to pay for EHC services [42]. In Cambodia it was highlighted that the high cost of hearing devices and cochlear implants is not affordable for most of the population leaving patients without viable treatment options [53]. Some studies offered ways to reduce OOP costs for instance, in India a micro level study showed that telemedicine is a useful tool to enable EHC integration by improving access to services in rural communities [46]. Healthcare providers bring the services closer to the communities through initiatives like telemedicine to reduce costs such as transport, screening time and loss of income and improve acceptability of services [48].

Using referral systems

The effective management of patients and referrals are important aspects of a robust health system and were highlighted in the reviewed papers as a factor influencing the use of EHC services. Community-based hearing screening programmes in Nigeria and Uganda which included CHWs in referral pathways showed that their inclusion at micro level assisted with effective referral for specialised services and reduced inappropriate referrals [44,54].

In Malawi, stakeholders identified the absence of acute symptoms, limited availability of EHC services, transportation difficulties such as distance to hospitals and lack of transport, lack of information, long waiting periods, high OOP, lack of awareness and communication as reasons for patients not attending follow-up visits [45]. This study recommended that referral pathways should consider context specific issues, such as geographical and financial challenges, and include multi-dimensional teams (e.g. CHWs, specialised HCWs and health centre managers) [45]. The experience in Nigeria showed that although referral pathways were in place, this did not lead to improved follow-up visits as prevailing issues such as access to specialised EHC facilities like the cost of hospital care prevented utilisation by patients and caregivers [54]. In Cambodia, ineffective referral pathways and low utilisation of EHC services were impacted by competitive processes by healthcare facilities to retain income or their reputation, lack of resources, lack of awareness and prioritisation [53]. This study highlighted the need for a more robust referral pathway linking various levels of healthcare. Finally, a study in Bangladesh among young children revealed that most caregivers do not attend referrals due to the absence of acute symptoms even though they were encouraged by CHWs [43].

Communication and awareness

Another theme identified from included papers was a lack of awareness of EHC services and knowledge of hearing loss amongst communities. In a Nigerian study, technology was used as a tool to educate communities with the aim of raising awareness and increasing knowledge of hearing screening interventions for increased utilization of services [54]. A micro level South African study showed that exposing caregivers and patients to persons affected by hearing loss can act as an enabler to integration as this can help with understanding the consequences of not attending follow-up appointments [48]. Similarly, a study conducted with mothers in South Africa described limited knowledge of infant hearing loss risk-factors and low awareness of EHC services [56]. Communication and awareness need to consider culture and its influence on healthcare seeking behaviour. The possible influences of culture on EHC integration are described in Box 2.

Box 2. The effect of culture in the healthcare setting is important to consider, particularly in LMICs with their rich cultural influences. Several studies identified culture as a key influencing factor:

- There is a need for training centres to consider local context relating to culture, knowledge and community needs [50].
- Culture-sensitive training in Peru was found to be useful to address challenges through service providers engaging with communities and allowing for feedback which assisted with community acceptance of services and improved implementation strategies [58].
- Understanding local culture can assist with health promotion initiatives as it can be used to facilitate the utilization of services.
- In South Africa, the importance of culture-sensitive service delivery in rural areas was highlighted as important for health seeking and provider reluctance to communicate [50].
- Furthermore, the lack of culturally appropriate health care was raised in another South African study as there is a need to take the patients' race, ethnicity and cultural practices into account with service delivery [64].
- In culturally rich countries such as Peru, the norm is to be accountable for other family members for instance the health of the elderly rests on the younger generation [58].
- Cultural-sensitivity and competency improves communication between health care providers and patients or caregivers [64].
- In India, caregivers indicated that they will not allow their children to wear hearing aids due to stigma [50].
- Cultural beliefs can hinder attendance at follow-up appointments. For instance, in Cambodia it is believed that a mother and infant must stay inside for three months after birth [61].

However, communities accepted EHC interventions when they were conducted by organisations with a good track record in communities. For example, a non-profit organisation (NPO) successfully implemented hearing screening at meso level in rural communities in Peru based on trust and existing partnerships [51]. The attitude and communication skills of audiologists at micro level in South Africa, meanwhile, had a positive effect on follow-up rates and utilisation of services [48]. Community-based EHC services delivered by local HCWs were positively received by patients in South Africa and helped to build trust in healthcare system [58]. Furthermore, micro level studies in LMICs showed that community participation is important to raise awareness and can facilitate acceptance and strategic planning of healthcare initiatives [42].

Discussion

This systematic review summarised the key integration approaches for ear and hearing care services reported from low and middle-income country health systems, drawing on literature from the period 2017-2024. The pool of eligible studies from LMICs was very low (seventeen papers) emphasising the gap in knowledge and likely lack of interest or priority in EHC services in developing countries. This is concerning given the significant burden of disease of hearing loss in LMICs. Similar findings were revealed in a recent review by Waterworth et al. [43]. Although publications such as the World Health Assembly report in 2017 on the Prevention of deafness and

hearing loss [27] and World Report on Hearing [1] sparked interest in EHC, this does not yet appear to have been translated into strengthening EHC services on the ground.

The review investigated EHC integration approaches by adapting the Valentijn framework [16] to categorise the dimensions and level of integration, as well as using the WHO EHC framework [1] to identify enablers and barriers to EHC integration. The use of these frameworks supported systematic synthesis of the available qualitative evidence and understanding of EHC integration approaches through a health systems lens, as summarised in Figure 7. However, during data synthesis we found it useful to add consideration of healthcare seeking behaviour to allow for the full range of identified factors influencing experiences of integration and use of EHC services in LMICs - addressing our overall review question.

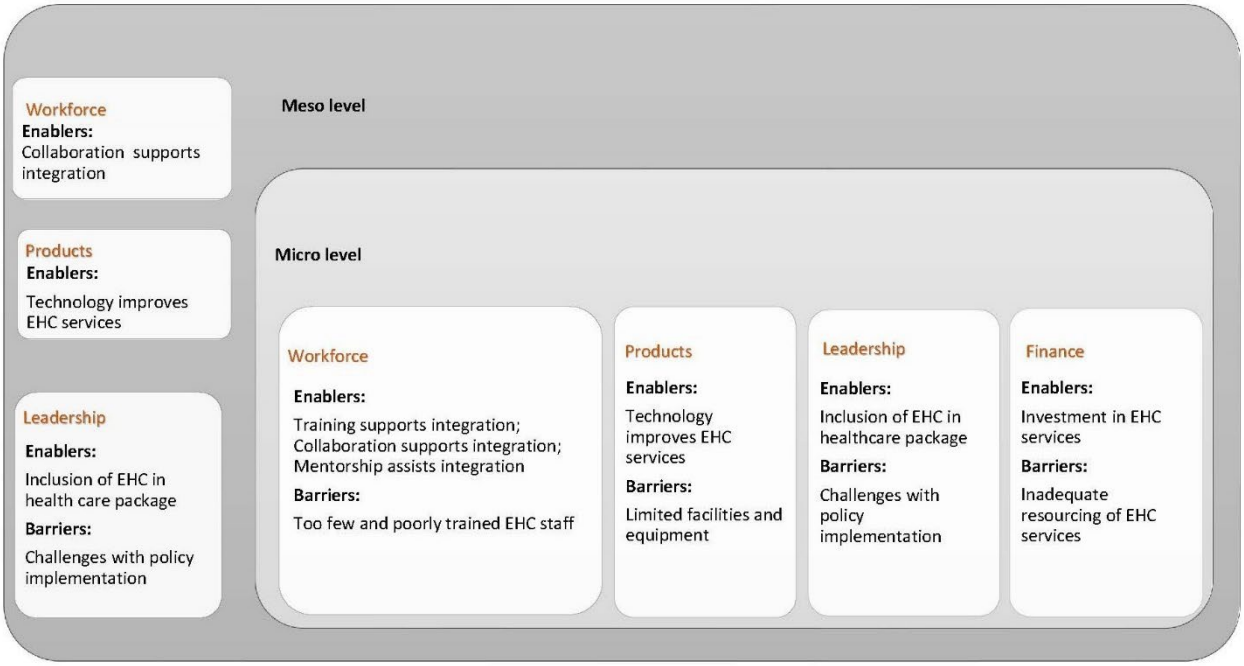

Figure. 7 Key themes categorised according to the level of integration (Source: Author)

Integration approaches for EHC service delivery

Most of the literature reviewed described integration at micro or individual level with a few studies at meso or organisational level and no studies at macro or systems level. Similar trends have been observed in broader literature which reviewed integrated care in LMICs and HICs [60]. The lack of macro level integration might be due to the limited number of LMICs with EHC health policies, perhaps also reflecting a lack of leadership around

EHC services. Studies mainly approached integration at service and clinical levels followed by professional, normative and organisational levels, often focussed on addressing accessibility constraints in rural areas through service delivery models.

EHC integration approaches in LMICs addressed the critical shortage of HCWs by focussing on clinical and service level integration [42–45]. These approaches incorporated CHWs into the EHC workforce through task shifting/sharing, by training CHWs with the goal to expand services and improve referral mechanisms. Several studies described service level integration through targeted programmes that aims to address accessibility to EHC services [42,46–50]. A combination of integration approaches was used to support integration with both horizontal and vertical approaches shown to be useful for EHC integration. Previous studies also showed that combining horizontal and vertical integration can be beneficial for approaches working across building blocks, within building blocks and across various health system functions [38]. However, broader literature shows that integration approaches in HICs focus more on improving systems processes rather than individual services [60]. Given the lack of such approaches in LMICs, there is a need to shift integration strategies to the macro level, such as national governments, with the goal of improving existing structures and creating new collaborative efforts. As governments are not prioritising policies for universal hearing screening and policy implementation in LMICs, this is resulting in late diagnosis and delayed treatment [51,56]. For instance, policy initiatives such as the inclusion of NBHS programmes to detect and treat hearing loss at an early age is recommended by the WHO [1] but has not been achieved in most LMICs, in contrast to high-income countries [61]. Another contrast between countries is that, as observed in this review, the aim of integration in most LMICs is to increase service delivery, whereas in HICs the focus is more on changing patterns of use towards more cost-effective services [60].

Enabling and constraining EHC integration

This review revealed that success in addressing the critical shortage of EHC healthcare workers is a key factor enabling or constraining integration in LMICs. To enable integration, factors such as training, collaboration and mentorship supported integration by increasing the number of healthcare workers supporting EHC service delivery [42–46,50,52]. Task shifting or sharing is recommended by the WHO as a tool to support EHC integration [1] and, as shown in this review, requires targeted training programmes to upskill CHWs with the goal of delivering EHC services at community level. Task shifting or sharing approaches to address HCW shortages have also been shown to be useful in LMICs for other health conditions [38]. However, this review also indicates that there is a need to standardise the way CHWs are trained in EHC service delivery to ensure a continuum of quality

healthcare and to offer continued support through mentorship and supervision beyond short-lived training programmes [43,44]. Addressing the software components of the health system, such as mentorship, motivation and acceptance of training interventions, can further assist with staff retention and positively impact integration of services. The literature reviewed also suggests that integration approaches should consider more collaborative and community centred approaches and be adaptable and more inclusive [43,45,54,56,57].

Despite the efforts made towards EHC integration there is still a lack of investment and sustainability plans for EHC services [42,43,46,53,55]. This is not only true for EHC services but an overall trend for LMIC health systems leaving those affected by neglected health conditions such as EHC at a disadvantage. The WHO's push towards integrating EHC services into national health systems is a key aspect for addressing these health inequities. Additionally, despite improvements in EHC technology, for instance catalysed by the recent COVID-19 pandemic, wider improvements in LMIC health systems are needed to benefit from them [62]. For example, a recent study showed that remote EHC services in India did not benefit from advanced technology due to a lack of implementation and infrastructure such as internet connectivity [62].

Healthcare seeking behaviour and EHC integration

Another key feature of this review was the inclusion of healthcare seeking as a systemic issue influencing the use of integrated or newly integrated EHC services. Healthcare seeking behaviour is influenced by accessibility of EHC services (considering overall availability, service location and affordability). The availability of EHC services, especially specialised services such as cochlear implants, simply does not meet the needs in LMICs [63]. We also identified that the geographical location of specialised healthcare facilities play an important role in referral attendance and follow-ups [43,45]. As always, financial challenges to access cannot be ignored, as shown in a recent study in India [63]. This review further highlighted the importance of referral systems to incorporate CHWs and foster collaboration between HCWs throughout different levels of the health system [44,45,52,54]. Incorporating EHC services through proper referral pathways are needed for continuum of care and use of services.

The available literature does, however, suggest that empowering communities and focussing on knowledge gaps related to hearing loss and EHC services can encourage EHC service use [48,54,56]. Through engaging with communities, the implementation strategies can also be adapted to local context to be more culturally sensitive and acceptable to patients and caregivers [42,48,51]. For instance, in countries like South Africa, where people

tend to first seek healthcare though traditional medicine before pursuing formal healthcare [58] this can be an opportunity for collaboration between the informal (traditional healers) and formal sectors (HCWs) of healthcare.

Key lessons:

This review aimed to shed light on experiences with EHC services' integration into the wider health system in LMICs. Four key lessons are that:

- it is important to address EHC integration at macro level and not only focus on micro and meso level approaches - global recommendations for early detection and treatment, such as NBHS programmes, can only be effective if they become national policy and are incorporated into primary healthcare packages;
- at micro-level, comprehensive and appropriate EHC training programmes for CHWs can address EHC staff shortages and support integration;
- the inaccessibility of EHC services impacts on the use of services and so issues impacting on healthcare seeking behaviour should be identified and addressed within the integration process;
- future research studies should address the themes identified in this review for instance, exploring what forms of mentorship could best support integration as we build towards improved EHC service delivery - lessons learnt can aid policymakers in developing and implementing policies to strengthen EHC services through integration approaches.

Limitations

Although a comprehensive search approach was used, a limitation of this study was that the focus was only on LMICs. It would be useful to broaden the scope of the review to include HICs as some areas in these countries are also under-resourced and might face issues not described in this study. It would also be interesting to compare EHC integration approaches in LMICs and HICs. Further, despite the limited published literature on EHC integration in LMICs there might be other approaches to integration or experiences that were not considered in this study. This reiterates the need for future research about the integration of EHC services in low-resource settings. Only focusing on English language literature will have excluded relevant experiences written in other languages. Finally, although this review did not include a quality assessment processes it only included peer-reviewed articles which would have already undergone a quality control process.

Conclusion

This study has described how EHC services are integrated in LMICs, as well as the factors enabling or constraining such integration, through a health systems lens. It also identified the influence of healthcare seeking behaviour on integration approaches. Various lessons are drawn from the experiences reviewed for consideration by policy makers and those involved in implementing integration of EHC services into the wider health system.

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Acronym list

Community health workers – CHWs

COVID-19 - Coronavirus disease

Ear and hearing care – EHC

Ear, nose and throat – ENT

Healthcare workers – HCWs

Hearing loss – HL

High-income countries – HICs

Low and middle-income countries – LMICs

Medical Subject Headings – MeSH

New-born hearing screening – NBHS

Out-of-pocket – OOP

World Health Organisation – WHO

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Appendices

Appendix 1: Research protocol

Table of Contents

Integration of ear and hearing care services in low and middle-income health systems: a systematic review and qualitative synthesis

Abbreviations

Decibels – dB
Disability-adjusted life-years – DALYs
Ear and hearing care – EHC
Ear, nose and throat – ENT
Early Hearing Detection and Intervention – EHDI
Healthcare workers – HCWs
Health system – HS
Hearing loss – HL
High-income countries – HICs
Low and middle-income countries – LMICs
New-born hearing screening – NBHS
Primary Healthcare – PHC
South Africa – SA
Universal health coverage – UHC
World Health Assembly – WHA
World Health Organisation – WHO

Glossary

Disability-adjusted life-years – DALYs are a measurement of burden of disease by combining the years lived with a disability and the years lost due to premature mortality [1]. A high level of DALYs relative to other conditions suggests action should be taken to lower or eliminate the impact of the condition [1].

Disabling hearing loss – Disabling hearing loss is described as hearing loss greater than 35 decibels (dB) in the better hearing ear [2].

Early communication intervention – This is an evidence-based approach to improve the health management of infants and young children regarding feeding difficulties, hearing impairment and emerging communication disorders [3].

Health system - The health system (HS) is defined as all organisations, people, and actions with the primary goal to promote, improve, or maintain health [4].

Hearing loss – People with hearing loss cannot hear as well as those with normal hearing. Categories for hearing are normal (<20dB), mild (20 to <35dB), moderate (35 to <50dB), severe (>50 to <80dB), profound (80 to <90dB), deafness (>90dB) (dB) [2].

Ototoxic hearing loss – Ototoxicity is caused by toxins or substances which damage the inner ear. Toxins are mainly associated with medications that are used to treat life threatening illnesses for example multi-drug resistant tuberculosis [5].

Systematic review – Systematic reviews is described as a method "to systematically search for, appraise and synthesis research evidence, often adhering to the guidelines on the conduct of a review provided by the Cochrane Collaboration or the NHS Centre for Reviews and Dissemination." [6]. The methodology is transparent and replicable [6].

Background and rationale

Introduction

Hearing loss has an impact on global public health. Approximately 20% of global population or1.5 billion people experience some form of hearing loss (HL) during their lifetime [2] . These statistics are alarming, but even more concerning is that the numbers of those affected by HL are predicted to increase by 1.5-fold in the next few decades without appropriate public health interventions [2]. The predicted rise in HL is influenced by factors such an ageing global population, noise-induced and ototoxic hearing loss and common ear infections [7]. Approximately 60% of the attributed causes of HL in children younger than 15 are preventable through public health measures such as immunisation, adequate referral systems, health promotion and education [8–11]. HL is higher in older populations and listed under the top ten causes of disability-adjusted life-years (DALYs) in the elderly [12].

HL is perceived as an "invisible disability" not only due to the lack of visual symptoms but also due to stigmatisation and lack of priority in health policies [2]. The impact of HL on functionality cannot be disputed as it has communicative, social, emotional and economic consequences which can have a life-long impact [2,9]. Therefore, although HL is not life-threatening, it has a devastating effect on quality of life. However, non-fatal conditions such as HL are often portrayed as unimportant by healthcare workers (HCWs) in low and middle-income countries (LMICs) and are not prioritised in health agendas [8,13].

Ear and hearing care in LMICs

Approximately 320 million people accounting for 80% of people with moderate to higher levels of HL live in LMICs [2,9,14]. The high burden of HL in LMICs adds pressure to already fragile health systems, in which resources such as health services and healthcare workers are limited [14,15]. Studies have showed that the ear, nose and throat (ENT) speciality in LMICs, as well as audiological and speech therapy services are alarmingly under resourced, understaffed and outdated compared to high income-countries [14–16]. There is a critical shortage of ear and hearing care (EHC) professionals in most LMICs [16–18]. A recent study which evaluated the EHC workforce in 141 countries over the past 10 years showed that 93% of low and 76% of lower-middle countries have access to less than one audiologist per million compared to more than 10 audiologists per million in 65% of high-income countries [16]. For instance, the Nigerian population of approximately 160 million people has access to less than 200 ENT specialist and less than 30 speech therapists, equating to one EHC professional per million [17]. There has been little to no increase in EHC professionals between 2009 and 2015 in LMICs [14]. Although the quality and affordability of EHC treatments like hearing aids have improved over the past few decades worldwide, such improvements are often not accessible in LMICs [12]. Overall, there is an extremely low coverage of EHC services in sub-Saharan Africa compared to high income-countries [14]. For instance, in 2015 there were 0.104 ENT surgeons/100,000 people in Ghana and 0.076 ENT surgeons/100,000 people in Nigeria compared to 2.36 ENT surgeons/100,000 people in the United Kingdom [14].

Notably, low coverage might also be linked to reluctance to seek healthcare, suggesting unmet burdens of need for EHC health services in LMICs than currently estimated. Contextual factors such as culture can play a role in health seeking behaviour. This phenomenon can be seen in some African cultures where people with hearing loss are believed to represent a bad omen and bring misfortune to the family, leading to stigmatization and potential reluctance to seek healthcare [19].[3]

[3] South Africans of African ancestry use traditional medicine on a regular basis and accept various cultural beliefs regarding hearing loss such as bewitchment, blood impurities and ancestors [19].

EHC in the South African context

Access to EHC services has improved over time in South Africa, in contrast to other African countries, mainly due to increased availability of training in audiology and better access to treatment options [3,14,18].[4] However, the prevalence rates for hearing loss in South Africa (SA) range between approximately 7.5% (in 1995) to 19.9% (in 2019), indicating that there are still prevailing challenges [3,9,10,20,21]. Further to this, the prevalence of disabling HL varies significantly between rural and urban regions [21]. Joubert et al. [20] showed disabling HL prevalence of 8.9% in a rural area (Limpopo province) compared to 4.6% in an urban area (Western Cape province). Although there has been improved access to EHC services, factors such as limited availability of resources, poor referral systems and inefficient medical management were highlighted to be associated with high prevalence of hearing loss in the country [20]. Contextual factors such as historical influences also have a significant impact on the profile of healthcare services across SA [22,23]. The public health history of SA reveals inequity in healthcare as racial segregation and labour migration led to differentiated economic development between geographic regions [23]. The more developed Western Cape region has a high audiologist and speech therapist ratio of 1.03/10,000 people compared to less developed Limpopo with a ratio of 0.22/10,000 people [22]. In SA, similar to other LMICs, the demand for audiological services far outweighs the supply, often leaving the most disadvantaged communities with inadequate EHC services [19,22].

The health system in SA consists of the public sector which is utilised by 85% of the population often representing the most disadvantaged communities, and the private sector which is utilised by the roughly 15% of the population who are insured or who can afford out of pocket payments [23]. Primary healthcare (PHC) provided through public sector services are the first point of contact with the South African health system for most people [19]. However, early communication interventions are part of the services provided by audiologists and speech therapists and are not included in PHC [24]. Thus, most people in SA do not have easy access to early communication interventions through PHC. Van der Linde et al., showed that the incremental implementation of early communication interventions through PHC programmes can address the current service delivery limitations especially in rural parts of SA [24]. They developed a four-level organisational framework which included managers, HCWs and communities to integrate early communication intervention services

[4]Cost-effectiveness analysis (CEA) investigating interventions for hearing loss showed that cochlear implants can be cost-effective in South Africa [18]. This indicates that cost-effective treatments are be available for integration into the South African HS.

incrementally into PHC [24]. New-born hearing screening (NBHS) programmes involve screening infants for hearing and should ideally be conducted within the first few months from birth as delayed intervention influences childhood development [2,25,26]. Early Hearing Detection and Intervention (EDHI) programmes are implemented through NBHS programmes, and a universal approach is recommended [25]. Yet such universal NBHS programmes are not implemented in the South African public health sector [25]. Instead, it uses a risk-based approach; so, for example, only high-risk babies with a family history of hearing loss are screened in the public sector. NBHS programmes are more accessible in the private healthcare sector [25]. The current implementation of EDHI programmes is, therefore, inadequate as the average age of enrolment is 31 months compared to the recommended age of 6 months for effective intervention [3,26]. These statistics highlights the EDHI implementation weaknesses which might improve if NBHS is available to all infants [25]. The current targeted or risk-based NBHS approach has led to approximately 50% of hearing loss cases being missed or late diagnosed [27]. Notably, the implementation of EDHI programmes is hampered by several contextual factors for instance constraints relating to available resources [19,27].

Health systems

Every health system (HS) is layered with complex interactions between different sectors functioning through six interconnected building blocks - namely leadership and governance, finance, information, human resources, service delivery and medicines and technology [4]. The relationship between the HS building blocks is influenced by contextual factors which can also change over time, requiring the HS to adapt and respond to new conditions [28,29]. Such adaptation can be achieved through effective allocation of existing resources to achieve health outcomes and contribute to HS strengthening [4]. Further adding to the complex nature of the HS are interconnections among the building blocks [29]. For instance, interventions targeting one HS building block, such as service delivery, will have intended and unintended system responses as one building block affects another and thus can impact the entire system [30]. Other than health, HS goals include improved health equity and access to quality healthcare services for everyone through fair expectations towards financial contributions thus be acceptable and responsive to the needs of all users [4,28].

A system thinking approach is commonly used in health policy and system research (HPSR) to enable a deeper understanding of the complexities of the relationships and interactions of its building blocks [28]. As explained previously, health service interventions can affect other building blocks: for example, integrating community

health workers to conduct hearing screens can generate financial implications for government in relation to, for example, recruitment, training and retention of CHWs [31]. In addition, overlaid across the building blocks are hardware and software components – such as, for human resources, staff availability (hardware) and staff motivation and attitudes (software). The interaction of these hardware and software components adds another layer of complexity in health systems, that may act to facilitate or constrain HS strengthening[32]. For example, a study in the Netherlands explored expectations, barriers and enablers towards an integrated care pathway for hearing impaired people using hardware and software components [33]. Software barriers identified specialised HCWs negative expectations of integrated care and reluctance to implement the pathway, given concerns about the quality of services delivered by non-specialised HCWs as well as an overall decline in their professional authority [33]. Furthermore, HCWs identified possible hardware and software facilitators of implementation such as such as good communication strategies, adequate training, continuous evaluation, efficient referral system, clearly defining tasks, availability of second opinion options and complaints service [33].

Integration of health services

Integration as an HS approach has been shown to be an important process in strengthening the HS to assist in reaching its goals [4,28,34–37]. It can enhance HS efficiency by improving acceptability of services to improve quality of care and ultimately, quality of life [38]. This is accomplished by supporting a holistic approach across the continuum of care putting the needs of people at the centre of the HS for the benefit of the population it serves [39]. Integration, for the purpose of this study, is defined as managerial or operational changes to the health system through resources, delivery, organisation and management of service delivery to assist in achieving HS goals[30]. Integration is not only explored from a functional aspect but also as a normative goal. Therefore, the concept of integration has various layers as the nature, level and method of integration varies across healthcare interventions [40]. When it comes to the concept of integrated care, various stakeholders in the health system define this concept through their perspectives and expectations [38]. The WHO uses a health systems approach to integrated care, to strengthen a people-centred HS through coherent efforts of multi-disciplinary teams by delivering quality service according to the needs of communities [38]. The WHO has continuously highlighted that there is a growing need for people-centred, integrated healthcare services [4,41]. Through a patient centred approach, patient-participation is increased which can improve acceptability and equitable access to quality care based on the health needs of people rather than diseases [41]. Healthcare interventions can be defined as innovative ideas, practices, objects or institutional arrangements including

organisational, financial and procedural changes to pre-existing interventions [29]. Some health interventions might be higher on policy agenda and therefore prioritised [42].

Valentijn et al. [39] conceptualised a framework for integrated care which captures the complexity of integration through the level and method of integration while recognising the synergy and relationship of various HS stakeholders. The approach to integration needs to be evaluated to determine if implementation is successful and to describe the unintended consequences of the approach. The range of approaches to describing integration presented by Valentijn et al. [39] and other key papers is summarised in Table 1.

Table 1. Summary of integration in healthcare

Dimensions of integration	**Description**
System integration	Combines structures, processes and techniques for the benefit of people and populations.
Organisational integration	Merging or coordination of provider networks and organisations
Functional integration	Non-clinical and operational functions
Professional integration	Partnerships between professionals within or between organisations
Service integration	Integrating clinical services at organisational level
Clinical integration	Integration of care by HCWs and providers into a single or coherent process
Normative integration	Based on shared values for coordination and collaboration
Systemic integration	Incorporating the coherence of rules and policies at various levels of the HS
Horizontal integration	Integration at the same level of healthcare (such as integrating services into primary healthcare; holistic focus)
Vertical integration	Integration at different levels of healthcare under one management system (such as integrating primary and secondary healthcare; disease focus)
Level of integration	
Micro level	Clinical level approach at which healthcare is delivered to the individual patient through the coordination of services (person-based).
Meso level	Organisational and professional level approach requiring organisational and inter-organisational relationships as well as professional partnerships to enable comprehensive service delivery to a defined population
Macro level	System level approach which is people-centred to acknowledge and meet the needs of the population through a strategic combination of structures, processes and techniques. Horizontal and vertical integration approaches are required to provide a continuum of care for all people and populations (population-based).

Sources: [38,39,43,44]

Integration of ear and hearing care services

In 2017, the World Health Assembly (WHA) urged governments to integrate hearing and ear care into their national health system [45]. In 2021, moreover, the World Report on Hearing promoted hearing loss as a global public health priority and recommended the integration of ear and hearing care (EHC) into universal health coverage (UHC) [2,45]. Integrating EHC into public health approaches such as UHC will ensure that these services are accessible to everyone [46]. Therefore, it is important to engage with policy makers towards the integration of audiological services into the HS to prevent, identify and treat hearing loss effectively [7].

Through an integrated health services approach the promotion of audiology and audiological services can increase awareness and access to audiological services [41,47–49]. Health services are the focus point for the integration of EHC, and the aim of integration is to improve access to quality EHC health services for people affected by hearing loss. Previous studies have shown that integration of EHC can be beneficial and useful in resolving barriers such as accessing EHC services or addressing human resource shortages through task-shifting [31,46,50,51]. However, the implementation of integrated EHC has been challenged by a lack of national policies, limited awareness of hearing loss, poor access to treatment and inadequate supply of healthcare professionals [7,14,18,22]. The WHO has also highlighted that a lack of EHC integration is often associated with limited support by government leadership [2]. Drawing from experience, the WHO has summarised various enablers for integrating EHC into health services in Figure 1 [2].

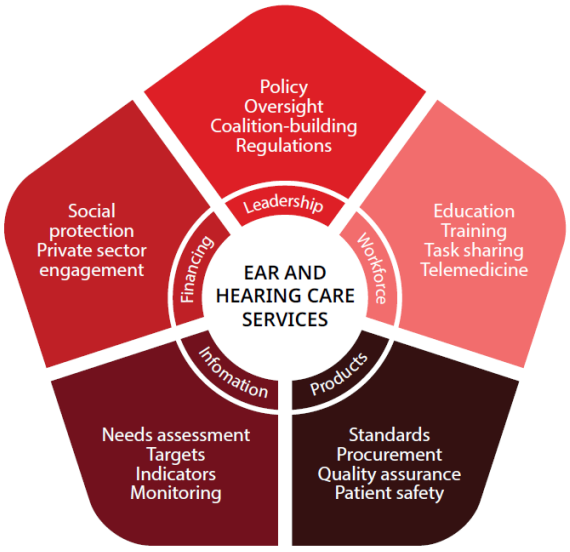

Figure 1. Health system building blocks and possible enablers of integration for EHC services [2]

Rationale and study purpose

Globally, to date, systematic reviews in the field of EHC have not applied a health systems approach but have rather focussed on health service delivery, the effect of audiological treatment on quality of life and social impact, technology and telehealth applications, or early interventions in children [18,45,52–58]. Despite its recognised importance, as discussed earlier, no in-depth, systematic review has been developed to consider the factors influencing the integration of EHC within health systems. As already argued, a health systems or systems thinking approach is essential in HS strengthening efforts as it can help identify HS factors influencing integration [28]. Therefore, this review will apply a HS approach better to understand the barriers and enablers to integration of EHC services with the HS.

Aim

The aim of this study is to conduct a systematic review and qualitative synthesis of literature published on the integration of ear and hearing care into health systems.

This study seeks to answer the following research question, "What approaches to integration of ear and hearing services have been implemented in LMICs and what factors have influenced integration experiences?". This study's specific objectives are to:

- describe the approaches to integration of ear and hearing healthcare services
- determine the barriers and enablers for integrating ear and hearing healthcare services into health systems
- identify the lessons that can be learnt from integration of ear and hearing healthcare services into health systems

Methods

An initial exploratory, rapid, literature review was conducted to explore the research topic and inform a systematic review. This initial review made clear that the integration of EHC has not been investigated through

a health systems lens. Therefore, EHC integration will be investigated in this research study by identifying the barriers and enablers for integration in LMICs. Thematic analysis of the results will allow for conceptualising lessons learnt from the integration of EHC health services into the health system.

Systematic review

A systematic review approach was considered the most appropriate method as it addresses broad questions to help guide evidence-based decision making through proven scientific methodologies [6,59]. This method of research is increasingly being used by policymakers to assist in guiding health system decisions [60]. An advantage of a systematic review that it is less time consuming and more financially viable than to conduct a new study [59]. Systematic reviews summarise multiple studies by focussing on a specific question or phenomenon ensuring consistency, rigour and relevance of findings in other settings to provide new explanations and a deeper understanding [59,61]. Key aspects of a systematic review are that it should be able to identify all possible information sources (within the resource constraints) in a transparent and reproducible manner [62]. These types of reviews have been described as an iterative process, however, any changes to the protocol should be reported and explained [63]. Systematic reviews should be well-documented through planning the methods process [61]

A qualitative systematic review approach is ideal for this study it allows for comparison across countries, contexts and time highlighting patterns based on individual experiences which can considered for relevance and application in other settings [64]. Qualitative syntheses integrate or compare findings from primary qualitative research studies to draw themes or constructs to broaden understanding on a particular topic through interpretation [6]. This review method is useful in exploring the barriers and facilitators of service delivery [6]. Therefore, the application of a qualitative systematic review will allow the for the exploration of the research topic.

Article identification

The foundation of a systematic review is an efficient searching strategy to identify relevant articles. Searching strategies is of paramount importance as it will dictate the material used in the research and informs the conclusions drawn from the results obtained [65]. Further to this the search systems should fulfil criteria such as reproducibility, accessibility, record type, coverage of databases and controlled vocabulary [62]. For this review, the researcher has consulted with a librarian from the Faculty of Health Sciences library at the University of Cape Town (UCT) to establish an appropriate plan to identify electronic databases for this study. This is to ensure that the search terms or key words, and databases selected are appropriate and up to date.

Search databases will include PubMed, Scopus, Web of Science, EBSCO, Cochrane library supplemented by Google Scholar. These databases are accessible via the UCT Health Sciences library. The databases were selected based on the broad scope of articles and relevant research areas covered for example, PubMed has a more healthcare focus. Search terms or keywords will be generated from the research question using Medical Subject Headings (MeSH) terms such as Public Health Systems Research OR Delivery of Healthcare, Integrated, Systems Integration, Health Services Research, Developing Countries or Lower Income Countries including terms generated from the research question ear and hearing care services OR audiological services. The search terms or keywords will use combinations generated via Boolean search strategies using for example “and” “or” which will be used to search databases. The list of LMICs which will be used during the search strategy is depicted in Box 1 (Appendix). Finally, if needed, authors will be contacted to retrieve relevant papers which the researcher could not access [66].

Only articles available in English language published in peer-reviewed, open-access journals or journals accessible through the University of Cape Town will be considered for this review. Study design will not be an exclusion criterion. Only articles from low-and-middle-income countries will be considered as most people affected by hearing loss live in resource limited LMICs [2].Publications from 1995 when the WHA passed a resolution on the prevention of deafness and hearing loss until-2022 will be included [67] .

Article selection

The process for conducting the systematic review will follow methods previously described by Moher et al. [63]. After research articles have been selected through database searching methods the next step entails removing duplicates [63]. These records will be screened for their relevance using the abstract titles and text and articles which do not meet the inclusion criteria will be excluded from the study [63]. Articles that are included will undergo full text review and those that do not meet inclusion criteria will be excluded from the study with an explanation. Critical appraisal of eligible material is required to ensure that quality standards are adhered to and that the results are reliable [61]. However, there are concerns about appropriate criteria for such appraisal of qualitative studies due to their complexity and the layers of information embedded in text [68]. Therefore, we will not implement a quality checklist but will include only published peer-reviewed articles. Articles which are included following the full text review will be analysed and used during reporting [63]. Reference management software EndNote will be used to capture information of included and excluded studies. [5]

Data extraction

Data extraction will be conducted using a data extraction form (Table 2, Appendix). Data will mainly be extracted from the methods and results sections. This study will draw on a range of existing frameworks identified from the literature review to guide data extraction from selected publications. Conceptual frameworks are used in this study, as this approach has shown to be valuable in aiding health system researchers to frame and extract relevant information from empirical research [69]. In this study, two main frameworks will be used to compile a comprehensive overview of the experiences of integration. These are:

- For the approach to integration, the dimensions and level of integration will be defined using the concepts described in Table 1
- The WHO framework (Fig 1) will be used to assist in identifying enablers and barriers to integration.

The data extraction template will operationalise critical concepts and categories drawn from these various frameworks to support systematic review. The template form was developed to ensure that information is

[5] Software programmes are powerful in assisting with the management (organisation, storing and retrieving) of data, but they cannot do the analysis.

accurately captured, transparent and informative. This will provide the lead researcher with sufficient relevant data to draw conclusions and recommendations. One reviewer will conduct the data extraction and a second reviewer (MPH supervisor) will conduct data extraction of a representative sample of articles as quality control [61].

Data analysis and synthesis

Rigorous thematic analysis has been found to be a trustworthy approach to data analysis and synthesis, including for systematic reviews, allowing rich, in-depth interpretation of data [70]. Thematic analysis will be conducted through a stepped process which will assist with data management and analysis (Fig 2) [71–73].

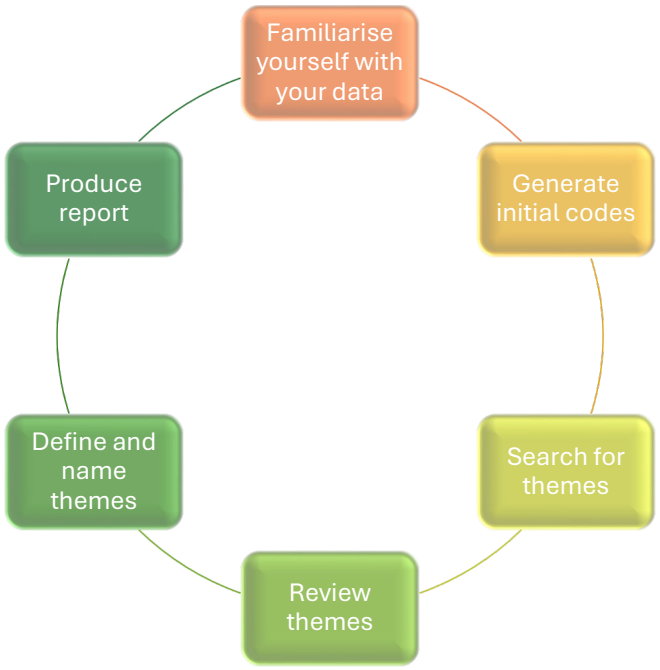

Figure 2. Thematic analysis phases [72]

The data extraction forms, based on the specified frameworks, will support thematic analysis of the approaches to integration and of barriers and enablers. However, within the main themes identified, we will develop further

subcodes based on an inductive thematic analysis approach, which is data-driven to allow richer analysis and the development of new concepts [69].

Finally, the identified themes, their influence on each other and outcomes of integration will be used to describe the lessons learnt through the various integration approaches [74].

Rigour

Some aspects of rigour in qualitative studies have been touched on in previous sections. For instance, the search strategy and documentation process will be reproducible and transparent. The searching strategy and data extraction table will be predefined; but the data extraction table will also develop through inductive sub-coding. Transparency in searching strategies and data extraction allows for the reproducibility in a well-organised approach using predefined methodology. The researcher will also reflect at each step of the process to ensure that the methodology is applied appropriately [73]. The MPH thesis supervisor will check data extraction methods to validate findings. Key findings from the review should be transferable from one setting to another regardless of the country context which adds to validation and generalisability [73]. The researcher will interpret and analyse data in a transparent and systematic manner [72].

Ethics

This research study will use previously published literature and will therefore be a low-risk study. The proposal will be submitted for approval to the Departmental Review Board in the School of Public Health and Family Medicine at the University of Cape Town.

Limitations

Language will be a limitation of this review as only literature published in English will be included. Access to publications can be a potential limitation. Only open access and articles accessible to the University of Cape Town will be included. If needed, the researcher will attempt to source relevant articles using alternative methods such as contacting authors directly or interlibrary loans. The exploratory literature review revealed that there has been limited attempts at integration of EHC in LMICs compared to HICs. This might limit generalisation from LMICs to HICs.

Dissemination of findings

The study will be published in open access as a thesis and an article summarising the findings will be published in an open-source journal. A summary document of the key findings will be available to other researchers, healthcare workers and policy makers.

Proposed Timeline

Item	Description	Timeline
Protocol	Concept discussions	July-August 2021
	Draft/s	Jan-July 2022
	Final	October 2022
	DRC submission	October 2022
Thesis	Research	August-September 2022
	Screening of titles and abstracts	September 2022
	Data extraction	October 2022
	Data analysis	November 2022
	Draft/s	December 2023
	Final/Submission	June 2024

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Appendix 2: Protocol Supplementary documents

Box 1. List of LMICs:

- Afghanistan OR Albania OR Algeria OR American Samoa OR Angola OR Armenia OR Azerbaijan OR Bangladesh OR Belarus OR Byelarus OR Belorussia OR Belize OR Benin OR Bhutan OR Bolivia OR Bosnia OR Botswana OR Brazil OR Bulgaria OR Burma OR Burkina Faso OR Burundi OR Cabo Verde OR Cape Verde OR Cambodia OR Cameroon OR Central African Republic OR Chad OR China OR Colombia OR Comoros OR Comores OR Comoro OR Congo OR Costa Rica OR Côte d'Ivoire OR Cuba OR Djibouti OR Dominica OR Dominican Republic OR Ecuador OR Egypt OR El Salvador OR Equatorial Guinea OR Eritrea OR Ethiopia OR Fiji OR Gabon OR Gambia OR Gaza OR Georgia OR Georgia Republic OR Ghana OR Grenada OR Grenadines OR Guatemala OR Guinea OR Guinea- Bissau OR Guyana OR Haiti OR Herzegovina OR Hercegovina OR Honduras OR India OR Indonesia OR Iran OR Iraq OR Ivory Coast OR Jamaica OR Jordan OR Kazakhstan OR Kenya OR Kiribati OR Democratic People's Republic of Korea OR Kosovo OR Kyrgyz OR Kirghizia OR Kirghiz OR Kyrgyzstan OR Lao PDR OR Laos OR Lebanon OR Lesotho OR Liberia OR Libya OR Macedonia OR Madagascar OR Malawi OR Malay OR Malaya OR Malaysia OR Maldives OR Mali OR Marshall Islands OR Mauritania OR Mauritius OR Mexico OR Micronesia OR Moldova OR Mongolia OR Montenegro OR Morocco OR Mozambique OR Myanmar OR Namibia OR Nepal OR Nicaragua OR Niger OR Nigeria OR Pakistan OR Palau OR Papua New Guinea OR Paraguay OR Peru OR Philippines OR Principe OR Romania OR Ruanda OR Rwanda OR Samoa OR Sao Tome OR Senegal OR Serbia OR Sierra Leone OR Solomon Islands OR Somalia OR South Africa OR South Sudan OR Sri Lanka OR St Lucia OR St Vincent OR Sudan OR Surinam OR Suriname OR Swaziland OR Syria OR Syrian Arab Republic OR Tajikistan OR Tadzhikistan OR Tajikistan OR Tadzhik OR Tanzania OR Thailand OR Timor OR Togo OR Tonga OR Tunisia OR Turkey OR Turkmen OR Turkmenistan OR Tuvalu OR Uganda OR Ukraine OR Uzbek OR Uzbekistan OR Vanuatu OR Venezuela OR Vietnam OR West Bank OR Yemen OR Zambia OR Zimbabwe

Box 2. Key for data extraction tables

Integration:

- Dimensions: functional, normative, clinical, organisational, system, professional, services
- Level: micro, meso, macro level
- Concept

Integration for HSS

- Target: population, person-focused
- Level: Systemic, Vertical, Horizontal

EHC services

- Leadership (policy, oversight, coalition building, regulations)
- Workforce (education, training, task shifting, telemedicine)
- Products (standards, procurement, quality assurance, patient safety)
- Information (needs assessment, targets, indicators, monitoring)
- Financing (social protection, private-sector engagement)

Table 2. Initial data extraction form

Study details							**Integration**			**EHC intervention**			**Integration of EHC for HSS**	
No	Title	Author	Year	Type of study	Country	Aim	Dimensions	Level	Concept	Was an intervention used? Yes/No	Type of intervention.	Description of intervention	Target	Level

Table 3. Data extraction form continued

Enablers of integration of EHC services							**Barriers of integration of EHC services**						
Leadership	Workforce	Products	Information	Financing	Other	Outcomes of integration	Leadership	Workforce	Products	Information	Financing	Other	Outcomes of integration

EHC – Ear and hearing care, HSS – Health system strengthening

Appendix 3 - Research appendices

Table 1. Data extraction form (Source: Author)

Study details						Integration approach					Enablers and barriers of integration		
No	**Title**	**Author, year**	**Type of study**	**Country**	**Aim**	**Concept of integration**	**Description of intervention**	**Target population**	**Dimensions of integration**	**Level of integration**	**Enablers**	**Barriers**	**Healthcare seeking behaviour**

Key for data extraction: Table 2

Dimensions

- Functional, Normative, Clinical, Organisational, System, Professional, Services

Level of integration

- Micro, Meso, Macro

Enablers or barriers of EHC integration

- Leadership (policy, oversight, coalition building, regulations), Workforce (education, training, task shifting, telemedicine), Products (standards, technology, procurement, quality assurance, patient safety), Financing (social protection, resources, investment)

Table 2. Summary of EHC integration approach of included articles

	Study details					Integration approach					Enablers and barriers of integration		
No	**Title**	**Author, year**	**Type of study**	**Country**	**Aim**	**Concept of integration**	**Description of intervention**	**Target population**	**Dimensions of integration**	**Level of integration**	**Enablers**	**Barriers**	**Healthcare seeking behaviour**
1	The role of community health workers in addressing the global burden of ear disease and hearing loss: a systematic scoping review of the literature.	O'Donovan, J. et al. (2019)	Scoping review	Multi-country including LMICs	To identify the role CHWs in the improvement of access to EHC services in LMICs and underserved areas.	Integration of CHWs into ear and hearing care services	Task shifting to cadres of HCWs with less specialised training (CHWs)	CHWs in low-resource settings	Clinical, Service	micro	Training supports integration.	EHC not prioritised in policies. Lack of HCWs. Inadequate training and support.	Ability to pay. Community participation and awareness.
2	Tele Otology in India: Last 10 Years-A Scoping Review	Angral, S. et al. (2021)	Scoping review	India	Evaluate tele otology and tele audiology to provide EHC services in India.	Integration of tele audiology in EHC services in low resource settings.	Tele audiology interventions using technology for remote EHC service delivery.	Low-resource settings	Service, Organisational	micro, meso	Training. Collaboration improved acceptability and implementation. Technology improves screening, diagnosis and referrals. Travel to clinics.	Lack of HCWs. Challenges with training. Lack of equipment and infrastructure. Lack of funding	Ability to pay.

3	Impact of COVID-19 pandemic on audiology practice: A scoping review	Aggarwal, K et al. (2022)	Scoping review	Multi-country including LMICs	Explore the impact of COVID-19 pandemic on audiological services and identify challenges.	To assess the influence of the COVID-19 pandemic on audiological practices and identify the unique challenges experienced.	No intervention	Audiologists	I	_	_	Lack of training.	_
4	Barriers to access to ear and hearing care services in low- and middle-income countries: A scoping review	Waterworth, C. J. et al. (2022)	Scoping review	LMICs	To identify barriers to accessing EHC services and identify potential solutions.	_	Programmes that support EHC services	People affected by hearing loss and caregivers; EHC HCWs.	Clinical	micro	Supervision adds to staff retention, competency, motivation and satisfaction. Allocate sufficient budget for EHC services.	Lack of HCWs. Lack of training in communication and counselling.	Access and ability to pay. Lack of knowledge and awareness. Limited referral attendance.
5	Community-based (CB) assessment and rehabilitation of hearing loss: A scoping review	Eubank, T. N. et al. (2022)	Scoping review	Multi-country (LMICs)	To describe community-based hearing rehabilitation.	To describe the implementation of community-based hearing care.	To describe the implementation of community-based hearing care.	Resource-limited communities	Professional	meso	Training. Feedback system. Collaboration between CHWs and HCWs.	_	_
6	Audiological follow-up in a risk-based newborn hearing screening programme: An exploratory study of the	Kanji, A. and Krabbenhoft, K. (2018)	Qualitative	South Africa	To investigate the positive and negative factors which influence caregivers to return for follow-up of high-	To explore the reasons for follow-up of high-risk infants and challenges experienced by caregivers to attend follow-up visits relating to risk-based	Risk-based hearing screening	Caregivers of infants attending follow-up visits.	Service	micro	_	_	Access and ability to pay.

	influencing factors				risk infants in a risk-based new-born hearing screening programme.	hearing screening.							
7	Providing the Best Audiological Care and Creating Sustainability in Peru	Holst, J. E. et al. (2020)	Qualitative	Peru	To describe the needs of the community from the perspective of the HWCs and identify plans for sustainable EHC.	Coordination of HWCs to implement programmes in rural communities.	NPO Idaho Condor Humanitarian who works in communities to identify health needs.	Rural communities	Professional, Normative, Organisational	meso	Inclusion of EHC in healthcare package. Professional collaboration. Approaches to EHC service delivery consider local context.	_	Communication and awareness.
8	Barriers and facilitators influencing hearing help-seeking behaviours for adults in a peri-urban community in South Africa: a preventive audiology study	Mtimkulu, T.K. et al. (2023)	Descriptive qualitative	South Africa	To understand the barriers and facilitators contributing to healthcare seeking.	_	No intervention	Hearing impaired patients		_	_	_	Access and ability to pay. Community-based services built trust.
9	Access to ear and hearing care services in Cambodia: a	Waterworth, C. J. et al. (2024)	Qualitative	Cambodia	To understand the availability and uptake of EHC	_	No intervention	EHC service providers		_	Public-private partnerships for training.	_	Access and ability to pay. Proper referral mechanisms.

	qualitative enquiry into experiences of key informants				services in Cambodia.								
10	Knowledge and cultural beliefs of mothers regarding the risk factors of infant hearing loss and awareness of audiology services	Govender, S. M. and Khan, N. B. (2017)	Quantitative	South Africa	To describe the knowledge of mothers pertaining to the risk factors associated with hearing loss, their awareness of EHC services and the influence of cultural beliefs.	Public awareness	No intervention	Mothers of infants	I	–	–	Challenges with policy implementation.	Limited knowledge. Awareness of EHC services.
11	Identifying hearing impairment and the associated impact on the quality of life among the elderly residing in retirement homes in Pretoria, South Africa	Govender, S. M. and De Jongh, M. (2021)	Quantitative	South Africa	To determine the presence of hearing impairment in elderly homes and its impact on quality of life.	Integrating hearing screening for the elderly.	Hearing screening and fitting hearing aids.	Vulnerable populations (elderly)	Service	micro	–	–	–
12	Reasons for low uptake of referrals to ear and	Bright, T. et al. (2017)	Mixed methods	Malawi	To explore the uptake of referrals to EHC	Integration of CHWs to conduct EHC screening for	Task shifting through training CHWs	Thyolo district in Malawi	Clinical	micro	Training of CHWs.	Too few staff. Limited infrastructur	Access to facilities. Effective referrals.

	hearing services for children in Malawi				services among children and barriers for lack of referral uptake.	further referrals.	to assist with referrals					e, equipment and support.	Lack of information and awareness. High OOP.
13	Childhood hearing loss; a need for primary healthcare	Ogunkeyede, S. A. et al. (2017)	Cross-sectional descriptive study	Nigeria	To describe the experiences of parents/caregivers in accessing EHC services.	Accessibility of EHC services by parents/caregivers of children with hearing impairment.	No intervention	Person-focused. Parents/caregivers of hearing-impaired children.	I	_	Collaboration	Limited EHC staff.	Lack of awareness of EHC services and knowledge of hearing loss. Cost of EHC. Including CHWs in referral systems. Inaccessibility of EHC services.
14	Enhancing Ear and Hearing Health Access for Children with Technology and Connectivity	Swanepoel, W. (2017)	Quantitative	South Africa	To assess improved access to EHC through community-based screening and technology.	Community-based screening and technology can improve access to EHC in underserved communities.	mHealth	Communities	Service	micro	Technology improves training, quality of care and access.	Lack of equipment, infrastructure, staff.	_
15	Interregional Newborn Hearing Screening via Telehealth in Ghana	Ameyaw, G. A. et al. (2019)	Quantitative	Ghana	To assess the feasibility of using telehealth to expand EHC services.	Implementing telehealth to improve access to EHC.	Comparing the use of telehealth to conventional methods to screen for hearing loss.	Healthcare facilities delivering NBHS.	Service	micro	Training and support. Collaborative centres. Inclusion of NBHS in healthcare packages.	Lack of HCWs.	_

16	Training, supervision and performance of Community Health Workers in the delivery of ear and hearing care to 321 community members in rural Uganda	O'Donovan, J. et al (2021)	Mixed methods	Uganda	Evaluation of training and service delivery of CHWs.	To provide training to CHWs to conduct hearing screening and evaluate the service provided.	CHWs were trained in hearing screening.	CHWs	Clinical	micro	Training supports task shifting/sharing. Staff support assist with integration. Collaboration at various levels.	Training not adequate.	Including CHWs in referral systems.
17	Clinical attendance rate at a tertiary adult audiological service in South Africa	Mubina Khan, M. et al (2023)	Mixed methods	South Africa	To explore the rate of attendance and factors influencing attendance at an audiology clinic.	_	No intervention	EHC patients	_	_	_	_	Access to EHC facilities.

Ear and hearing care (EHC), Community health workers (CHWs), healthcare workers (HCWs), low- and middle-income countries (LMICs), non-profit organization (NPO), new-born hearing screening (NBHS)

Appendix 4 – Ethics approval letter

School of Public Health
Departement Openbare Gesondheid
Isikolo Sempilo Yoluntu
UNIVERSITY OF CAPE TOWN

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30 October 2022

STUDENT NUMBER: LTGCAR002

Dear Carmen de Kock,

Please be advised that this protocol has been reviewed by the School of Public Health Departmental Research Committee (DRC), agreeing that the study does not require Human Research Ethics Committee (HREC) approval, and has been submitted to Vuyi Mgoqi at the Postgraduate Office, for the Dean's Circular.

Title: Integration of ear and hearing care services in low and middle-income health systems: a systematic review and qualitative synthesis

Please upload this to Peoplesoft in the 'Copy of Ethics Approval Letter' section when you do your Intent to Submit.

Kind regards

Dr Tasleem Ras
Co-chair: Departmental Research Committee
School of Public Health

Our vision is to be an inclusive, engaged and research-intensive African university.

Appendix 5 - The instructions for authors for the target journal

Instructions for authors

Thank you for choosing to submit your paper to us. These instructions will ensure we have everything required so your paper can move through peer review, production and publication smoothly. Please take the time to read and follow them as closely as possible, as doing so will ensure your paper matches the journal's requirements. For general guidance on every stage of the publication process, please visit our Author Services website. For editing support, including translation and language polishing, explore our Editing Services website

Thank you for choosing to submit your paper to *Global Health Action*. Please take time to read and follow these instructions. Complete guidelines for preparing and submitting your manuscript to *Global Health Action* are provided below. Errors and incomplete information will cause delays in the handling of your submission.

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methods as the best way of addressing the stated aims and objectives. The methods and analyses are not sufficiently transparent or reproducible. The study design does not clearly address the research question(s). There are major flaws in the study design or data which impact negatively on the reliability and validity of the results and conclusions. 7. The study does not use the most recent or best available data, or the authors do not present a justification for using historical material. 8. The study cannot be contextualized within a current global health policy context. 9. The study uses primary data collected by local researcher(s) in low- or middle-income countries but the paper does not include local researchers as co-authors. Exceptions may apply if the study involves a secondary analysis from an open access data source. 10. The manuscript is incorrectly structured. The English language (e.g., grammar, style, tense, and syntax) is not coherent or too informal. Clean concise scientific writing is required. 11. The references are not correctly linked, up-to-date, or relevant. The Global Health Action reference style is NLM. If there are more than six authors list the first six followed by et. al. Otherwise list all authors and initials.

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Peer review processes After manuscripts have passed the initial screening, they are subjected to rigorous external peer review to ensure that the research is 'good science'. Manuscripts are referred electronically and correspondence with reviewers is by email. Manuscripts are sent to at least two independent reviewers. Fast-track peer review may be provided upon request. *Global Health Action* uses a 'single blind' peer review process: This means that reviewers' identities remain unknown to the authors but authors' names are known to the reviewers. Peer reviewers are asked to give their opinion on issues pertinent to the scientific and formal aspects of a manuscript, and to judge on grounds of originality and global health significance. Peer reviewers can make one of the following recommendations for editors to consider: 1. Accept manuscript (i.e., no need for any revision); 2. Conditional accept (i.e., can be accepted if the author makes the requested minor editorial revisions); 3. Minor revision (i.e., can be accepted after minor revisions have been made); 4. Major revision (i.e., can be accepted or rejected after major revisions have been made; the manuscript may be sent for another round of peer review); 5. Reject manuscript - (i.e., the manuscript is sub-standard); the current submission will be closed, and 6. Reject and re-submit - close the current submission. This decision gives authors the option of making a new submission which would be subject to a further independent assessment and review as required for all new submissions. Reviewers can ask authors to consider their comments, tighten arguments based on existing data, or identify areas where more data are needed. If the English language and writing style is poor and the expression is not logical and coherent, this alone can be grounds for a revision. All authors are asked to have their manuscripts checked and edited for grammar, punctuation, tense, spelling and typological errors. To facilitate rapid publication, authors are usually given two weeks for minor revisions and four weeks for major revisions. Two-week extensions may be granted upon request if there are 'reasonable grounds'. If authors do not comply with time frames, editors may reject manuscripts. Some manuscripts undergo more than one round of peer review and revision before the Editor makes the final decision.

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