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Empirical research and available data on assistive technology for persons with disabilities in Malawi: A review

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ABSTRACT

Empirical research and data are necessary for policy, planning and provision of services for persons with disabilities. Research data may be available but still not used by researchers and policy makers. The aim of this study is to explore existing empirical research and sources of data on Assistive Technology (AT) in Malawi in order to facilitate the development of an AT policy and Assistive Product List (APL). A two-stage process using a scoping review methodology was adopted to identify (1) empirical research on AT in Malawi and (2) sources of existing data on AT in Malawi. Following a narrative synthesis, 12 heterogenous studies that reported on the use, availability, sources and knowledge about AT in Malawi were identified. Identified studies suggest that there is high unmet need for AT and services in Malawi. Five major sources of data on disability and AT were Identified. Only 2 out of the 12 studies had used existing sources of data. The high unmet need for AT and services in Malawi have substantial implications for persons with disabilities. Developing mechanisms that will improve the use of existing data on AT in all countries is pivotal for the efficient and effective development of AT ecosystems.

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KEYWORDS
assistive products; assistive technology services; Malawi; research review

Introduction

Assistive Technology (AT) refers to assistive products (AP) and associated systems and services that are developed for the maintenance and improvement of function. Access to APs such as a wheelchair, spectacles, hearing aids and communication boards are important for well-being and inclusion of persons with disabilities (WHO, 2016). However, the World Health Organization (WHO) estimates that only 1 in 10 who require access to AT currently have them (WHO, 2016). Global estimates suggest that 1 billion people in the world currently require access to AT, with 2 billion expected by 2050 due to population increase, increase in non-communicable diseases and functional limitations associated with aging (WHO, 2016). To respond to this need, and in response to the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD), the WHO embarked on the Global Cooperation on Assistive Technology (GATE) initiative, with the aim to address these unmet and future needs (United Nations, 2006; World Health Organization, 2014, 2019). However, there is a lack of valid and reliable data on AT use, need and unmet need from which to drive sustainable policies and systems.

The relevance of empirical research and data to health policy and practice has been extensively documented (Arzberger et al., 2004; Weiss, 1979). Research helps to generate evidence for the justification and direction of social change and to also evaluate measures implemented to achieve desired change. Research data provides the raw material for evaluation and signpost for further or future research. Empirical research data is also relevant for the replication of analysis, evaluation of research results and practice, and crafting effective and sustainable policy (Arzberger et al., 2004; Cappa et al., 2015; Weiss, 1979). The overall importance of research and data in health research and practice informs their incorporation as an integral part of most interventions and development programs (AT2030, 2020; World Health Organization, 2019).

It is not uncommon for research to recommend further research and evidence to answer additional research questions, even when lessons from exiting research or available data abound (Phillips, 2001; Vlassov, 2004). This may apply to the disability sector where there is a dearth of research, both in low- and middle-income settings and high-income settings. The World Report on Disability and the GReAT Consultation 2019 recommends improving disability data collection and strengthening research on disability (World Health Organisation, 2011, 2019) and with the progressive increase in number of persons with disabilities globally, and global commitment and acknowledgment of the fundamental rights of persons with disabilities, enshrined in the UNCRPD, there is an increased global need to improve the quality of life of persons with disabilities (United Nations, 2016). Increasing access to AT is one way of ensuring the realization of this goal.

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It is therefore not surprising that Research and Evidence is the first and among the four clusters of the Assistive Technology 2030 program that seeks to improve data and evidence to unlock investment into AT (AT2030, 2020). Supporting research and gathering evidence for AT use in order to identify what works is perceived as integral to improving access to AT and reducing the high unmet need for AT globally and in low income settings in particular (AT2030, 2020; Smith et al., 2019; World Health Organization, 2019). A recent WHO report underscores and reiterates the critical role of data to achieving the Sustainable Development Goals (SDGs) (WHO, 2020). The report declares that "without accurate health data and reporting, it's hard to tell how we're doing" (WHO, 2020). This assertion is not only true for SDG3, which is specific to good health and wellbeing but the other SDGs that require AT for their achievement (Tebbutt et al., 2016). However, in low-income settings, research and data on AT are often sparse in the face of heighted rates of disability and increasing need for AP (Holloway et al., 2018; WHO, 2019).

Study context

Malawi is a South African country with an estimated population of 18.6 million people that is expected to double by 2038. The economy depends largely on agriculture and foreign aid (World Bank, 2021). There is high unmet need for health services for persons with disabilities (Munthali, 2011; Munthali et al., 2019). In Malawi, only about 4.5% of the persons with disabilities have access to AT and AT provision is suggested to be largely donor driven with a high dependency on foreign aid (Munthali, 2011). At the same time, studies indicate a dearth in research and data on disability which is perceived as a limitation to planning and advocacy for affected individuals (Ebuenyi et al., 2020; Munthali, 2011; Munthali et al., 2019). Article 31 of the UNCRPD recommends that State parties undertake actions that ensure information and research data relevant for policy formulations for the benefit of persons with disabilities (United Nations, 2006). A recent UNICEF report on Malawi suggests that the lack of comprehensive and timely data and statistics is a major limitation to effective planning and budgeting on disability (UNICEF, 2019). The report also highlighted the lack and shortage of AP on account of scarce resources.

Although, the lack of AT for persons with disabilities may also be on account of several other factors, it is evident that effective research and data on AT is critical to the discourse of AT provision in Malawi (UNICEF, 2019). In Malawi, the housing and population census and Demographic and Health Surveys capture data on persons with disability (NSO, 2020). However, it is not evident to what extent it captures information on AT. Although, research on the use and provision of AT exist in Malawi, it is also not clear to what extent available data sources from public institutions or private research organizations are used. The aim of this study is to (1) explore empirical research on AT for persons with disabilities in Malawi, and (2) to explore the relationship between existing research on AT and available data on AT in Malawi.

Methods

Review strategy

In order to explore our study objectives, we adopted an analytical scoping review methodology (Peters et al., 2015). First, using the Arksey & O'Malley framework (Arksey & O'Malley, 2005), we conducted a systematic search of empirical research on AT in Malawi. Second, through online search and correspondence with the National Statistical office in Malawi, we set out to map all available sources of data on AT. The National Statistical Office of Malawi is the primary government agency that collects and disseminates statistics in the country.

Data collection

A systematic literature search was conducted on 14th October 2020 using two databases, PUBMED and SCOPUS. The search was conducted using the following keyword-based search strategy: Assistive technolog* OR assistive device* OR adaptive technolog* OR wheelchair* OR mobility device* OR mobility aid* OR hearing aid* OR sensory device* OR eyeglasses AND Malawi. Further search was conducted on Google Scholar using the same keywords to identify research that may have been missed using the databases.

Using a predefined eligibility criteria, we included all studies on AT or its synonyms that focused on Malawi or had participants from Malawi. Our initial search yielded 105 articles that were exported to EndNote. We conducted title and abstract screening and after which 27 studies were selected for full text screening. Only original peer reviewed research articles written in English were deemed eligible for inclusion in the review. We applied no year limits in the review. The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) diagram (Moher et al., 2015) in Figure 1 depicts the process of study election.

For the mapping of available sources of data on AT, we conducted an online search on Google for data on AT in Malawi. The search on Google produced over 400,000 results and the first two pages were the most relevant and contained the articles identified in the database search. Also, we examined all sources of AT data used in the empirical research identified in the systematic review of literature. Next, we contacted the National Statistical Office (NSO) Malawi for a list and summary of all sources of AT data in Malawi. A final list of all sources of AT data identified were entered into an Excel sheet for review.

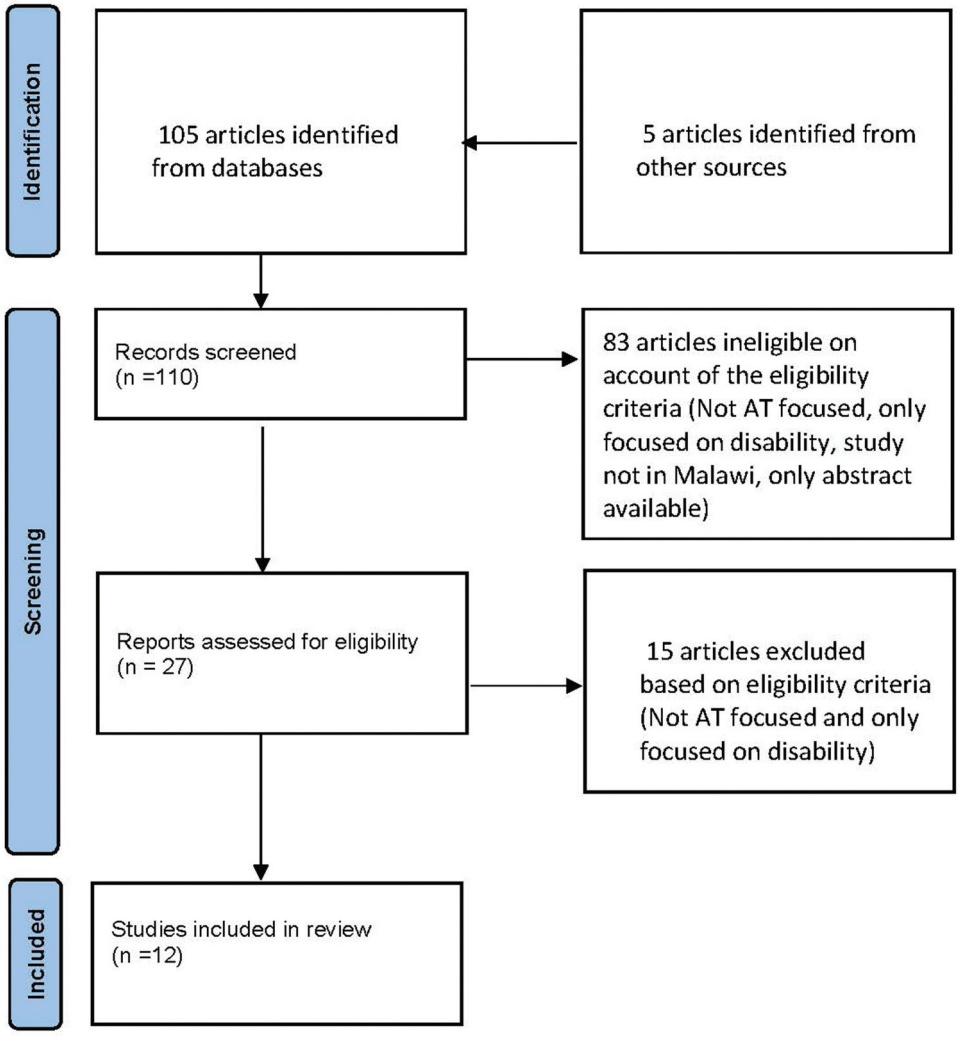

Figure 1. PRISMA flowchart of study selection process.

Data synthesis

For the review, an extraction table was created to obtain information related to author, year of publication, study objective and design, and the AT(s) highlighted in the selected studies. The available sources of data were analyzed to extract information on data sources, year of collection, details and the data collection.

This was followed by a narrative synthesis to highlight the contribution of the different studies to evidence on use and availability, awareness and provision of AT in Malawi and the extent to which they may have used the identified sources of data in Malawi.

Results

Studies on AT in Malawi

Our literature search identified 105 articles from the databases and an additional 5 articles through manual search making it 110 articles (Figure 1). Out of the 110 articles screened based on their title and abstract, 83 were excluded. The full text of 27 articles were screened based on the inclusion criteria and 12 articles published between 2015 and 2019 were included for analysis. The study characteristics of the included articles are as shown in Table 1.

The included studies were published between 2004 and 2019 and of varying methodologies. Half (6) of the studies were qualitative (Agarwal-Harding et al., 2019; Magnusson, 2019; Munthali et al., 2019; Norris, 2017; Tataryn et al., 2017; Visagie et al., 2019), two were cross-sectional surveys (Hrapcak et al., 2016; Magnusson & Ahlstrom, 2017), one was mixed method (Pal et al., 2015) and three were large surveys (Eide & Munthali, 2017; Loeb & Eide, 2004; Visagie et al., 2017). It is pertinent to state that only six of the studies were specifically on Malawi (Agarwal-Harding et al., 2019; Eide & Munthali, 2017; Hrapcak et al., 2016; Loeb & Eide, 2004; Munthali et al., 2019; Tataryn et al., 2017), while the remaining six were multicountry studies that included study participants from Malawi and other countries.

The themes of the studies were also varied and ranged from the prevalence of use of AT, availability and use of AT, knowledge and provision of AT (Agarwal-Harding et al., 2019; Eide & Munthali, 2017; Hrapcak et al., 2016; Loeb & Eide, 2004; Magnusson, 2019; Magnusson & Ahlstrom, 2017; Munthali et al., 2019; Norris, 2017; Pal et al., 2015; Tataryn et al., 2017; Visagie et al., 2017, 2019). The findings will be described based on these themes.

Table 1. Study characteristics and findings.

Lead Author; Year;	Study Design; n*	Objective	Summary of Findings	AT Types covered
Agarwal-Harding, 2019	Qualitative; n=N/A	To estimate current capacity of Malawian public hospitals to manage musculoskeletal trauma	2 of 4 hospitals reported unavailability of orthopedic clinicians and walking assistive devices	Walking assistive devices (walkers/frames, canes and crutches).
Eide & Munthali, 2017	National survey; n=30577	To explore the living Conditions among People with disabilities	Majority (61.7 %) reported using devices for personal mobility; almost one in four (38.9 %) used an information device. AT use increased with increasing severity. 69.6 % said their AT were in good condition and the most common (37.7 %), source of assistive device was private procurement, government (27.2 %) and other governmental services (4.8 %). NGOs provided devices to 12.9 %. Out of 4475 persons with disabilities, 56.5% were aware of AT services, 31.4% needed AT services but only 6.1% have AT devices; 80.5% gap in AT services. More than twice as many use assistive devices in urban vs. rural areas ($\chi 2 = 41.04$, $p < .001$). Most (44.2 %) respondents with an assistive device report that they repair and maintain the device themselves, and one in five (22.3 %) report that their assistive devices are not maintained or repaired. Majority (63.4 %) were satisfied with their AT.	Wheelchairs, hearings aids, calipers, prosthetics/orthotics, sunscreen lotions for persons with albinism and drugs for persons with epilepsy
Hrapcak et al., 2016	Cross-sectional; n=380	To estimate prevalence and types of hearing loss in HIV-infected children in Lilongwe, Malawi	24% of study participants had hearing loss. Children with hearing impairment less likely to attend school, had poorer emotional ($p = 0.02$) and school functioning ($p = 0.04$).	Hearing aid
Leob & Eide, 2004	National Survey; n=15364	To explore the living conditions among people with disabilities	About 17.1% (304 of 1550) of respondents use assistive devices. significantly more men (25%) than women (14%) ($\chi 2 = 28.2$, $df = 1$, $p < 0.001$). Personal mobility devices (e.g wheel chair, crutches, sticks) were the most available(70.4%). 75.5% were aware of AT services, 65% ad need for AT service while only 17.9% received it. Gap in AT service was 81.1% ; 74.8% for physical, 86% for sensory and 100% for mental/emotional disabilities. 64% said their device was in good working condition. Main sources of AT were private acquisition (34%), government (19%), NGOs (9%). 30% repaired the devices themselves while 38.3% do not repair their or unable to afford repairs.	Wheelchairs, crutches, walking sticks, white cane, guide dog, standing frame, eye glasses, hearing aids, magnifying glass, enlarge print, Braille, Special fasteners, bath & shower seats, toilet seat raiser, commode chairs, safety rails, eating aids, Sign language interpreter, fax, teletypewriter (TTY), portable writer, PC, Gripping tongs, aids for opening containers, tools for gardening, Flashing light on doorbell, amplified telephone, vibrating alarm clock and Keyboard for the blind

(*Continued*)

Table 1. (Continued).

Lead Author; Year;	Study Design; n*	Objective	Summary of Findings	AT Types covered
Magnusson & Ahlstrom, 2017	Cross-Sectional; n=88	To investigate similarities and differences between Sierra Leone and Malawi concerning participants' mobility and satisfaction with their lower-limb prosthetic or orthotic device and related service delivery.	42% of participants in Malawi had difficulty with use of AT; majority did not have the money to procure AT. Participants in both countries were quite satisfied (mean 3.7-3.9 of 5) with their assistive device. Participants most dissatisfied with: comfort (46%), dimensions (39%), and safety (38%) of their assistive device.	Prosthetic and orthotic devices.
Magnusson, 2019	Qualitative; n=49	To compare and synthesize findings related to experiences of prosthetic and orthotic service delivery in Tanzania, Malawi, Sierra Leone and Pakistan from the perspective of local professionals.	Four common themes emerged: low awareness and prioritization of prosthetic and orthotic services; difficulty managing specific pathological conditions and problems with materials; limited access to prosthetic and orthotic services; and the need for further education for professional development.	Prosthetic and orthotic devices
Munthali et al., 2019	Qualitative; n=52	To explore barriers which people with disabilities experience in accessing health care services in Malawi.	Persons with disabilities experience several barriers to health services. Expansion of the provision of assistive devices and strengthening the links between key component of access to quality health care is very essential.	Hearing aids, wheelchairs, crutches
Norris, 2017	Qualitative; n=30	To test the impact of Peer Training, Motivation created a knowledge, skills and well-being questionnaire, in two locations: Kenya and Malawi	Participants reported increase in knowledge, skills and well-being, supporting their experience and that this training provides vital information and support mechanisms for wheelchair users	Wheelchairs
Pal et al., 2015	Mixed methods; n=40	To examine the role of mobile devices in access to social, economic, and architectural spaces and resources by people with vision impairments in two urban settings in Rwanda and Malawi.	The use of a range of Assistive Technologies (AT) on phones was very low. Only participants had phones with pre-loaded AT on a smart phone, and two more were regular, active AT users.	Mobile phones
Tataryn et al., 2017	Key Informant Method; n=15000	To estimate the prevalence of moderate/severe, hearing, vision and physical impairments, intellectual impairments and epilepsy in children in two districts in Malawi and associated need for rehabilitation and other services.	The estimated prevalence of impairments/epilepsy was 17.3/1000 children (95% CI: 16.9-17.7). Physical impairment (39%) was most common followed by hearing impairment (27%), intellectual impairment (26%), epilepsy (22%) and vision impairment (4%). Approximately 2100 children per million population could benefit from physiotherapy and occupational therapy; 300 per million need a wheelchair.	Wheelchair, orthosis

(*Continued*)

Table 1. (Continued).

Lead Author; Year;	Study Design; n*	Objective	Summary of Findings	AT Types covered
Visagie et al., 2017	Survey; n=1496	To explore assistive technology sources, services and outcomes in South Africa, Namibia, Malawi and Sudan.	Walking aids were most commonly bought/ provided (46.3%), followed by visual aids (42.6%). The most common sources for assistive technology were government health services (37.8%), "other" (29.8%), and private health services (22.9%). 59.3% received information in how to use the device. Maintenance mostly by users and their families (37.3%). Devices helped a lot in 73.3% of cases and improved quality of life for 67.9% of participants; 39.1% experienced functional difficulties despite the devices.	Walking mobility devices, Wheeled mobility aids, visual aids and hearing aids
Visagie et al., 2019	Qualitative; n=86	To describe users' and suppliers' perceptions of the AT-Info-Map app.	Two broad themes: usefulness of the AT-Info-Map application and technical issues and content, emerged from the data analysis. Subthemes under usefulness focused on the importance of using current technology, convenience of the app, the need for accuracy, responsiveness of supplier to user's needs, influence on AT market and how the app creates an opportunity for networking. Challenges to download and navigate the app, the need for training in its use, exclusion of those not literate in English and those with visual impairments were subthemes under technical issues and content.	NA

*Where studies report participants in more than one country, *n* represents the number of participants reported on in Malawi only.

Prevalence, availability and use of AT

The *prevalence* of AT use in Malawi were reported by two studies. A 2004 study reported that out of 65% of persons with disabilities in need of AT, only 17.1% received it (Loeb & Eide, 2004). A similar study conducted 13 years later by the same authors reported that although 56.5% of persons with disabilities needed AT, only 6.1% received it (Eide & Munthali, 2017).

On the *availability and use* of AT, the majority (nine) of the studies showed that personal mobility devices were the commonest types on AT and reported something about them (Agarwal-Harding et al., 2019; Eide & Munthali, 2017; Loeb & Eide, 2004; Magnusson, 2019; Magnusson & Ahlstrom, 2017; Munthali et al., 2019; Norris, 2017; Tataryn et al., 2017; Visagie et al., 2017). While a large national survey conducted in 2004 reported that based on availability of AT devices, personal mobility devices accounted for 70.4% (Loeb & Eide, 2004) in Malawi, a 2017 national survey reported that they accounted for 61.7% followed by information devices (38.9%) (Eide & Munthali, 2017). However, a qualitative study that investigated service provision capacity of four public hospitals in Malawi reported the unavailability of walking devices in two of the hospitals (Agarwal-Harding et al., 2019) while another qualitative study that explored perspectives of providers of AT suggested low prioritization of orthotic and prosthetic devices (Magnusson, 2019). In a mixed method study that explored the use of AT on phones for persons with visual impairments, only four out of 76 participants had such devices (Pal et al., 2015). Two studies that focused on different disabilities in children reported the prevalence of hearing impairment as 24% (Hrapcak et al., 2016) and 27% (Tataryn et al., 2017) and the poor availability of hearing aid for these children were considered a limitation to enrollment and or participation in school.

The primary reason for lack of access and use of AT was financial. A multicountry cross sectional study highlighted that 42% of study participants from Malawi had difficulties with the use of AT on account of the lack of money to procure them (Magnusson & Ahlstrom, 2017). There were variations in the report of the main sources of AT. While one multicountry survey reported that government (37.8%) was the main source of AT (Visagie et al., 2017), the two Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology (SINTEF) studies in Malawi reported that private acquisition were the main sources of AT in the country followed by government. In the 2004 SINTEF study, private and government sources accounted for 34% and 19% of AT source, while in 2017 it was 37.7% and 27.2%, respectively (Eide & Munthali, 2017; Loeb & Eide, 2004). In the study that investigated the use AT on phones for persons with visual impairments, Pal and colleagues reported that only 9 of the 40 participants from Malawi were using free or donated devices, while the rest purchased their own devices (Pal et al., 2015).

In addition to finance, location and gender also affected the use of AT. In the 2004 SINTEF study, significantly more men (25%) than women (14%) were using AT in Malawi while in the 2017 survey, a significant gender disparity was also observed in usage of AT but only in urban vs rural areas (Eide & Munthali, 2017; Loeb & Eide, 2004). The gendered pattern to use and availability of AT was highlighted in the study on gender and accessibility (Pal et al., 2015).

The majority of the studies reported satisfaction in the use of AT. A multicountry cross sectional study reported a mean satisfaction rate of 3.7–3.9 out of 5 (Magnusson & Ahlstrom, 2017), one national survey reported that 64% of individuals using AT said it was functioning well (Loeb & Eide, 2004) while another national survey reported a 63.4% satisfaction rate (Eide & Munthali, 2017). In spite of these above average satisfaction rates, studies reported that the repair of AT was undertaken mainly by the users. Visagie and colleagues reported that repairs and maintenance was undertaken by users and their families (37.3%) while 39.1% experienced difficulty despite the use of the devices. In the 2004 SINTEF study, Loeb and Eide noted that 30% of users repaired their devices while 38.3% do not repair their devices or unable to affords repairs (Loeb & Eide, 2004). In the 2017 SINTEF study, 44.2% of users repaired the AT themselves while one in five (22.3%) reported an inability to repair or maintain their devices (Eide & Munthali, 2017).

Knowledge, awareness and provision of AT

On *knowledge and awareness of* AT, a multicountry qualitative study reported a low awareness of orthotic and prosthetic services in Malawi (Magnusson, 2019). Visagie and colleagues reported that 59.3% of AT users received information on how to use their devices (Visagie et al., 2017). Awareness of AT services in the 2004 and 2017 SINTEF studies in Malawi were 75.5% and 56.5%, respectively (Eide & Munthali, 2017; Loeb & Eide, 2004). A two country qualitative study to explore the impact of training on AT use, noted that peer training improved the skills and use of AT for wheelchair users (Norris, 2017).

Information on *provision of AT* from the studies were of varying relevance. A multicountry qualitative study suggested the need for further education and professional development for providers of AT services (Visagie et al., 2017); and in another qualitative study Munthali and colleagues in highlighting the barriers to health services recommended the strengthening and expansion of AT service provision (Munthali et al., 2019). In a qualitative study to describe the perceptions of users and suppliers on use of a digital application that maps AT, Visagie and colleagues also highlighted the need for suppliers to be responsive to needs of users by ensuring the digital tool for visually impaired individuals was user friendly (Visagie et al., 2019). The study also highlighted the importance of training on the use of the application (Visagie et al., 2019). This theme on training for the improved use of AT was also reported by the multicounty qualitative study on the impact of peer training for the use of Wheelchairs (Norris, 2017).

Available sources of data on AT and disability

We identified five main available sources of data on AT and disability in Malawi (Table 2). Two of the data sources – *Population and Housing Census (PHC)* and *Malawi Demographic and Health Survey (MDHS)* are generated by the government (NSO, 2020) while the other two data sources –

Table 2. Sources of data on AT and disability in Malawi.

Data source	Year	Description	Collector	AT Types covered
Population and Housing Census (PHC)	2008 2018	Collects data desegregated by age, sex, and location on persons with disabilities in seeing, hearing, walking/climbing, speaking, intellectual, self-care and other difficulties. The 2018 PHC also collected information on persons with albinism and epilepsy.	National Statistical Office (NSO, 2020)	Glasses and Hearing aids
Malawi Demographic and Health Survey (MDHS)	2015/16	Includes questions on the functioning and disability among children aged 2-17. The questions are adapted from a module developed as a part of Multiple Indicator Cluster Surveys (MICS). The questions include speech and language, hearing, vision, learning (cognition and intellectual development), mobility and motor skills, emotions, and behaviors.	National Statistical Office (NSO, 2020)	Braille machinery, accessible infrastructure
Multiple Indicator Cluster Surveys (MICS)	2019	Includes questions on the functioning and disability among children aged 5-17.	National Statistical Office (NSO, 2020)	N/A
Living conditions among persons with disabilities in Malawi	2004, 2017	Large National and representative household survey commissioned by SINTEF among households and individuals with and without disabilities aimed at mapping the living conditions among persons with disabilities and to compare with the non-disabled population.	SINTEF (2020)	Wheelchairs, calipers and prosthetics/orthotics, sunscreen lotions for persons with albinism and drugs for persons with epilepsy, care and protection, mobility, household items, computer assistive technology, handling products and goods, communication, information
Enabling Universal and Equitable Access to Healthcare for Vulnerable People in Resource Poor Settings in Africa (EquitAble)	2010-2013	Four-year collaborative project that produced empirical knowledge on access to health care for vulnerable people in resource poor settings in Africa.	EquitAble (2020)	Wheelchairs, eyeglasses, hearing aids, walking frames, Prostheses, streetlights with sound, crutches, buggies for children with cerebral palsy (CP)

Living conditions among persons with disabilities in Malawi (SINTEF, 2020) and *Enabling Universal and Equitable Access to Healthcare for Vulnerable People in Resource Poor Settings in Africa* (EquitAble) (EquitAble, 2020) were generated by public and private consortiums in collaboration with stakeholders in Malawi.

In Malawi, the government mainly gathers data through the population Census and Demographic and Health surveys that are collected by the National Statistical Office (NSO) every 10 and 5 years respectively. Between 1998 and 2018, there have been three population and Housing census. However, it was only from 2008 that the module on data on persons with disability was added. Earlier census in the country reported on the prevalence of handicapped persons (NSO, 2001). The most recent population census was in 2018 (NSO, 2020). Although, perceived need for AT may be inferred based on disability type, the census data does not collect AT specific data. The only restriction to the use of the Census data is that only 10% of it is available for public use.

The MDHS is another source of data on disability in Malawi. Between 1992 and 2015, there has been five (in 1992, 2000, 2004, 2010 and 2015) demographic health surveys (Lungu et al., 2019); however, it was only from 2015 that information on disability was collected. Another source of disability data is the Multiple Indicator Cluster Surveys (MICS) that enumerates information on different health conditions and recently disabilities (NSO, 2020). Four MICS (in 1995, 2006, 2014 and 2019) has been conducted between 1995 and 2019. It important to highlight that the MDHS only recently included a module on disability in relation to children. It has no specific data on AT use. Hence, its use as a source of AT data is limited to making inferences on need based on disability types. This observation was also noted about the MICS data in Malawi that only collected disability specific data in 2019.

The data on living conditions among persons with disabilities in Malawi was collected by SINTEF, Center for Social Research (CSR) and Federation of Disability Organizations in Malawi (FEDOMA). The initial data collection in Malawi was in 2003 while the most recent was in 2016/17 (SINTEF, 2020). On the two occasions, large national representative data was collected that compared persons with and without disabilities.

The EquitAble data was commissioned via a grant from the European Union for a four year (2010–2013) project that sought to develop empirical data on healthcare access for vulnerable persons in resource poor settings in Africa (EquitAble, 2020).

All the available sources of data have institution specific mechanisms for access and use of the data. Interested researchers in Malawi can apply for and receive access to the census and demographic health survey data through the NSO. Similarly, the SINTEF and EquitAble data are available for use by interested researchers via application to the various principal investigators of the projects. In Table 3, we present a list of possible data sources in the areas of disability, rehabilitation and assistive technology.

Empirical studies and use of available sources of data

Majority (10) of studies included in this review did not use any of the available sources of data. The two studies (Eide & Munthali, 2017; Loeb & Eide, 2004) that used the available sources of data on disability and AT were the 2004 and 2017 SINTEF reports which was from the same researchers that collected the data.

The other 10 studies collected primary data using different methodologies to achieve their objectives.

Discussion

Our study showed that there is a dearth of empirical research on AT in Malawi. Half of the studies were qualitative studies and only three studies are population-based studies. Majority of the identified empirical research did not use the available sources of data on AT. Although the 2018 Malawi population and housing census reported that 10.4% of persons aged 5 years and older in Malawi have a disability (Governement of Malawi, 2019), few studies have focused on AT access that have the potential to improve their lives. The main source of information on AT in the country is from the SINTEF reports and EquitAble, which highlights the high unmet need for AT services in the country. From 2004 to 2017, there has been a decline in the access to needed AT from 17.9% to 6.1%. The declining access to *met need* for AT in Malawi may mean that the SDG indicators for wellbeing for children and persons with disabilities in the country may not be achieved (United Nations, 2016).

This is not surprising because studies suggest AT services are not prioritized in Malawi (Blessing, 2014; Ngomwa, 2018; UNICEF, 2019). Although previous studies noted that disability and AT services are mainly donor dependent (Munthali, 2011), the SINTEF reports suggests that procurement of AT is mainly via out of pocket spending (Eide & Munthali, 2017; Loeb & Eide, 2004) while Visagie and colleagues indicated that government was the main provider (Visagie et al., 2017). The source and method of AT procurement have implications for their access and utilization. It may also provide information on whether affected individuals use AT that fulfil their needs (Holloway et al., 2018). However, these findings must be interpreted with caution and should take into consideration the synergy between government and NGOS in the provision of AT in the country and the fact that end users may not know the actual providers. In spite of the source of AT, it is apparent that users are not receiving enough and out of pocket payment for AT use is not a sustainable way to increase access to AT for persons with disabilities who often also face socio-economic disadvantages in poor income settings (Holloway et al., 2018). The impact of poverty and its role in predicting access to education and healthcare services for persons with disabilities in Malawi has been previously documented (Banks & Zuurmond, 2015). Both the SDGs and the CRPD mandates countries to support the provision of life saving AT for persons with disabilities (United Nations Development Programme, 2020). The lack of hearing aid for children with hearing impairment reported in this study means that affected children may miss opportunities of education which further worsens the impact of disability. For every unmet need in AT, affected individuals experiences an increase in disability adjusted life years (Hemphill et al., 2019). It is pertinent to highlight that

Table 3. Some sources of data on disability, rehabilitation and assistive technology.

Data Source	Description	Data Managers
Census	Conducted in several countries globally	National statistics Office
Household surveys • Multiple Indicator Cluster Surveys (MICS) • Demographic and Health Surveys (DHS)	MICS is supported by UNICEF in low- and middle-income countries (LMICs). DHS is supported by the United States Agency for International Development (USAID)	National statistics Office
World Health Survey (WHS)	Conducted by the WHO in collaboration with partners in Malawi	WHO
United Nations Organisations • WHO MiNDbank https://www.mindbank.info/ • ILO NATLEX https://www.ilo.org/dyn/natlex/natlex4.home	The MiNDbank is A database of resources covering mental health, substance abuse, disability, general health, human rights, and development The NATLEX is the International Labor Organization database of national labor, social security and related human rights legislation	WHO ILO
Others • SINTEF https://www.sintef.no/en/projects/studies-on-living-conditions • World Policy Centre UCLA https://www.worldpolicycenter.org/topics/disability/policies	Private sources of data by research groups or organisations	Organization specific

majority of the available AT are mobility devices with the gap in AT services for sensory and mental/neurological disabilities nearing 81.1% and 100%, respectively (Loeb & Eide, 2004). A recent review by Ngomwa on access to AT in Malawi, noted the high unmet need for AT for persons with intellectual disabilities in Malawi and the importance of policy actions to ensure availability, affordability and appropriateness (Ngomwa, 2018). Provision of AT must be inclusive so as not to exclude persons with psychosocial or cognitive disabilities often left out in service provision for persons with disabilities (Ebuenyi, 2019).

In addition to the poor availability of AT in Malawi, studies included in this review indicate that over one third of them are repaired and maintained by the users themselves (Eide & Munthali, 2017; Loeb & Eide, 2004; Visagie et al., 2017). Zahid et al. recommends that support for localized capacity building and low cost and do-it-yourself AT in low-income settings is relevant for improving AT access (Zahid et al., 2019). Although this may work for some users especially those with family support, it is not apparent how those unable to help themselves or receive family support may manage or maintain their AT. This is specifically important for children and the elderly who are dependent and use AT services. This challenge calls for efforts to develop and train manpower for AT repair and maintenance. The World Health Organization's 8-Steps in Wheelchair provision service for low-income settings was reported to be associated with positive outcomes. Its adoption and implementation in Malawi may be helpful toward better provision of Wheelchairs (Toro et al., 2015). Malawi only recently started the training of Occupational therapist and other rehabilitation professional; however, this may be an opportunity to adopt task sharing methodologies to involve community health care workers (Gray et al., 2019) or adopt the use of peer training for the management and use of AT as reported by Norris (Norris, 2017). Yet, it is worthwhile to explore the recommendations of the studies in this review for training of health professional on the provision of AT services. Although most study participants reported satisfaction with the use of AT, almost an equal number reported difficulty with the use of AT. Hence, the reported satisfaction may be contingent on years of deprivation which may constrain affected individuals to lower their expectations to what is available. Awareness about AT is commendable even though it is dwarfed by available need. It is important for efforts to boost and maintain the awareness for the usefulness of AT by ensuring provision of the much-needed AT. In spite of the heightened awareness about AT, the use of available data of AT in Malawi is dismal.

Our findings indicate a difference between empirical research on AT and the available sources of data on AT. Access and sharing of research data are not only relevant for improvement of science but for evolving evidence based policies to solve societal problems (Arzberger et al., 2004; Smith et al., 2019). In this review, most of the empirical studies have not used any of the available sources of data even though these sources of data are available for use by researchers. At this point, it is important to state that out of the five sources of data on disability and AT, only the SINTEF and EquitAble data routinely collected information on AT. The other sources of data were mainly on disability. Hence, AT use and need in the country may only be inferred from the different types of disabilities reported. Yet, it is not apparent why these sources of data are never used by researchers on disability and AT. The implication of the non-usage of these data sources is that time and resources are used collecting data that already exist. The resources and time spent collecting new data may be put to better use and preserve scarce resources by engaging with existing sources of data. Identifying mechanisms to improve the use of available data on disability and AT is relevant to exploring the full benefit of data in Malawi and other settings. We recommend that researchers and those evaluating research proposals, particularly for low- or middle-income settings, should consider the extent to which such research engages with and builds on existing data sources. Table 3 presents a list of possible data sources in the areas of disability, rehabilitation and assistive technology, which may be available in many countries, and which should be explored and taken into account prior to a research submission being made. Confirmation that a checklist of such data sources has been consulted prior to a proposal being submitted – even if only to rule out their relevance to the proposed research question – should constitute part of the evaluation process for applications for research funding. Furthermore, we recommend that data derived from the citizens of a country should have a copy of that data available within the country. Research ethics committees may help realize this to ensure data availability, accessibility equitable utilization. The National Commission for Science and Technology in Malawi must evolve mechanisms to monitor and ensure compliance. Findings from this study and other studies we have undertaken enable us propose an AT ecosystem for Malawi and will guide recommendations for an AT research agenda in the AT policy and AP List being developed in the country (Ebuenyi et al., 2020).

Our study is not without limitations. Our literature search was on two databases and also used a specific criterion that may have missed other studies on AT. Although half of the included studies were qualitative, both qualitative and quantitative studies have their merits and demerits. Our aim in this study was to show what is available. The identified sources of data may have precluded private sources of data that are unknown to the NSO and the online search engine. We embarked on this rapid review to provide insight on the research and data on AT in Malawi to support our project. A more comprehensive review may be helpful to identify what may have been missed by our review. This study provides an overview of available research evidence on AT and the use of available data sources in the country. The results from the study are relevant for the Assistive Product List Implementation Creating Enablement of inclusive SDGs (APPLICABLE) project (Ebuenyi et al., 2020) which seeks to develop an AT policy and AP list in Malawi.

Conclusion

In this review, we analyzed empirical research on AT access and use in Malawi in relation to use of the main sources of data in the country. We found that even though AT is greatly needed by the people with different kinds of impairments in Malawi, while data on AT is limited, the actual use

of the available data is even more limited. The nonuse of the available sources of data on AT in Malawi by the empirical studies that we reviewed may be attributed to the conditions attached to release the data for public use or the absence of specific information that is needed in different studies. Areas for improvement include making the available national data accessible to researchers with fewer conditions associated with its use and stakeholders publishing more of their work in order to build the literature base for AT information in Malawi, which can ultimately contribute to evidence-based programming and policies.

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Authors' contributions

IDE and MM conceptualized the study. IDE and JK conducted the literature search and completed the screening and selection of articles with input from EMS. IDE wrote the initial draft with JK, which was reviewed by EMS, MZJ, AM and MM. All authors read and approved the final version of the manuscript.

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