Global report on assistive technology[1]

Section 3
Identifying barriers to assistive technology

Key messages

There are many barriers to accessing assistive technology, including:

- **Lack of awareness** often drives low uptake, compounded by an absence of information on the types and availability of assistive products.
- **High costs** due to over-priced assistive products and associated service delivery cost is one of the most common barriers.
- **Limited physical and geographical access** puts assistive technology out of reach for many potential users.
- **Inadequate product range, quantity, quality and suitability** can make assistive products unavailable, unsafe, ineffective and even abandoned.
- **Procurement and delivery challenges** delay and reduce access.
- **Capacity gaps exist in the assistive technology workforce** with shortage of workforce with adequate knowledge on assistive technology and lack of trained personnel at all levels of health and social care.
- **Low policy profile and lack of legislation** lead to the low prioritization of assistive technology, and legislation that fails to cover people with all types of functional difficulty.
- **Lack of funding and investment** for the strengthening of national assistive technology systems exists in many countries, alongside disparities in funding levels by programmes, including insurance systems, and geographical areas within countries.
- **Fragmentation of the assistive technology sector**, including between professions, user groups, funding and provision mechanisms, and multiple access pathways characterize the sector.
- **Sociodemographic barriers** hinder equitable universal access to assistive technology.

Assistive technology should be – like all aspects of a health service – available and accessible equally to all, regardless of gender, socioeconomic status or geographic location. As shown in Section 2[2], the real access scenario is often, however, far from this ideal.

Limited services

Lack of awareness and information

Poor understanding of assistive technology often drives low uptake, compounded by an absence of trustworthy information on the types and availability of assistive technology and possible solutions *(133)*. Beliefs, misconceptions and stigma can also discourage and prevent users and their families from finding out how to obtain needed assistive products *(134)*.

While there may be awareness of more commonly available assistive products such as wheelchairs, hearing aids and spectacles, potential users and providers may not be familiar with a wide range of assistive products for communication, cognition, or self-care that could make significant improvements in the lives of people in need. Poor literacy, lack of Internet access, inaccessible or untrustworthy information pose further barriers to becoming aware of the need for and benefits of using assistive technology *(28)*.

Information about product costs and how to gain access to assistive technology tends to be fragmented across several public institutions (e.g. health, social welfare and education), and private or NGO providers. Without a centralized and accessible assistive technology information source, the burden of finding basic information (e.g. how do I get a pair of affordable crutches that suit my size and living environment?) is placed on the user and their support networks.

Lack of services

Many assistive products require pre- and post- purchase services involving trained personnel – services that should be integrated into health, education or social services rather than being linked to the standalone purchase of a product from a local shop. To ensure that assistive products are fit for purpose, WHO recommends four types of provision services: assessment, fitting, user training and follow up *(135)*. Benefits and safety may be compromised by weakness in any of these steps. When product options and related services are inadequate or not available close enough to where the potential user lives, more time and financial resources are needed to reach assistive technology providers. Discrimination has been identified as a common experience for people with disabilities when accessing the health system. A negative experience with health care or other providers can discourage users from accessing assistive products and related support *(136)*.

Lack of early identification – such as universal hearing or eye screening – results in unmet assistive technology needs. For those able to access assistive technology, the quality of products and services available depend on the presence of trained personnel, service standards, delivery time, number of visits required and procurement of safe and effective products.

---

[2] See: "Disability – issues, problems, solutions", No. III-VI/2022(44-45), pp. 44-68

The amount and nature of services provided are determined by training and practice standards and resources available to ensure those standards can be met. For instance, personnel working within the public health system may be trained in all four services (i.e. assessment, fitting, user training and follow up) but follow-up services are not funded. Thus, even when users receive a product that meets their needs, inadequate follow-up services can reduce long-term usability and lead to abandonment. The lack of planning and funding for follow-up services such as maintenance, repairs and spare parts can be a barrier to sustained use of assistive products. Deficits in service provision were observed in the current systems, as described in Section 2. Even when safety and durability standards are in place to ensure product quality, some assistive products require ongoing maintenance, adaptations or repairs. The more customized and complex the product, the more likely it is that the user will need follow-up services to ensure optimal and sustained fit and function. Children and older people need more frequent follow- up services than others to match gradually changing body structures and functional abilities.

Limited physical and geographical access

Limited geographic and population coverage often puts assistive technology out of reach for potential users (**see Andriana's story**)[3]. For example, many assistive products and related services may only be available through selected tertiary hospitals in urban centres or the capital city, which can require extensive travel and overnight stays for users, their families and caregivers. Lack of accessible and inclusive transport, communication and physical environments create additional barriers. Even when provision covers broader geographical areas (including at community level), the range of assistive products can be limited.

Inaccessible facilities, equipment, information and negative attitudes of providers add to barriers to assistive technology.

Meet Andriana

Indonesia

Andriana lives with her mother and grandmother, some distance from the closest urban centre. She was born with an impairment that made walking difficult. When she walked, she dragged her feet, moved carefully and slowly, and often fell.

While Andriana was growing up, her mother and grandmother tried to get help from the local health clinic, but the medical staff were only able to treat common health conditions and did not refer them to another clinic that could address her disability-related needs. Thus, she did not know the cause of her impairments throughout her childhood.

The absence of needed services and inclusive attitudes during Andriana's youth contributed to some traumatic experiences. Andriana was persistently bullied in

---

[3] "Coverage" refers to currently met assistive technology needs, not legislative and policy level coverage that has yet to be implemented at the ground level.

school, so her family decided to withdraw her from school and keep her at home to help with daily chores. When an earthquake hit her village, she was not able to quickly escape her house. Some of the walls collapsed and she had to wait to be rescued.

When Andriana was 22 years old, she and her family were introduced to a visiting physiotherapy team by a local organisation. Andriana learned that she has cerebral palsy, and her needs were assessed. She was fitted with orthopaedic shoes and provided with physical therapy. After only three visits she learned how to walk safely with her new shoes. She also noticed that physical therapy helped to relieve pain in her back. One of her family members expressed their gratitude for Andriana finally receiving this critical and long-awaited care, "On behalf of her family, I would like to say thank you very much… and we hope that the government could pay more attention to us."

Inadequate products

Low quality

National and international technical standards determine product quality in terms of strength, durability, performance, safety, reliability, comfort, etc. Poor-quality assistive products exist due to inadequate standards, lack of regulatory enforcement and lack of knowledge about the need for safe and effective products. When users have no access to affordable, safe and effective assistive products, the only alternative may be a substandard device that does not meet needs or match local context *(137)*.

The enforcement of standards is a complex and costly task given the range of assistive product types and assistive technology suppliers and providers (e.g. pharmacies, NGOs, manufacturers and individual private brokers). Determining if assistive products adhere to safety and performance standards often requires trained experts in different specialties and enforcement by regulatory agencies. It is essential that assistive products comply with adequate standards to avoid further harm and lack of reliability and usability *(138)*.

Limited range, option and quantity

Many countries have inadequate ranges, options and quantities of assistive products as evidenced from the survey outcomes presented in Section 2, where assistive products in use – as well as service provision – primarily included basic products to support vision, mobility and hearing. Assistive products, including spare parts, are frequently imported because local (national) manufacturing capacity is limited both in the scale of production and product range (types, sizes, price points) *(25)*. Even in countries that have local capacity to design and test assistive products, manufacturing equipment may be imported.

Although importing assistive products is a feasible and cost-effective option, inadequate buying power (even in bulk quantity) can be the most significant barrier to increasing national supply. Other barriers include the lack of information to enable buyers to compare and purchase assistive products on the global market, and a limited range of assistive products that are suitable for a diversity of local contexts, particularly assistive

products designed for and tested in low-resource settings *(139)*. Donations of new or second-hand assistive products, which meet standards and regulatory requirements, can be a major supply source in some countries. However, donations can have limited and inconsistent supply and may be of poor quality *(140)*.

Lack of repair, refurbishment and reuse of assistive products reduce how long they can be kept in circulation within a service delivery system to meet the needs of more than one user. The exclusion of spare parts at the time of or after purchasing assistive products can lead to abandoned products. Additionally, manufacturers may not design assistive products to ensure easy repairs, or may restrict supply of spares causing additional economic hardship on users and family members.

Assistive products need to match the needs of all age groups, functional requirements and environments. Sometimes designers and manufacturers tend to develop high-end and or high-margin products for a minority group rather than the majority. Also, an emphasis on producing urban-oriented assistive products rather than products suitable for use in rural or all-terrain environments can lead to lack of access to appropriate products or abandonment of provided products.

Lack of supply

Changing funding priorities and broader economic instability can cause an erratic supply of assistive products. The programming priorities of governments, NGOs and development partners depend on funding cycles, need, political priorities and agendas.

Public ministries involved in assistive technology procurement may be subject to shifting leadership and budget priorities *(141)*.

At the macroeconomic level, fluctuating international exchange rates and financing system instability (e.g. banking, inflation) influence the buying of assistive products. During a crisis, assistive product sourcing and supply can be halted. Health product supply chains around the world were disrupted by the COVID-19 pandemic (e.g. high freight costs) *(142)*. Given that these crises themselves can result in injuries that require additional supply of assistive technology, designing resilient assistive technology supply chains and systems that function during crises is imperative *(143,144)*.

Poor suitability

When assistive products are mismatched for user needs, they can cause harm or be abandoned. For example, a video relay service may be the most effective solution for someone who has hearing difficulties, but lack of consistent Internet access makes this option unsuitable. In addition, evidence shows that users' perceived usefulness of assistive products and user choice improves adoption and outcomes *(145)*. Aesthetic preferences are particularly important for prominent devices (e.g. spectacles) and specific populations (e.g. young adults) *(146)*. Despite the importance of design for the willingness to access and use assistive products, many of them are neither child- nor gender-friendly.

Procurement and delivery challenges

Procurement practices determine what is purchased (i.e. products, spare parts and accessories, and services), alongside factors such as price and contractual arrangements with buyers and suppliers. Poorly designed, funded and managed procurement and delivery processes delay and reduce access and can be overlooked when identifying bottlenecks in the assistive technology system.

The wheelchair is my leg, my chair and my everything.
Sammy (32), Kenya

Inefficient procurement

Procurement mechanisms can be fragmented across and within ministries and multiple sectors (e.g. NGOs, private health care), and can cause fluctuations in quantity and characteristics of assistive technology from year-to-year *(140)*. Procurement priorities are rarely demand-driven because of lack of data.

Gatekeepers that determine what assistive products are ultimately purchased (e.g., procurement officials, budget managers) may not always make the best buying decision or take user preferences into consideration. Even when adequately trained assistive technology professionals suggest a specific product, purchasing decisions by procurement officials can default to the lowest cost option due to budget limitations or inadequate training. Consulting users while doing large-scale procurement is almost unheard of.

Inefficient delivery

Inadequate delivery systems to get assistive technology or other health products to users present a bottleneck in assistive technology systems *(141)*. Lack of transparent information systems (e.g. for inventory, tracking), poor delivery infrastructure, inefficient distribution channels, mismanagement of supply warehouses etc. can all create a host of logistical challenges in getting purchased products to users **(Box 3.1)**. In addition, product delivery delays or non-inclusive services can prevent someone from moving forward along the access pathway. Delays may also worsen users' health status or lead to poor usage *(147)*.

Box 3.1 Assistive technology procurement study: WHO Western Pacific region

A procurement study in the WHO Western Pacific region found that procurement for assistive technology is not well integrated into government annual budget and planning cycles, and thus receives minimal and inconsistent funding from year-to-year. The provision of assistive technology is limited for all categories, with the least availability for low-vision, communication, self-care and cognition products.

Source: Assistive technology procurement study: technical report. Manila: World Health Organization Regional Office for the Western Pacific; 2020 *(140)*.

Workforce capacity gaps

Workforce shortfalls limit geographic and population coverage and compromise the quality of assistive technology services *(148,149)*. As indicated in Section 2, many countries have limited or no assistive technology dedicated professionals able to offer expertise in a broad range of assistive products. Given the broad scope of assistive technology and the multi-tasking skills required in many product categories, the breadth and depth of dedicated training of assistive technology professionals is not feasible in all contexts. Lack of data on the extent and nature of this workforce shortage hinders advocacy and policy-making efforts.

The degree of specialization, training requirements and practice standards vary across the diverse range of assistive technology disciplines and sectors (i.e. public, private and non-profit), creating a fragmented landscape for human resource planning.

Overall, there are too few well-trained assistive technology personnel, whether they are direct service providers, or part of the broader assistive technology workforce (which supports the functioning of the assistive technology system itself).

Lack of direct service providers

Academic and professional training programmes that prepare assistive technology professionals are few and far between and may in any case not adequately equip direct service providers with the knowledge and skills to meet the diverse needs of users. Assistive technology competence is not just knowledge of assistive products and how they might assist a person with a functional difficulty – it also involves understanding the implications of the health condition of the person and the future outlook, awareness of environmental barriers, context awareness, and supporting the user in realizing life goals using the assistive product. A lack of skilled professionals to support the choice and personalization of assistive products can lead to poor procurement choices **(see Jack's story)**. Providing the incorrect assistive products can also result in abandonment, developing secondary conditions or even premature death *(150)*.

Meet Jack

Papua New Guinea

Jack is 17 years old, and lives in the remote highlands of Papua New Guinea. As a young teenager, Jack sustained a spinal cord injury when a tree fell on him. He was cared for in the local hospital, where he was provided with a donated, second-hand wheelchair. This wheelchair was too large for him, had no cushion to protect him from pressure wounds, and he was unable to propel himself in it.

Recognising Jack's need, a collaborative effort by his community, the local hospital, the government wheelchair provider based in Port Moresby, and support from donors and a non-government organisation, enabled an outreach visit by the government wheelchair provider. Two staff made the journey, including a flight and five hours four-wheel driving.

For Jack, meeting the trained staff provided him with a chance to learn more about how to use his wheelchair including how he can propel himself. He was more comfortable in the new wheelchair, better protected from pressure wounds, and able to access and move about his school.

Since the initial visit, the outreach programme has continued, further supporting Jack and others in his community.

Limitations in broader assistive technology workforce

In addition to direct service providers, there is a lack of personnel that play important roles in the assistive technology system (e.g. biomedical and rehabilitation engineers involved in the design, development and production of assistive products). Trained staff are also needed in a variety of roles to effectively operationalize assistive technology policies and plans (e.g. procurement managers). There is a need to attract many different types of well-qualified personnel into the assistive technology field, such as nurses, pharmacists and community health workers. Unlike the medicines sector, assistive technology may not be treated as a holistic sector in professional training programme or in the labour market, where industry-specific positions (e.g. assistive products supply chain management) are commonly available.

Market failures

The current and growing demand for assistive products globally has yet to translate into actions addressing various forms of market shortcomings *(139)*.

Market fragmentation

The potential market size of the current and future assistive technology sector is not known, partly because assistive technology is not treated yet as a distinct sector. The fragmentation of provision and funding, along with the broad range of assistive products and related services, means that assistive technology is viewed in categories, subgroups of users or disciplines, and not as the collective and vast global market it represents.

Inadequate demand information

On the supply side, manufacturers and suppliers lack information to estimate demand *(151)*. On the demand side, buyers from all sectors (i.e. public, private, non-profits) and users are not equipped with necessary information that allows them to compare product features and purchase products.

Barriers to market entry

For manufacturers or suppliers, getting new assistive products certified – especially when they are recognized as medical products, and covered by financing schemes – can be a time- and resource- intensive process. Likewise, getting registered as a new assistive technology company (i.e. start-ups, manufacturers, suppliers, or support services) can

be a lengthy process. Inconsistent product specifications and standards can also pose a disincentive to market entry.

Governance and funding issues

Low policy profile

Lack of awareness about the scope and scale of assistive technology needs and the potential benefits of assistive technology access to individuals, communities and broader society lead to the low prioritization of assistive technology, and legislation that does not always cover people with all types of functional difficulty (as the progress indicators on system preparedness presented in Section 2 reveals). Coverage is inadequate and inconsistent in terms of who is eligible to receive assistive technology, and what types of products and services are covered. Access to assistive technology has been shown to increase participation in socioeconomic activities, and reduce poverty and hunger for users and their households, yet there is a lack of disaggregated data on the return on investment for different types of assistive products to motivate public or private sector funding *(152)*.

Lack of funding and investment

As demonstrated in Section 2, there is inadequate funding for products and services, and lack of investment in strengthening national assistive technology programmes and systems. Funding mechanisms for assistive technology can reside with ministries (e.g. health, education, labour and social welfare), or be privatized like private health or social welfare insurances and schemes, or follow a hybrid model of public–private partnership. There can also be disparities in funding levels by geographical area within a country. Where provision of assistive technology has been part of welfare or charity-based services it may not have been fully integrated into public funding streams and services *(153)*.

During budget decision-making at national or district levels, assistive technology may not be a discrete category but is instead covered under a general line (e.g. consumables, or products for older people or people with disabilities). Without a dedicated budget for assistive technology (and for specific types), it is hard to advocate for an increased budget or track assistive technology expenditure.

Fragmentation of the assistive technology sector

Fragmentation of assistive technology provision among sectors, departments and ministries increases the complexity of information users need about how to gain access to assistive technology. A pathway to access assistive technology often varies based on a user's profile, assistive technology needed and context. Fragmentation is due to the wide range of assistive products and the way the sector has been developed or professionals have been trained thus far. Professional silos, fragmented funding and provision mechanisms, and multiple access pathways characterize the sector *(153)*. While some countries have designed and implemented an integrated assistive technology system that covers the full range of assistive products, others have a piecemeal approach with little coordination among the stakeholders.

Sociodemographic barriers

Access barriers can be unique to different users and overcoming them is essential to achieving equitable access to assistive technology. Sociodemographic factors such as age, gender, type of functional difficulty and socioeconomic status have been reported to influence access *(154)*.

Age

Stigma among peers or non-inclusive school settings can prevent children from accessing or using assistive technology *(25)*. Families' beliefs about children's capabilities and the benefits of assistive technology play a major role in accessing it **(see Lupita's story)** *(155)*. Lack of time and necessary support can be a hindering factor for people at working age to access assistive products, as they cannot afford loss of income due to time off work. As people age, the need for assistive products increases, and older people likely need multiple assistive products as discussed in Section 2 *(156)*. However, inaccessible physical environments or information sources can create extra barriers for older people to access assistive products and services without support from their family. Low availability of assistive products that meet the needs of older people can also be a barrier *(157,158)*.

Meet Lupita

Nicaragua

Martha, or 'Lupita' as her family and friends call her, is a lively and cheerful young girl. She lives with her mother and extended family on the outskirts of the city of Leon, Nicaragua. When Lupita was six months old, the family noticed that she had problems following sounds produced by toys and 'chichiles', a Nicaraguan handmade rattle.

Lupita was diagnosed with a hearing impairment, a condition that has had a big impact on her relationship with other children in her neighbourhood. They refer to Lupita as a 'rare animal', as she can neither hear nor talk and communicates only via signs. In addition to a hearing impairment, Lupita has stiffness in her legs, which meant it took her longer to walk and affected her moving around.

Lupita and her family have been supported since her diagnosis by a local organization with language stimulation therapy and introduction of sign language. The family were also very keen for Lupita to have hearing aids as soon as possible. They felt that this would assist her development and help her to better integrate with her community. Since receiving her hearing aids, as she adjusts to them, Lupita continues to participate in language therapies and uses sign language to keep developing her overall use of language. Most importantly she has now joined her peers at school and is rapidly gaining confidence.

Gender

The outcomes of the population surveys reported in Section 2 indicate that women tend to access assistive products to a lesser extent than men, although there are variations between countries. In some countries, men were twice as likely than women to access assistive products. Assistive products, professionals and service delivery systems are not always gender-friendly. Even privacy is compromised while providing assistive products especially during mass distribution. Previous studies have found that women are less likely to access assistive technology because of financial and cultural factors *(39)*. This is in line with evidence showing difficulties for women with disabilities to access health care in general due to sociocultural, financial and structural barriers in some countries *(159)*.

Type of functional difficulty

Low awareness of the variety of assistive products is a barrier to access, especially for people with certain functional difficulties. This was reflected by the low prevalence of use of assistive products in communication, cognition or self-care. The barrier could have been worsened by the low service coverage in certain functional domains, as revealed in Section 2. People with multiple or severe functional difficulties face additional hardships to access all the assistive products they need.

Living environment

The population surveys presented in Section 2 found that access to assistive products was lower for people living in rural areas compared to urban areas. Limitations in the range of assistive products, low coverage of assistive technology providers and poor infrastructure in rural or remote living areas can impose additional barriers for people to access and use their assistive products **(Box 3.2)** *(160)*.

Box 3.2 Accessing assistive technology in remote settings (Canada)

In northern Canada, a combination of factors such as harsh cold weather and infrastructure issues contribute to reduced access to assistive technology. Travel by boats, snowmobile and sleds can be particularly challenging for those with locomotor disabilities, while assistive technology that depends on electricity can be compromised by power interruptions. Governments can fulfil their responsibility under the UN *Convention on the Rights of Persons with Disabilities* by designing assistive technology systems that are context-sensitive.

Source: Altin N, MacLachlan J, Phenix A, Nixon S. Colonization, climate, and critical analysis: Examining access to assistive technology in Northern Canada using the World Health Organization's Global Cooperation on Assistive Technology initiative. In N. Layton, J. Borg (Eds), Global perspectives on assistive technology: proceedings of the GReAT Consultation 2019, World Health Organization, Geneva, Switzerland, 22–23 August 2019. Volume A *(160)*.

Socioeconomic status

The outcome of the population surveys in Section 2 suggested a strong association between access to assistive products and the socioeconomic status across the surveyed countries. High out-of-pocket expenditure for the products is the most frequently reported barrier by participants in almost all surveyed countries.

References

1. Resolution WHA71.8. Improving access to assistive technology. In: Seven-ty-first World Health Assembly, Geneva, 21–26 May 2018. Resolutions, decisions and an-nexes (WHA71/2018/REC/1). Geneva: World Health Organization; 2018 (https://apps. who.int/gb/ebwha/pdf_files/WHA71/A71_R8-en.pdf,ac-cessed 20 April 2022).
2. Convention on the Rights of Persons with Disabilities (CRPD). New York: Unit-ed Nations Department of Economic and Social Affairs; 2006 (https://www. un.org/development/desa/disabilities/convention-on-therights-of-persons-with-disabilities.html, accessed 20 April 2022).
3. Global perspectives on assistive technology: proceedings of the GReAT Con-sultation 2019, World Health Organization, Geneva, Switzerland, 22–23 August 2019. Volume A. Geneva: World Health Organization; 2019 (https://apps.who. int/iris/handle/10665/330371, accessed 20 April 2022).
4. Global perspectives on assistive technology: proceedings of the GReAT Con-sultation 2019, World Health Organization, Geneva, Switzerland, 22–23 August 2019. Volume B. Geneva: World Health Organization; 2019 (https://apps.who. int/iris/handle/10665/330372, accessed 20 April 2022).
5. Companion papers to the Global Report on Assistive Technology. Assistive Technology. 2021;33(sup1) (https://www.tandfonline.com/toc/uaty20/33/ sup1, accessed 20 April 2022).
6. International Classification of Functioning, Disability and Health (ICF). Geneva: World Health Organization; 2001 (https://www.who.int/standards/classifica-tions/international-classification-of-functioning-disability-andhealth, accessed 20 April 2022).
7. Decade of healthy ageing: baseline report. Geneva: World Health Organization; 2021 (https://www.who.int/ publications/i/item/9789240017900, accessed 20 April 2022).
8. Assistive products for persons with disability — Classification and terminol-ogy (ISO 9999). Geneva: International Organization for Standardization; 2016 (https://www.iso.org/standard/60547.html, accessed 20 April 2022).
9. International Society for Gerontechnology [website]. Eindhoven: International Society for Gerontechnology; 2022 (https://www.gerontechnology.org/, ac-cessed 20 April 2022).
10. About rehabilitative and assistive technology [website]. Rockville: National In-stitutes of Health; 2018 (https://www.nichd.nih.gov/health/topics/rehabtech/ conditioninfo, accessed 20 April 2022).

11. AAL Programme [website]. Brussels: AAL Association (http://www.aal-europe. eu/about/, accessed 20 April 2022).

12. European Association of Service Providers for Persons with Disabilities (EASPD) [website]. Brussels: European Association of Service Providers for Persons with Disabilities; 2022 (https://www.easpd.eu/, accessed 20 April 2022).

13. Development of proposed Kindergarten to Grade 12 (K-12) education standards – 2021 initial recommendations report. Toronto: Government of Ontario; 2021 (https://www.ontario.ca/document/development-proposed-kindergarten-grade-12-k-12-education-standards-2021-initial-recommendations, accessed 20 April 2022).

14. Nordic Welfare Centre [website] (https://nordicwelfare.org/en/, accessed 20 April 2022).

15. WIPO Technology Trends 2021: Assistive Technology. Geneva: World Intellectual Property Organization; 2021.

16. Universal Declaration of Human Rights (Art. 25). New York: United Nations; 1948 (https://www.un.org/en/ about-us/universal-declaration-of-human-rights, accessed 20 April 2022).

17. The right to health (Fact Sheet 31). Geneva: Office of the United Nations High Commissioner for Human Rights and the World Health Organization; 2008 (https://www.ohchr.org/en/publications/fact-sheets/factsheet-no-31-right-health, accessed 20 April 2022).

18. Cieza A, Causey K, Kamenov K, Wulf Hanson S, Chatterji S, Vos T. Global estimates of the need for rehabilitation based on the Global Burden of Disease study 2019: a systematic analysis for the Global Burden of Disease Study 2019. The Lancet. 2021;396(10267):2006–17.

19. Joseph PA. Study on certain factors influencing language performance of hearing impaired students. Asia Pacific Disability and Rehabilitation Journal. 2003;14(2):201–208.

20. Shore SL. Use of an economical wheelchair in India and Peru: Impact on health and function. Medical Science Monitor. 2008;14(12):PH71–PH79.

21. Murchland S, Parkyn H. Using assistive technology for schoolwork: The experience of children with physical disabilities. Disability and Rehabilitation: Assistive Technology. 2010; 5(6):438–447.

22. Adolfsson M. Applying the ICF-CY to identify everyday life situations of children and youth with disabilities [PhD thesis]. Jönköping: Jönköping University; 2011.

23. May-Teerink T. A survey of rehabilitative services and people coping with physical disabilities in Uganda, East Africa. International Journal of Rehabilitation Research. 1999;22(4):311—316. doi:10.1097/00004356199912000-00008.

24. Nicolson A, Moir L, Millsteed J. Impact of assistive technology on family caregivers of children with physical disabilities: A systematic review. Disability and Rehabilitation: Assistive Technology. 2012;7(5):345–349. doi:10.3109/17 483107.2012.667194.

25. Assistive technology for children with disabilities: Creating opportunities for education, inclusion and participation: A discussion paper. Geneva: United

Nations Children's Fund and World Health Organization; 2015, Geneva (https://www.unicef.org/disabilities/files/Assistive-Tech-Web.pdf, accessed 20 April 2022).

26. Botelho FHF. Childhood and Assistive Technology. Growing with opportunity, developing with technology. New York: United Nations Children's Fund; 2020.

27. The state of the world's children 2013: Children with disabilities. New York: United Nations Children's Fund; 2013 (https://www.unicef.org/reports/state-worlds-children-2013, accessed 20 April 2022).

28. World report on disability. Geneva: World Health Organization; 2011 (https://www.who.int/teams/noncommunicable-diseases/sensory-functions-disability-and-rehabilitation/world-report-on-disability, accessed 20 April 2022).

29. Improving the health and wellbeing of people living with neglected tropical diseases through rehabilitation and assistive technology: thematic brief. Geneva: World Health Organization; 2022 (https://www.who.int/publications/i/item/9789240035140, accessed 26 March 2022).

30. World Population Ageing 2017. Highlights. New York: United Nations Department of Economic and Social Affairs; 2017 (https://www.un.org/en/development/desa/population/publications/pdf/ageing/WPA2017_Highlights.pdf, accessed 20 April 2022).

31. Decade of Healthy Ageing: Plan of Action. Geneva: World Health Organization; 2020 (https://www.who.int/publications/m/item/decade-of-healthy-ageing-plan-of-action, accessed 28 March 2022).

32. Garçon L, Khasnabis C et al. Medical and assistive health technology: Meeting the needs of aging populations, The Gerontologist. 2016; 56(Suppl_2):S293–S302. doi:10.1093/geront/gnw005.

33. Older adult fall prevention. Atlanta: Centers for Disease Control and Prevention; 2021 (https://www.cdc.gov/homeandrecreationalsafety/falls/adultfalls.html, accessed 20 April 2022).

34. Falls: What causes a fall? London: United Kingdom National Health Service; 2021 (https://www.nhs.uk/conditions/falls/#:~:text=Older%20people%20are%20more%20likely,a%20brief%20loss%20of%20consciousness, accessed 20 April 2022).

35. Sriram V, Jenkinson C, Peters M. Carers' experience of using assistive technology for dementia care at home: a qualitative study. BMJ Open 2020;10:e034460. doi:10.1136/bmjopen-2019-034460.

36. Dahler AM, Rasmussen DM, Andersen PT. Meanings and experiences of assistive technologies in everyday lives of older citizens: a meta-interpretative review. Disability and Rehabilitation: Assistive Technology. 2016:11(8):619–629.

37. Yusif S. Soar J, Hafeez-Baig A. Older people, assistive technologies, and the barriers to adoption: a systematic review. Int J Medical Informatics. 2016;94:112–116.

38. Zander V, Gustafsson C, Landerdahl Stridsberg S, Borg J. Implementation of welfare technology: a systematic review of barriers and facilitators, Disability and Rehabilitation: Assistive Technology. 2021. doi: 10.1080/17483107.2021.1938707.

39. Borg J, Lindström A, Larsson S. Assistive technology in developing countries: national and international responsibilities to implement the Convention on the Rights of Persons with Disabilities. The Lancet. 2009;374(9704):1863–1865.

40. Scherer MJ. Living in the state of stuck: How assistive technology impacts the lives of people with disabilities (Fourth Edition). Cambridge: Brookline Books; 2005.

41. Tebbutt, E., Brodmann, R., Borg, J. et al. Assistive products and the Sustainable Development Goals (SDGs). Global Health. 2016;12:79 doi:10.1186/s12992-016-0220-6.

42. Disability and development report. Realizing the Sustainable Development Goals by, for and with persons with disabilities. New York: United Nations; 2018 (https://www.un.org/development/desa/dspd/2019/04/undisability-and-development-report-realizing-the-sdgs-by-for-and-with-persons-with-disabilities/, accessed 20 April 2022).

43. Hoogerwerf EJ, Mavrou K, Traina I (eds). The role of assistive technology in fostering inclusive education strategies and tools to support change. Abingdon: Routledge; 2021.

44. Bell D, Foiret J. The impact of assistive technology on the educational performance of students with hearing impairment: A rapid review of the research. In N. Layton, J. Borg (Eds), Global perspectives on assistive technology: proceedings of the GReAT Consultation 2019, World Health Organization, Geneva, Switzerland, 22–23 August 2019. Volume A.

45. Scherer MJ. Connecting to learn: Educational and assistive technology for people with disabilities. Washington DC: American Psychological Association; 2004.

46. WIPO Technology Trends 2021: Assistive Technology. Geneva: World Intellectual Property Organization; 2021 (https://www.wipo.int/edocs/pubdocs/en/wipo_pub_1055_2021.pdf, accessed 20 April 2022).

47. Joseph P. A study on certain factors influencing language performance of hearing impaired students. Asia Pacific Disability and Rehabilitation Journal. 2003;14(2):201–208.

48. Gilroy SP, Leader G, McCleery JP. A pilot community-based randomized comparison of speech generating devices and the picture exchange communication system for children diagnosed with autism spectrum disorder. Autism Research. 2018;11(12):1701–1711.

49. Maor D, Mitchem KJ. Can technologies make a difference for hospitalized youth: Findings from research. Journal of Computer Assisted Learning. 2015;31(6):690–705.

50. Rumrill P et al. Promoting cognitive support technology use and employment success among postsecondary students with traumatic brain injuries. Journal of Vocational Rehabilitation. 2016;45(1):53–61.

51. Pratiwi AB et al. The economic impacts of wheelchair use: Evidence from Central Java, Indonesia. Journal of Community Empowerment for Health. 2019;2(2):190–197.

52.   Policy brief on entrepreneurship for people with disabilities. Paris: Organisa-tion for Economic Cooperation and Development and European Union; 2014 (https://www.oecd.org/cfe/leed/Policy-briefentrepreneurship-people-disabil-ities.pdf, accessed 20 April 2022).

53.   Gentry T et al. Reducing the need for personal supports among workers with autism using an iPod touch as an assistive technology: delayed randomized con-trol trial. Journal of autism and developmental disorders. 2015;45(3):669– 684.

54.   Guidelines on the provision of manual wheelchairs in less resourced settings. Geneva: World Health Organization; 2008 (https://www.who.int/publications/i/item/9789241547482, accessed 20 April 2022).

55.   Adjorlolo S. Can teleneuropsychology help meet the neuropsychological needs of Western Africans? The case of Ghana. Applied Neuropsychology: Adult. 2015;22(5):388–398.

56.   Davis, T. Transforming the outpatient experience through the use of assistive technology. International Journal of Integrated Care. 2014;14:56–57.

57.   Ferreira RC et al. Assistive technologies for improving the oral hygiene of lep-rosy patients residing in a former leprosy colony in Betim, Minas Gerais, Brazil. PloS one. 2018;13(7).

58.   Shore S. The long-term impact of wheelchair delivery on the lives of people with disabilities in three countries of the world. African Journal of Disability (Online). 2017;6:1–8.

59.   Hwang CS et al. An eye-tracking assistive device improves the quality of life for ALS patients and reduces the caregivers' burden. Journal of Motor Behavior. 2014;46(4):233–238.

60.   Millan MJ, Agid Y, Brüne M, Bullmore ET, Carter CS, Clayton NS et al. Cogni-tive dysfunction in psychiatric disorders: characteristics, causes and the quest for improved therapy. Nature Reviews Drug Discovery. 2012;11(2):141–68. doi:10.1038/nrd3628. PMID: 22293568.

61.   Strauss J, Zhang J, Jarrett ML, Patterson B, Ameringen MV. Apps for mental health. In: Stein DJ, Fineberg NA, Chamberlain SR (Eds). Mental health in a digi-tal world (Global mental health in practice). Cambridge MA: Academic Press; 2022.

62.   Technology and the future of mental health treatment [website]. Bethesda: National Institute of Mental Health; 2019 (https://www.nimh.nih.gov/health/topics/technology-and-the-future-of-mental-healthtreatment, accessed 20 April 2022).

63.   Withers MK. Assistive technology for mental health. Mylo [website]; 2021 (htt-ps://www.heymylo.ie/post/assistive-technology-for-mental-health, accessed 20 April 2022).

64.   Walsh M, Cormack R, MacLachlan M. "Right to Connect": Digital and assis-tive technology use in disability services during Covid-19: A report on the experiences of 120 service providers. Dublin: Health Service Executive of Ireland; 2020 (https://www.hse.ie/eng/about/who/cspd/ncps/disability/

programme-publications/digital-and-assistive-technology-use-in-disability-services-during-covid19-report.pdf, accessed 20 April 2022).

65.   Sorkin DH, Janio EA, Eikey EV, Schneider M, Davis K, Schueller SM et al. Rise in use of digital mental health tools and technologies in the United States during the COVID-19 pandemic: survey study. Journal of Medical Internet Research. 2021;23(4):e26994.

66.   Pretorius C, Chambers D, Coyle D. Young people's online help-seeking and mental health difficulties: Systematic narrative review. Journal of Medical Internet Research. 2019;21(11):e13873.

67.   Ravneberg B, Söderström S. Disability, society and assistive technology. Abingdon: Taylor & Francis; 2017.

68.   Olsson A et al. Effects of tracking technology on daily life of persons with dementia: three experimental single-case studies. American Journal of Alzheimer's Disease & Other Dementias. 2015;30(1):29–40.

69.   Rowland JL et al. Perspectives on active video gaming as a new frontier in accessible physical activity for youth with physical disabilities. Physical Therapy. 2016;96(4):521–532.

70.   Newman DK. Incontinence products and devices for the elderly. Urologic Nursing. 2004; 24(4):316– 33;quiz334.

71.   Sutema IAMP, Jaya MKA, Bakta IM. Medicine reminder to improve treatment compliance on geriatric patients with diabetic neuropathy at Sanglah Central Hospital, Bali-Indonesia. Bali Medical Journal. 2018;7(2):516.

72.   De-Rosende-Celeiro I, Torres G, Seoane-Bouzas M, Ávila A (2019) Exploring the use of assistive products to promote functional independence in self-care activities in the bathroom. PloS one. 2019;14(4):e0215002. doi:10.1371/journal.pone.0215002.

73.   Szanton SL et al. Effect of a biobehavioral environmental approach on disability among low-income older adults: a randomized clinical trial. JAMA Internal Medicine. 2019;179(2):204–211.

74.   Liu, L. et al. Smart homes and home health monitoring technologies for older adults: A systematic review. International Journal of Medical Informatics. 2016;91:44–59.

75.   Tough H, Siegrist J, Fekete C. Social relationships, mental health and wellbeing in physical disability: a systematic review. BMC Public Health. 2017;17(1):1–18.

76.   Social determinants of health: the solid facts. 2nd edition. Copenhagen: World Health Organization Regional Office for Europe; 2003 (https://www.euro.who.int/ data/assets/pdf_file/0005/98438/e81384.pdf, accessed 20 April 2022).

77.   Rousseau-Harrison K, Rochette A. Impacts of wheelchair acquisition on children from a personoccupation-environment interactional perspective. Disability and Rehabilitation: Assistive Technology. 2013; 8(1):1–10.

78.   Kurne SA, Gupta AD. Impact of Long-term Use of Adaptive Seating Device among Children with Cerebral Palsy and their Families in Mumbai, India: A feasibility study. Disability, CBR & Inclusive Development. 2016; 27(3):118–131.

79. Scassellati B, Boccanfuso L, Huang CM, Mademtzi M, Qin M, Salomons N et al. Improving social skills in children with ASD using a long-term, in-home social robot. Science Robotics. 2018;3(21).

80. Weinstein BE, Sirow LW, Moser S. Relating hearing aid use to social and emotional loneliness in older adults. American Journal of Audiology. 2016;25(1):54–61.

81. Solovieva T I et al. Employer benefits from making workplace accommodations. Disability and Health Journal. 2011;4(1):39–45.

82. Borg J et al. Assistive technology use is associated with reduced capability poverty: a cross-sectional study in Bangladesh. Disability and Rehabilitation: Assistive Technology. 2012;7(2):112–121.

83. Spreckley M et al. Impact of Hearing Aids on Poverty, Quality of Life and Mental Health in Guatemala: Results of a before and after Study. International Journal of Environmental Research and Public Health. 2020;17(10):3470.

84. Getting to equal: The disability inclusion advantage. Dublin: Accenture; 2018 (https://www.accenture.com/_acnmedia/PDF-89/Accenture-Disability-Inclusion-Research-Report.pdf#zoom=50, accessed 20 April 2022).

85. The case for investing in assistive technology. The dramatic economic, health, and social benefits of assisting a billion people to live fulfilling and dignified lives. Geneva: ATScale; 2020 (https://atscalepartnership.org/investment-case, accessed 20 April 2022).

86. Addo R et al. Economic burden of caregiving for persons with severe mental illness in sub-Saharan Africa: A systematic review. PloS one. 2018;13(8):e0199830.

87. Laskar AR et al. Psychosocial effect and economic burden on parents of children with locomotor disability. The Indian Journal of Pediatrics; 2010;77(5):529– 533.

88. Marasinghe KM. Assistive technologies in reducing caregiver burden among informal caregivers of older adults: a systematic review. Disability and Rehabilitation: Assistive Technology. 2016;11(5):353–360.

89. Bensi N, Bitelli C, Hoogerwerf EJ. Assistive technologies and other solutions for independence: cost or investment? In: Assistive Technology Research Series. Everyday Technology for Independence and Care. Amsterdam: IOS Press; 2011.

90. Gips A, DiMattia PA, Gips J. The effect of assistive technology on educational costs: Two case studies. In: International Conference on Computers for Handicapped Persons. Berlin: Springer; 2004.

91. Blackstone S. Communication access across the healthcare continuum. Augmentative Communication News. 2009;21(2):1–16 (https://aac-rerc.psu.edu/_userfiles/file/ACN_Pat_Prov.pdf, accessed 20 April 2022).

92. World report on ageing and health. Geneva: World Health Organization; 2015 (https://apps.who.int/iris/ handle/10665/186463, accessed 20 April 2022).

93. Lansley P et al. Can adapting the homes of older people and providing assistive technology pay its way?. Age and Ageing. 2014;33(6):571–576.

94. Layton N, Irlam C. Assistive technology for older Australians: Rapid evidence review and economic pathway analysis. Canberra: National Aged Care Alliance; 2018 (https://naca.asn.au/wp-content/ uploads/2018/11/NACA_Assistive_

Technology_for_Older_Australians_Position_Paper-1-June-2018.pdf, accessed 20 April 2022).

95. Andrich R, Mathiassen NE, Hoogerwerf EJ, Gelderblom GJ. Service delivery systems for assistive technology in Europe: An AAATE/EASTIN position paper. Technology and Disability. 2013;25(3):127–146. doi:10.3233/TAD-130381.

96. Zahid A, Krumins V, de Witte L de. The development of innovation sharing platforms for low cost and do-it-yourself assistive technology in low and middle-income countries. In N. Layton, J. Borg (Eds), Global perspectives on assistive technology: proceedings of the GReAT Consultation 2019, World Health Organization, Geneva, Switzerland, 22–23 August 2019. Volume A.

97. Desideri L. Assistive technology service delivery for children with multiple disabilities: a family-centred approach to assure quality [PhD thesis]. Maastricht: University of Maastricht; 2015. doi: 10.26481/dis.20151021ld.

98. Scherer, Marcia J. and Craddock, Gerald. Matching Person and Technology (MPT) Assessment Process, 125 – 131.

99. The Global Assistive Technology Information Network [website]. EASTIN Network (http://www.eastin.eu/en/searches/products/index, accessed 20 April 2022).

100. Shanghai Resource Center for Assistive Devices for the Disabled (www.shfuju.com, accessed 20 April 2022).

101. Policy brief: Access to assistive technology. Geneva: World Health Organization; 2021 (https://www.who.int/publications/i/item/978-92-4-000504-4, accessed 20 April 2022).

102. Jesus TS, Bright F, Kayes N, Cott CA. Person-centered rehabilitation: What exactly does it mean? Protocol for a scoping review with thematic analysis towards framing the concept and practice of personcentered rehabilitation. BMJ Open. 2016;6(7).

103. Strategic action framework to improve access to assistive technology in the Eastern Mediterranean Region. Cairo: World Health Organization. Regional Office for the Eastern Mediterranean; 2022 (https://apps.who.int/iris/handle/10665/352488, accessed 20 April 2022).

104. World Programme of Action Concerning Disabled Persons. New York: United Nations Department of Economic and Social Affairs; 1982 (https://www.un.org/development/desa/disabilities/resources/worldprogramme-of-action-concerning-disabled-persons.html, accessed 20 April 2022).

105. Standard Rules on the Equalization of Opportunities for Persons with Disabilities. New York: United Nations Department of Economic and Social Affairs; 1993 (https://www.un.org/development/desa/disabilities/ standard-rules-on-the-equalization-of-opportunities-for-persons-with-disabilities.html, accessed 20 April 2022).

106. Convention on the Rights of the Child. New York, United Nations, Office of the High Commissioner for Human Rights; 1989 (https://www.ohchr.org/en/instruments-mechanisms/instruments/convention-rightschild, accessed 20 April 2022).

107. 2030 Agenda for Sustainable Development. New York: United Nations Department of Economic and Social Affairs; 2015 (https://sdgs.un.org/2030agenda, accessed 20 April 2022).

108. Disability and Development Report: Realizing the Sustainable Development Goals by, for and with persons with disabilities. New York: United Nations Department of Economic and Social Affairs; 2018 (https://www.un.org/development/desa/disabilities/publication-disability-sdgs.html, accessed 20 April 2022).

109. Khasnabis C, Mirza Z, MacLachlan M. Opening the GATE to inclusion for people with disabilities. The Lancet. 2015;386:2229–2230

110. MacLachlan M, Banes D, Bell D, Borg J, Donnelly B, Fembek M et al. Assistive technology policy: a position paper from the first global research, innovation, and education on assistive technology (GREAT) summit. Disability and Rehabilitation: Assistive Technology. 2018;13(5):454–466. doi:10.1080/17483107.2018.1468496.

111. Global strategy and action plan on ageing and health. Geneva: World Health Organization; 2017 (https://www.who.int/publications/i/item/9789241513500, accessed 20 April 2022).

112. Rehabilitation 2030 Initiative [website]. Geneva: World Health Organization; 2019 (https://www.who.int/ initiatives/rehabilitation-2030, accessed 20 April 2022).

113. Priority assistive products list. Geneva: World Health Organization; 2016 (https://www.who.int/publications/i/item/priority-assistive-products-list, accessed 20 April 2022).

114. Zhang W, Eide AH, Pryor W, Khasnabis C, Borg J. Measuring self-reported access to assistive technology using the WHO Rapid Assistive Technology Assessment (rATA) questionnaire: protocol for a multi-country study. International Journal of Environmental Research and Public Health. 2021;18(24):13336.

115. WG Short Set on Functioning (WG-SS). Hyattsville: The Washington Group on Disability Statistics; 2020 (https://www.washingtongroup-disability.com/question-sets/wg-short-set-on-functioning-wg-ss/, accessed 20 April 2022).

116. Healthy life expectancy (HALE) at age 60 (years). The Global Health Observatory. Geneva: World Health Organization (https://www.who.int/data/gho/data/indicators/indicator-details/GHO/gho-ghe-hale-healthylife-expectancy-at-age-60, accessed 20 April 2022).

117. Global Burden of Disease Results Tool. Seattle: Institute for Health Metrics and Evaluation; 2022 (https://ghdx.healthdata.org/gbd-results-tool, accessed 20 April 2022).

118. World report on vision. Geneva: World Health Organization; 2019 (https://www.who.int/publications-detailredirect/9789241516570, accessed 20 April 2022).

119. Orji A, Kamenov K, Dirac M, Davis A, Chadha S, Vos T. Global and regional needs, unmet needs and access to hearing aids. International Journal of Audiology. 2020;59(3):166–172. doi:10.1080/14992027.20 20.1721577.

120. World report on hearing. Geneva: World Health Organization; 2021 (https://www.who.int/publicationsdetail-redirect/world-report-on-hearing, accessed 20 April 2022).

121. Cieza A, Causey K, Kamenov K, Hanson SW, Chatterji S, Vos T. Global estimates of the need for rehabilitation based on the Global Burden of Disease study 2019: a systematic analysis for the Global Burden of Disease Study 2019. The Lancet. 2020; 19;396(10267):2006–17. doi:10.1016/S01406736(20)32340-0.

122. Prevalence of coverage of assistive technology in the WHO European Region. A scoping review. Copenhagen: World Health Organization Regional Office for Europe; 2021 (https://apps.who.int/iris/handle/10665/344520, accessed 20 April 2022).

123. Eide AH, Mji G, Chiawula M. Need for, access to and quality of assistive technology in lowand middleincome countries. In N. Layton, J. Borg (Eds), Global perspectives on assistive technology: proceedings of the GReAT Consultation 2019, World Health Organization, Geneva, Switzerland, 22–23 August 2019. Volume A.

124. Smith EM, Ebuenyi ID, Kafumba JA, Jamali-Phiri M, MacLachlan M, Munthali A (2020) An overview of assistive technology products and services provided in Malawi. Disability and Rehabilitation: Assistive Technology. 2020. doi:10.1080/17483107.2020.1854356 .

125. Brief Model Disability Survey: Results for India, Lao's Democratic Republic and Tajikistan. Executive Summary. Geneva: World Health Organization; 2019 (https://apps.who.int/iris/bitstream/handle/10665/330013/WHO-NMH-NVI-19.15-eng.pdf, accessed 20 April 2022).

126. Boggs D, Kuper H, McTaggart I, Murthy GVS, Oye J, Pollack S (2020) Estimating assistive product need in Cameroon and India: results of population-based surveys and comparison of self-report and clinical impairment assessment approaches. Tropical Medicine and International Health. 2020;26(2):146–158. doi.10.1111/tmi.13523.

127. Danemayer J, Boggs D, Delgado Ramos V et al. Estimating need and coverage for five priority assistive products: a systematic review of global population-based research. BMJ Global Health. 2022;7:e007662. doi:10.1136/bmjgh-2021-007662.

128. Rohwerder B. Assistive technologies in developing countries. London: Department for International Development; 2018.

129. Berardi A, Smith EM, Miller WC, Assistive technology use and unmet need in Canada. Disability and Rehabilitation. 2020;16(8):851–856. doi:10.1080/17483107.2020.1741703.

130. Layton N, Smith EM, Battistella LR et al. Measuring met and unmet assistive technology needs at the national level: Comparing national database collection tools across eight case countries. In N. Layton, J. Borg (Eds), Global perspectives on assistive technology: proceedings of the GReAT Consultation 2019, World Health Organization, Geneva, Switzerland, 22–23 August 2019. Volume A.

131. Al-Tayar R, Humbert T, Di Pietro L, Guo A, Zhang W, Tebbutt E, Mishra S. A rapid assessment on access to assistive technology in the World Health Organization's European Region. In N. Layton, J. Borg (Eds), Global perspectives on assistive technology: proceedings of the GReAT Consultation 2019, World Health Organization, Geneva, Switzerland, 22–23 August 2019. Volume A.

132. Assistive technology in Tajikistan: Situational analyses. Copenhagen: World Health Organization Regional Office for Europe; 2019.

133. Pryor W, Nguyen L, Islam QN, Jalal FA, Marella M. Unmet needs and use of assistive products in two districts of Bangladesh: Findings from a household survey. International Journal of Environmental Research and Public Health. 2018;15(12):2901. doi:10.3390/ijerph15122901.

134. Van Brakel WH. Measuring health-related stigma—A literature review. Psychology, Health & Medicine. 2006;11(3):307–334. doi:10.1080/13548500600595160.

135. Personnel training in priority assistive products [website]. Geneva: World Health Organization; 2018 (https://www.who.int/news-room/feature-stories/detail/personnel-training-in-priority-assistive-products(tap), accessed 20 April 2022).

136. Kuper H, Heydt P. The Missing Billion: Access to health services for 1 billion people with disabilities. 2019. (https://www.themissingbillion.org/the-report-2, accessed 20 April 2022).

137. Improving access to assistive technology. Report by the Director-General (A71/21). In: Seventy-first World Health Assembly, Geneva, 21–26 May 2018. Provisional agenda item 12.5. Geneva: World Health Organization; 2018 (http://apps.who.int/gb/ebwha/pdf_files/WHA71/A71_21-en.pdf, accessed 20 April 2022).

138. Kelso SS, Mann DD. Assistive technology for farmers with physical disabilities (http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.1071.820&rep=rep1&type=pdf, accessed 20 April 2022).

139. Savage M, Albala S, Seghers F, Kattel R, Liao C, Chaudron M et al. Applying market shaping approaches to increase access to assistive technology in low-and middle-income countries. Assistive Technology. 2021;33:124–135.

140. Assistive technology procurement study: technical report. Manila: World Health Organization Regional Office for the Western Pacific; 2020.

141. Visagie S, Eide AH, Mannan H, Schneider M, Swartz L, Mji G et al. A description of assistive technology sources, services and outcomes of use in a number of African settings. Disability and Rehabilitation: Assistive Technology. 2017;12(7):705-712. doi:10.1080/17483107.2016.1244293.

142. Vo TD, Tran MD. The impact of covid-19 pandemic on the global trade. International Journal of Social Science and Economics Invention. 2021;7(1):1-7.

143. Smith EM, Hernandez ML, Ebuenyi I, Syurina EV, Barbareschi G, Best KL, et al. Assistive technology use and provision during COVID-19: results from a rapid global survey. International Journal of Health Policy and Management. 2020.

144. Layton N, Mont D, Puli L, Calvo I, Shae K, Tebbutt E et al. Access to assistive technology during the COVID-19 global pandemic: voices of users and

families. International Journal of Environmental Research and Public Health. 2021;18(21):11273.

145. Desmond D, Layton N, Bentley J, Boot FH, Borg J, Dhungana BM et al. Assistive technology and people: a position paper from the first global research, innovation and education on assistive technology (GREAT) summit. Disability and Rehabilitation: Assistive Technology. 2018;13(5):437-44.

146. Ripat J, Woodgate RL, Bennett L. Attitudes faced by young adults using assistive technology as depicted through photovoice. Disability and rehabilitation: Assistive technology. 2020;15(3):314–21. doi:10.1080/17 483107.2019.1571118.

147. Senjam SS, Foster A, Bascaran C, Vashist P. Awareness, utilization and barriers in accessing assistive technology among young patients attending a low vision rehabilitation clinic of a tertiary eye care centre in Delhi. Indian journal of ophthalmology. 2019;67(10):1548.

148. Bright T, Wallace S, Kuper H. A systematic review of access to rehabilitation for people with disabilities in low-and middle-income countries. International Journal of Environmental Research and Public Health. 2018;15(10):2165.

149. Resnikoff S, Felch W, Gauthier T, Spivey B. The number of ophthalmologists in practice and training worldwide: a growing gap despite more than 200 000 practitioners. British Journal of Ophthalmology. 2012;96(6):783–7.

150. Oderud T. Surviving spinal cord injury in low income countries. African Journal of Disability. 2014;3(2):1-9.

151. Danemayer J, Boggs D, Polack S, Smith EM, Ramos VD, Battistella LR et al. Measuring assistive technology supply and demand: A scoping review. Assistive Technology. 2021;33(sup1):35–49.

152. Albala SA, Kasteng F, Eide AH, Kattel R. Scoping review of economic evaluations of assistive technology globally. Assistive Technology. 2021;33(sup1):50–67.

153. Visagie S, Scheffler E, Seymour N, Mji G. Assistive technology service delivery in South Africa: Conceptualising a systems approach. South African Health Review. 2020;(1):119–27.

154. Borg J, Ostergren PO. Users' perspectives on the provision of assistive technologies in Bangladesh: awareness, providers, costs and barriers. Disability and Rehabilitation. 2015;10(4):301–308. doi10.3109/1 7483107.2014.974221.

155. Botelho FH. Childhood and Assistive Technology: Growing with opportunity, developing with technology. Assistive Technology. 2021;33(sup1):87–93.

156. Marasinghe KM, Lapitan JM, Ross A. Assistive technologies for ageing populations in six low-income and middle-income countries: a systematic review. BMJ innovations. 2015;1(4).

157. Dahler AM, Rasmussen DM, Andersen PT. Meanings and experiences of assistive technologies in everyday lives of older citizens: a meta-interpretative review. Disability and Rehabilitation: Assistive Technology. 2016;11(8):619– 629.

158. Yusif S, Soar J, Hafeez-Baig A. Older people, assistive technologies, and the barriers to adoption: a systematic review. Int J Medical Informatics. 2016;94:112– 116.

159. Matin BK, Williamson HJ, Karyani AK, Rezaei S, Soofi M, Soltani S. Barriers in access to healthcare for women with disabilities: a systematic review in qualitative studies. BMC Women's Health. 2021;21(1):1.

160. Altin N, MacLachlan J, Phenix A, Nixon S. Colonization, climate, and critical analysis: Examining access to assistive technology in Northern Canada using the World Health Organization's Global Cooperation on Assistive Technology initiative. In N. Layton, J. Borg (Eds), Global perspectives on assistive technology: proceedings of the GReAT Consultation 2019, World Health Organization, Geneva, Switzerland, 22–23 August 2019. Volume A.

161. Provision of wheelchairs in Tajikistan: Economic assessment of alternative options. Copenhagen: World Health Organization Regional Office for Europe; 2019 (https://apps.who.int/iris/bitstream/handle/10665/312049/9789289054041eng.pdf, accessed 20 April 2022).

162. Community-based rehabilitation: CBR guidelines. Geneva: World Health Organization; 2010 (https://www.who.int/publications/i/item/9789241548052, accessed 20 April 2022).

163. Gwamuri J, Wittbrodt BT, Anzalone NC, Pearce JM. Reversing the trend of large scale and centralization in manufacturing: The case of distributed manufacturing of customizable 3-D-printable self-adjustable glasses. Challenges in sustainability. 2014;2(1):30–40.

164. Sujatha S, Bapat GM, Dash SS. GRID: a model for the development of assistive devices in developing countries. Disability and Rehabilitation: Assistive Technology. 2021;16(3):317–323. doi:10.1080/17483107. 2019.1673838.

165. Bapat GM, Sujatha S. Identification and analysis of knee-ankle-foot orthosis design requirements based on a feedback survey of orthosis users in India. Disability and Rehabilitation: Assistive Technology. 2019;14(1):82–90. doi:10.1080/17483107.2017.1416187.

166. Marino M, Pattni S, Greenberg M, Miller A, Hocker E, Ritter S, Mehta K. Access to prosthetic devices in developing countries: Pathways and challenges. In: 2015 IEEE global humanitarian technology conference (GHTC); 8 Oct 2015. Seattle: Institute of Electrical and Electronics Engineers; 2015 (http://ieeexplore.ieee. org/stamp/stamp.jsp?tp=&arnumber=7343953, accessed 20 April 2022).

167. Holloway C, Morgado Ramirez DZ, Bhatnagar T, Oldfrey B, Morjaria P, Moulic SG et al. A review of innovation strategies and processes to improve access to AT: Looking ahead to open innovation ecosystems. Assistive Technology. 2021;33(sup1):68–86.

168. Ramstrand N, Maddock A, Johansson M, Felixon L. The lived experience of people who require prostheses or orthoses in the Kingdom of Cambodia: A qualitative study. Disability and Health Journal. 2021;14(3):101071.

169. IPO Technology Trends 2021: Assistive Technology. Geneva: World Intellectual Property Organization; 2021 (https://www.wipo.int/edocs/pubdocs/en/wipo_pub_1055_2021.pdf, accessed 20 April 2022).

170. Sund T. Assistive technology in Norway – a part of a larger system. Norwegian Department of Assistive Technology; 2017. (https://www.nav.no/_/attachment/

inline/7b119b1c-fe72-488a-a1ef-be424e72faff:c52b8c 6ee759299749538a6fd-0554d1efa695abf/assistive-technology-in-norway-170217v2.pdf, accessed 20 April 2022).

171. Oldfrey B, Barbareschi G, Morjaria P, Giltsoff T, Massie J, Miodownik M, et al. Could assistive technology provision models help pave the way for more environmentally sustainable models of product design, manufacture and service in a post-COVID world? Sustainability. 2021;13(19):10867.

172. Wirtz VJ, Hogerzeil HV, Gray AL, Bigdeli M, de Joncheere CP, Ewen MA et al. Essential medicines for universal health coverage. The Lancet. 2017;389(10067):403–76.

173. Saidi T, Douglas TS. Medical device regulation in South Africa: The Medicines and Related Substances Amendment Act 14 of 2015. South African Medical Journal. 2018;108(3):168–70.

174. South African Health Products Regulatory Authority [website]. Pretoria: National Department of Health, South African Government; 2022 (https://www.sahpra.org.za/, accessed 20 April 2022).

175. Smith EM, MacLachlan M, Ebuenyi ID, Holloway C, Austin V. Developing inclusive and resilient systems: COVID-19 and assistive technology. Disability & Society. 2021;36(1):151–4.

176. Assistive technology market estimates: Rapid growth ahead [website]. East Greenwich: Bureau of Internet Accessibility; 2019. (https://www.boia.org/blog/assistive-technology-market-estimates-rapid-growth-ahead, accessed 20 April 2022).

177. Jeffrey S, Lei Y, Latif A. Older people's needs and opportunities for assistive technologies. In: The impact of digital technologies on public health in developed and developing countries. Springer Nature, 2020.

178. Randall N, Bennett CC, Šabanović S, Nagata S, Eldridge L, Collins S, Piatt JA. More than just friends: inhome use and design recommendations for sensing socially assistive robots (SARs) by older adults with depression. Paladyn, Journal of Behavioral Robotics. 2019;10(1):237–55.

179. A manual for public procurement of assistive products, accessories, spare parts and related services. Geneva: World Health Organization and the United Nations Children's Fund; 2020 (https://www.who.int/publications/i/item/9789240013988, accessed 20 April 2022).

180. Battistella LR, Juca SS, Tateishi M, Oshiro MS, Yamanaka EI, Lima E, Ramos VD. Lucy Montoro Rehabilitation Network mobile unit: an alternative public healthcare policy. Disability and Rehabilitation: Assistive Technology. 2015;10(4):309–15.

181. Layton N, Harper K, Martinez K, Berrick N, Naseri C. Co-creating an assistive technology peer-support community: learnings from assistive technology chat. Disability and Rehabilitation: Assistive Technology. 2021. Doi:10.1080/17483107.2021.1897694.

182. Guidelines on the provision of manual wheelchairs in less resourced settings. Geneva: World Health Organization; 2008 (https://www.who.int/publications/i/item/9789241547482, accessed 20 April 2022).

183. Hunt PF. Inclusive education: The case for early identification and early intervention in assistive technology. Assistive Technology. 2021;33(sup1):94–101.

184. Andrich R, Norman G, Mavrou K, Roentgen U, Daniels R, Desideri L, at el. Towards a global quality framework for assistive technology service delivery. In N. Layton, J. Borg (Eds), Global perspectives on assistive technology: proceedings of the GReAT Consultation 2019, World Health Organization, Geneva, Switzerland, 22–23 August 2019. Volume B.

185. Scherer MJ. Assistive technology selection to outcome assessment: the benefit of having a service delivery protocol, Disability and Rehabilitation: Assistive Technology. 2019;14(8):762–763. doi:10.1080/174 83107.2019.1664649.

186. Govender SM, Mars M. Assessing the efficacy of asynchronous telehealth-based hearing screening and diagnostic services using automated audiometry in a rural South African school. South African Journal of Communication Disorders. 2018;65(1):1–9.

187. Rono HK, Bastawrous A, Macleod D, Wanjala E, Di Tanna GL, Weiss HA et al. Smartphone-based screening for visual impairment in Kenyan school children: a cluster randomised controlled trial. The Lancet Global Health. 2018;6(8):e924–32.

188. Puli L, Layton N, Mont D, Shae K, Calvo I, Hill KD et al. Assistive technology provider experiences during the COVID-19 pandemic. International Journal of Environmental Research and Public Health. 2021;19:10477.

189. Mohammad K, Lathwal A, Mahesh R, Satpathy S. Economic competition and its determinants in medical equipment public procurement. Journal of Medical Engineering and Technology. 2021;45(3):177–186. doi: 10.1080/03091902.2021.1891310.

190. Yadav P. Health product supply chains in developing countries: diagnosis of the root causes of underperformance and an agenda for reform. Health systems and reform. 2015;1(2):142–54.

191. Braun J, Gertz SD, Furer A, Bader T, Frenkel H, Chen J et al. The promising future of drones in prehospital medical care and its application to battlefield medicine. Journal of Trauma and Acute Care Surgery. 2019;87(1S):S28–34.

192. Burnett AM, Yashadhana A, Lee L, Serova N, Brain D, Naidoo K. Interventions to improve school-based eye-care services in low-and middle-income countries: a systematic review. Bulletin of the World Health Organization. 2018;96(10):682.

193. Diaconu K, Chen YF, Cummins C, Jimenez Moyao G, Manaseki-Holland S, Lilford R. Methods for medical device and equipment procurement and prioritization within low-and middle-income countries: findings of a systematic literature review. Globalization and health. 2017;13(1):1–6.

194. Assistive technology capacity assessment (ATA-C) instruction manual. Geneva: World Health Organization; 2021 (https://www.who.int/publications/i/item/9789240019065, accessed 20 April 2022).

195. Smith EM, Gowran RJ, Mannan H, Donnelly B, Alvarez L, Bell D, et al. Enabling appropriate personnel skill-mix for progressive realization of equitable access to assistive technology. Disability and Rehabilitation: Assistive Technology. 2018;13(5):445–53.

196. Bogunjoko TJ, Hassan AO, Okonkwo O, Akanbi T, Ulaikere M, Akinye A, et al. Impact of middle level eye care personnel on the delivery of eye care services in South-western Nigeria. International Journal of Community Medicine and Public Health. 2018;5:871–9.

197. Kaggwa G. Ophthalmic clinical officers: developments in Uganda. Community Eye Health. 2014;27(86):34.

198. Jesus TS, Landry MD, Dussault G, Fronteira I. Human resources for health (and rehabilitation): six rehabworkforce challenges for the century. Human resources for health. 2017;15(1):1–2.

199. Assistive Technology Professional (ATP) Certification [website]. Washington DC: Rehabilitation Engineering and Assistive Technology Society of North America (https://www.resna.org/Certification/Assistive-Technology-Professional-ATP, accessed 20 April 2022).

200. ISPO accreditation [website]. Brussels: International Society for Prosthetics and Orthotics (ISPO) (https://www.ispoint.org/page/Accreditation, accessed 20 April 2022).

201. Tay-Teo K, Bell D, Jowett M. Financing options for the provision of assistive products. Assistive Technology. 2021;33(sup1):109–23.

202. Menich N. Challenges in access to assistive technology in Hungary. In N. Layton, J. Borg (Eds), Global perspectives on assistive technology: proceedings of the GReAT Consultation 2019, World Health Organization, Geneva, Switzerland, 22–23 August 2019. Volume A.

203. De Witte L, Carter L, Rimmer M, Ertmer F, de Witte L. Models of assistive technology service delivery in low resource settings: A literature review of different approaches and their quality and impact. In N. Layton, J. Borg (Eds), Global perspectives on assistive technology: proceedings of the GReAT Consultation 2019, World Health Organization, Geneva, Switzerland, 22–23 August 2019. Volume A.

204. Whittaker G, Wood GA, Oggero G, Kett M, Lange K. Meeting AT needs in humanitarian crises: The current state of provision. Assistive Technology. 2021;33(sup1):3–16.

205. Sheppard P, Polack M, McGivern M. Missing millions: how older people with disabilities are excluded from humanitarian response. London: HelpAge International. 2018

206. Funke C, Dijkzeul D. Mainstreaming disability in humanitarian action: A field study from Cox's Bazar, Bangladesh. Bochum: Institute for International Law of Peace and Armed Conflict; 2021 (https://www.cbm.org/fileadmin/user_upload/mainstreaming-disability-in-humanitarian-action-a-field-study.pdf, accessed 20 April 2022).

207. Hisamatsu M. Panel discussion on disaster resilience and disability: Ensuring equality and inclusion. Coorganized by UNDESA, UNISDR in collaboration with Indonesia and Norway and the Nippon Foundation, UN Headquarters, New York. 2013.

208. Global Humanitarian Overview. Geneva: UN Office for the Coordination of Humanitarian Affairs (OCHA); 2021. (https://www.unocha.org/global-humanitarian-overview-2021, accessed 20 April 2022).

209. Mousavi G, Ardalan A, Khankeh H, Kamali M, Ostadtaghizadeh A. Physical rehabilitation services in disasters and emergencies: A systematic review. Iranian Journal of Public Health. 2019;48(5):808.

210. Hidden victims of the Syrian crisis: disabled, injured and older refugees [website]. Lyon: Handicap International and HelpAge International; 2014 (https://reliefweb.int/report/syrian-arab-republic/hiddenvictims-syrian-crisisdisabled-injured-and-older-refugees, accessed 20 April 2022).

211. Demographics and disability. Disability assessment among Syrian refugees in Jordan and Lebanon (Factsheet 1). Lyon: Handicap International and iMMAP; 2018 (https://d3n8a8pro7vhmx.cloudfront.net/handicapinternational/pages/3885/attachments/original/1537197235/01_Demographics_and_Disability_ Final_1072018.pdf, accessed 20 April 2022).

212. Tataryn M, Blanchet K. Evaluation of post-earthquake physical rehabilitation response in Haiti, 2010–a systems analysis. London: International Centre for Evidence on Disability; 2012.

213. Priority product list for persons with disabilities during COVID-19. New York: United Nations Children's Fund; 2020 (https://www.unicef.org/innovation/disability-friendly-supplies, accessed 20 April 2022).

214. Emergency medical teams: Minimum technical standards and recommendations for rehabilitation. Geneva: World Health Organization; 2016 (https://www.who.int/publications/i/item/emergency-medicalteams, accessed 20 April 2022).

215. Lathia C, Skelton P, Clift Z. Early rehabilitation in conflicts and disasters. Lyon: Handicap International; 2020 (https://hi.org/sn_uploads/document/36199-Humanity--Inclusion-Clinical-Handbook-web_1.pdf, accessed 20 April 2022).

216. Jesus TS, Kamalakannan S, Bhattacharjya S, Bogdanova Y, Arango-Lasprilla JC, Bentley J et al. Refugee Empowerment Task Force and International Networking Group of the American Congress of Rehabilitation Medicine. PREparedness, REsponse and SySTemic transformation (PRE-RE-SyST): a model for disability-inclusive pandemic responses and systemic disparities reduction derived from a scoping review and thematic analysis. International Journal for Equity in Health. 2021;20(1):204. doi:10.1186/s12939-02101526-y.

217. The Impact of physical rehabilitation on the lives of persons with physical impairments in Myanmar: Research Report. London: International Centre for Evidence in Disability, London School of Hygiene & Tropical Medicine; 2017 (https://www.lshtm.ac.uk/media/23466, accessed 20 April 2022).

218. Inclusive post-disaster reconstruction: Building back safe and accessible for all: 16 minimum requirements for building accessible shelters. Bensheim: CBM International; 2015 (https://www.cbm.org/fileadmin/user_ upload/Publications/16-minimum-requirements-for-building-accessible-shelters.pdf, accessed 6 February 2022).

219. Physical and functional rehabilitation in long-standing (long-term) refugee camps (Policy Paper). Lyon: Handicap International; 2015 (https://hi.org/ sn_uploads/document/PP_RehabLongStandingCamps.pdf, accessed 20 April 2022).

220. Age and Disability Capacity Programme (ADCAP) [website]. London: HelpAge International (https://www.helpage.org/what-we-do/emergencies/adcap-age-and-disability-capacity-building-programme, accessed 20 April 2022).

221. Inclusion of persons with disabilities in humanitarian action. Inter-Agency Standing Committee (IASC); 2019 (https://interagencystandingcommittee. org/iasc-task-team-inclusion-persons-disabilitieshumanitarian-action/documents/iasc-guidelines, accessed 20 April 2022).

222. Banks LM, Davey C, Shakespeare T, Kuper H. Disability-inclusive responses to COVID-19: Lessons learnt from research on social protection in lowand middle-income countries. World Development. 2021 Jan; 137:105178.

223. Stough LM, Kang D. The Sendai framework for disaster risk reduction and persons with disabilities. International Journal of Disaster Risk Science. 2015 Jun;6(2):140–9.

224. A principled and inclusive response to COVID-19, focused on the most vulnerable. HI Messages on COVID-19. Humanity & Inclusion; 2020. (https://hi.org/sn_uploads/document/SHORT-HI-Messages-on-COVID19-Policy-Paper15042020-ENG.pdf, accessed 20 April 2022).

225. Mont D, Layton N, Puli L, Gupta S, Manlapaz A, Shae K et al. Assistive technology during the COVID-19 global pandemic: The roles of government and civil society in fulfilling the social contract. International Journal of Environmental Research and Public Health. 2021;18(22):12031.

226. Accessible transportation for persons with disabilities regulations. Ottawa: Canadian Transportation Agency; 2022 (https://otc-cta.gc.ca/eng/accessible-transportation-persons-disabilities-regulations, accessed 20 April 2022).

227. Ochieng' AM, Onyango GM, Wagah GG. Evaluation of incorporation of universal design parameters in the planning approval process of Kisumu Main Bus Terminus. East African Journal of Arts and Social Sciences. 2021; 3(1):12–23. doi:10.37284/eajass.3.1.261.

228. Travel with a disability: Digital accessibility is vital from the start. New York: Essential Accessibility; 2017 (https://www.essentialaccessibility.com/blog/digital-accessibility-travel, accessed 20 April 2022).

229. Steinfeld E. Universal design in mass transportation. In Preiser W, Smith K (eds.). Handbook of universal design, 2nd edition. New York: McGraw Hill; 2011.

230. Mitchell C, Rickert T. Review of international best practices in accessible public transportation for persons with disabilities. Kuala Lumpur; United Nations Development Programme Malaysia; 2010 (https://g3ict.org/publication/

review-of-international-best-practices-in-accessible-public-transportationfor-persons-withdisabilities, accessed 20 April 2022).

231. Priority seats for the elderly in public transportation [website]. Geneva: World Health Organization; 2021 (https://extranet.who.int/agefriendlyworld/priority-seats-for-the-elderly-in-public-transportation/, accessed 20 April 2022).

232. Transportation [website]. Geneva: World Health Organization (https://extranet.who.int/agefriendlyworld/age-friendly-practices/transportation/, accessed 20 April 2022).

233. Access to transportation by people with disabilities. Illustrations of implementation from the United States – Quick reference. Washington DC: National Council on Disability; 2005 (https://www.ncd.gov/ publications/2005/08022005-AccessTr, accessed 20 April 2022).

234. Delivering disability inclusive infrastructure in low-income countries. London: Infrastructure and Cities for Economic Development; 2019 (http://icedfacility.org/wp-content/uploads/2019/07/ICED_DII_LICs.pdf, accessed 20 April 2022).

235. The seven principles [website]. Dublin: Centre for Excellence in Universal Design, National Disability Authority (NDA) (https://universaldesign.ie/ what-is-universal-design/the-7-principles/, accessed 20 April 2022).

236. Rick Hansen Foundation Accessibility Certification. Cost comparison feasibility study. Richmond: Rick Hansen Foundation; 2020 (https://www.rickhansen.com/sites/default/files/downloads/20200115-rhfac-finalreport-full-v3.pdf, accessed 20 April 2022).

237. The business case for digital accessibility. Cambridge: Web Accessibility Initiative; 2018 (https://www. w3.org/WAI/business-case/, accessed 20 April 2022).

238. Vicente K. The human factor: Revolutionizing the way people live with technology. Toronto: Random House of Canada; 2004.

239. Lim Y, Giacomin J, Nickpour F. What Is Psychosocially Inclusive Design? A Definition with Constructs, The Design Journal. 2021;24(1):5–28. doi:10.1080/14606925.2020.1849964.

240. Phillips B, Zhao H. Predictors of assistive technology abandonment. Assistive Technology. 1993;5(1):36–45. doi:10.1080/10400435.1993.10132205.

241. Spinelli G, Massimo M, Martin W. Objects of desire and of disgust: Analysis and design of assistive technologies. In: Christer K, Craig C, Wolstenholme D (eds.). Proceedings of the 5th International Conference on Design4Health; Sheffield, United Kingdom. 4th – 6th September 2018. Vol. 2 (http://bura.brunel.ac.uk/handle/2438/16681, accessed 20 April 2022.

242. Sumner J, Lin SC, Bundele A, Yee WL. Co-designing technology for aging in place: A systematic review. The Gerontologist. 2021;61(7):e395–e409. doi:10.1093/geront/gnaa064.

243. Ollevier A, Aguiar G, Palomino M et al. How can technology support ageing in place in healthy older adults? A systematic review. Public Health Reviews. 2020;41:26. doi:10.1186/s40985-020-00143-4.

244. Vanderwal L, Rautiainen R, Kuye R, Peek-Asa C, Cook T, Ramirez M et al. Evaluation of longand shorthandled hand hoes for land preparation, developed in

a participatory manner among women vegetable farmers in The Gambia. Applied Ergonomics. 2011;42(5):749–756. doi:10.1016/j.apergo.2010.12.002.

245. McDonald SS, Levine D, Richards J, Aguilar L. Effectiveness of adaptive silverware on range of motion of the hand. PeerJ. 2016;4:e1667. doi:10.7717/peerj.1667.

246. Pullin G. Design meets disability. Cambridge: MIT Press; 2011.

247. Eone [website] (https://www.eone-time.com/pages/our-story#inclusive-design, accessed 20 April 2022).

248. Why makers making change [website]. Burnaby: Makers Making Change; 2022 (https://makersmakingchange.com/, accessed 20 April 2022).

249. Hackability [website]. Torino: Hackability; 2022 (http://www.hackability.it, accessed 20 April 2022).

250. Layton NA, Steel EJ. An environment built to include rather than exclude me: Creating inclusive environments for human well -being. International Journal of Environmental Research and Public Health. 2015;12:11146–11162.

251. Signage. In: International health facility guidelines. Sydney: Total Alliance Health Partners International; 2015 (https://healthfacilityguidelines.com/ ViewPDF/ViewIndexPDF/iHFG_part_c_signage, accessed 20 April 2022).

252. For example, Photosymbols: www.photosymbols.com (accessed 20 April 2022).

253. Carnemolla P, Bridge C. A scoping review of home modification interventions – Mapping the evidence base. Indoor and Built Environment. 2020;29(3):299–310.

254. Gitlow L. Assessments of context: Physical. In Asher I (ed.), Asher's Assessment Tools: An Annotated Index, 4th edition. Bethesda: American Occupational Therapy Association; 2014.

255. Rogers E. Diffusion of innovations (5th edition). New York: Free Press; 2013.

256. Cognitive accessibility — Part 1: General guidelines (ISO 21801-1:2020). Geneva: International Organization for Standardization; 2020 (https://www.iso.org/obp/ui#iso:std:iso:21801:-1:ed-1:v1:en, accessed 20 April 2022).

257. Health care and the Americans With Disabilities Act. Seattle: ADA National Network (https://adata.org/ factsheet/health-care-and-ada, accessed 20 April 2022).

258. Gudlavalleti MVS, John N, Allagh K et al. Access to health care and employment status of people with disabilities in South India, the SIDE (South India Disability Evidence) study. BMC Public Health. 2014;14:1125. doi:10.1186/1471-245814-1125.

259. Iezzoni LI, Rao SR, Ressalam J, Bolcic-Jankovic D, Agaronnik ND, Donelan K, Lagu T, Campbell EG. Physicians' perceptions of people with disability and their health care. Health Affairs. 2021;40(2):297–306. doi:10.1377/ hlthaff.2020.01452.

260. Sermsuti-Anuwat N, Pongpanich S. Perspectives and experiences of Thai adults using wheelchairs regarding barriers of access to dental services: a mixed methods study. Patient Preference and Adherence. 2020:1461b+. doi:10.2147/PPA.S174071.

261. Signage. In: International health facility guidelines. Sydney: Total Alliance Health Partners International; 2015 (https://healthfacilityguidelines.com/ ViewPDF/ ViewIndexPDF/iHFG_part_c_signage, accessed 20 April 2022).

262. Accessible medical examination tables and chairs. Seattle: ADA National Network (https://adata.org/factsheet/accessible-medical-examination-tables-and-chairs, accessed 20 April 2022).

263. Web Accessibility Evaluation Tools List. Cambridge: Web Accessibility Initiative; 2020 (https://www.w3.org/WAI/ER/tools/, accessed 20 April 2022).

264. Borg J, Lantz A, Gulliksen J. Accessibility to electronic communication for people with cognitive disabilities: a systematic search and review of empirical evidence. Universal Access in the Information Society. 2014;14(4):547–562. doi:10.1007/s10209-014-0351-6.

265. Digital Accessibility: Cognitive. Boston: Harvard University; 2022 (https://accessibility.huit.harvard.edu/disabilities/cognitive, accessed 20 April 2022).

266. Fischer ME, Cruickshanks KJ, Schubert CR, Pinto AA, Carlsson CM, Klein BE et al. Age-related sensory impairments and risk of cognitive impairment. Journal of the American Geriatrics Society. 2016;64(10):1981–1987. doi:10.1111/jgs.14308.

267. Schubert CR, Cruickshanks KJ, Fischer ME, Chen Y, Klein BEK et al. Sensory impairments and cognitive function in middle-aged adults, The Journals of Gerontology: Series A. 2017;72(8):1087–1090. doi:10.1093/gerona/glx067.

268. Text to speech. Web Accessibility Initiative (WAI). Cambridge: Web Accessibility Initiative; 2022 (https://www.w3.org/WAI/perspective-videos/speech/, accessed 20 April 2022).

269. Assistive technology for memory. Dewar B-K, Kopelman M, Kapur N, Wilson BA. In: O'Neill B, Gillespie A (eds.), Assistive technology for cognition: A handbook for clinicians and developers. Hove: Psychology Press; 2014 (https:// www. researchgate.net/profile/Brian_Oneill6/publication/270217357_Assistive_ Technology_for_Cognition/links/5e318a8f92851c7f7f0a6552/Assistive-Technology-for-Cognition.pdf, accessed 20 April 2022).

270. Watchorn V, Hitch D, Grant C, Tucker R, Aedy K, Ang S, Frawley P. An integrated literature review of the current discourse around universal design in the built environment is occupation the missing link? Disability & Rehabilitation. 2021;43(1):1–12. doi:10.1080/09638288.2019.1612471.

271. The WHO Age-friendly Cities Framework [website]. Geneva: World Health Organization; 2017 (https://extranet.who.int/agefriendlyworld/age-friendly-cities-framework, accessed 20 April 2022).

272. The Mobile Economy. Atlanta: GSMA Intelligence; 2021 (https://www.gsma.com/mobileeconomy/wpcontent/uploads/2021/07/GSMA_MobileEconomy2021_3.pdf, accessed 20 April 2022).

273. Information and communication technologies (ICTs). New York: United Nations Department of Economic and Social Affaird (Poverty) (https://www. un.org/development/desa/socialperspectiveondevelopment/issues/information-and-communication-technologies-icts.html, accessed 20 April 2022).

274. Patrick M, McKinnon I and Austin V. Inclusive design and accessibility in Ulaanbaatar, Mongolia. AT2030 Inclusive Infrastructure Case Studies. Prepared by the Global Disability Innovation Hub and partners for the UK Foreign, Commonwealth and Development Office; 2020. doi:10.13140/RG.2.2.26922.44485.

275. Krotofil J, McPherson P, Killaspy H. Service user experiences of specialist mental health supported accommodation: A systematic review of qualitative studies and narrative synthesis. Health Soc Care Community. 2018;26(6):787–800. doi:10.1111/hsc.12570.

276. Disability at a glance 2019: Investing in accessibility in Asia and the Pacific — Strategic approaches to achieving disability-inclusive sustainable development. Bangkok: United Nations Economic and Social Commission for Asia and the Pacific; 2019 (https://www.unescap.org/publications/disability-glance-2019, accessed 20 April 2022).

277. Welfare technology – Research articles on welfare technology and a summary of ethical aspects (In Swedish). Stockholm: National Board of Health and Welfare; 2017.

278. Kruse CS, Fohn J, Umunnakwe G, Patel K, Patel S. Evaluating the facilitators, barriers, and medical outcomes commensurate with the use of assistive technology to support people with dementia: A Systematic Review Literature. Healthcare. 2020;8(3):278. doi:10.3390/healthcare8030278.

279. Trails, tours, safaris and beaches. Cape Town: Disability Info South Africa (http://disabilityinfosa.co.za/mobility-impairments/accessible-travel-accommodation/tours-safaris-beaches/, accessed 20 April 2022).

280. Right to education: State obligations and responsibilities [website]. Paris: United Nations Educational, Scientific and Cultural Organization (https://en.unesco.org/themes/right-to-education/state-obligations, accessed 20 April 2022).

281. Hunt PF. Inclusive education: The case for early identification and early intervention in assistive technology. Assistive Technology. 2021;33(sup1):S94– S101. doi: 10.1080/10400435.2021.1974122.

282. What is universal design? Buffalo: Center for Inclusive Design and Environmental Access; 2012 (http://idea.ap.buffalo.edu/about/universal-design/, accessed 20 April 2022).

283. Educating the world's most vulnerable children [website]. New York: United Nations Children's Fund USA; 2014 (https://www.unicefusa.org/stories/educating-worlds-most-vulnerable-children/17621, accessed 20 April 2022).

284. Toward inclusive learning spaces: Physiological, cognitive, and cultural inclusion and the learning space rating system [website]. Boulder: Educause; 2020 (https://er.educause.edu/articles/2020/2/towardinclusive-learning-spaces, accessed 20 April 2022).

285. Hume K. Clean up your act! Creating an organized classroom environment for students on the spectrum [website]. Bloomington: Indiana Resource Center for Autism (https://www.iidc.indiana.edu/irca/articles/clean-up-your-act-creating-an-organized-classroom-environment-for-students-on-the-spectrum.html, accessed 20 April 2022).

286. Why use a slant board? [website] OT Toolbox; 2021 (https://www.theottoolbox.com/why-use-slant-board/, accessed 20 April 2022).

287. McKenzie J, Karisa A, Kahonde C, Tesni S. Review of universal design for learning in low- and middleincome countries'. Cape Town: Including Disability in Education in Africa (IDEA); 2021.

288. Education [website]. New York: United Nations Children's Fund; 2021 (https://www.unicef.org/education, accessed 20 April 2022).

289. Shrestha, B.P., Millonig, A., Hounsell, N.B. et al. Review of public transport needs of older people in European context. Population Ageing. 2017;10:343–361. doi:10.1007/s12062-016-9168-9.

290. Home location and approach. Dublin: Centre for Excellence in Universal Design (http://universaldesign.ie/Web-Content-/Section-1-Home-Location-andApproach.pdf, accessed 20 April 2022).

291. Aranda-Jan CB et al. Mobile technologies as assistive technologies in humanitarian and development contexts. 2019 IEEE Global Humanitarian Technology Conference. 17–20 Oct. 2019. Seattle, WA. United States.

292. Landry MD, Van den Bergh G, Hjelle KM, Jalovcic D, Tuntland HK. Betrayal of trust? The impact of the COVID-19 global pandemic on older persons. Journal of Applied Gerontology. 2020;39(7):687–689. doi:10.1177/0733464820924131.

293. Physical and functional rehabilitation in long-standing (long-term) refugee camps. Lyon: Handicap International; 2015 (https://hi.org/sn_uploads/document/PP_RehabLongStandingCamps.pdf, accessed 20 April 2022).

294. The Impact of physical rehabilitation on the lives of persons with physical impairments in Myanmar: Research report. International Centre for Evidence in Disability, London School of Hygiene & Tropical Medicine; 2017 (https://www.lshtm.ac.uk/media/23466, accessed 20 April 2022).

295. Inclusive innovation transforms a standard latrine into a disability-friendly solution. New York: United Nations Children's Fund; 2020 (https://www.unicef.org/supply/stories/inclusive-innovation-transformsstandard-latrine-disability-friendly-solution, accessed 20 April 2022).

296. Inclusive post-disaster reconstruction: Building back safe and accessible for all. Bensheim: CBM International; https://www.cbm.org/fileadmin/user_upload/Publications/16-minimum-requirements-forbuilding-accessible-shelters.pdf, accessed 20 April 2022).