5 Managing Hearing Loss through the Lifespan

Christine Yoshinaga-Itano

Key information for local and national policy and lawmakers

The goal of this chapter is to describe the prevention and treatment of disabling hearing loss. The definition of a disabling hearing loss refers to hearing loss greater than 40 dB in the better hearing ear in adults of 15 years or older, and greater than 30 dB in the better hearing ear in children from birth to 14 years of age (Olusanya, Neumann, & Saunders, 2014). According to the World Health Organization (2016), 60% of hearing loss in children under 15 years of age can be prevented.

The global costs for unaddressed hearing loss are estimated to pose an annual global cost of $750 billion (World Health Organization, 2017a). The significant number of individuals with disabling hearing loss results in costs to health and education systems, with 63–73% of these costs being incurred outside of high-income countries. Governments can develop actions and policies to prevent hearing loss (Kubba, MacAndie, Ritchie, & MacFarlane, 2004; Mackenzie & Smith, 2009; MacQueen, 2012; Olusanya et al., 2014; Smith, 2017; World Health Organization, 1995, 2005, 2017, 2018, 2021a).

The World Health Organization recommends that governments develop policies that integrate ear and hearing care into primary healthcare systems as part of universal health coverage. Therefore, it is important to undertake advocacy to raise awareness among policymakers and civil society, to build capacity to address the human resource gap, and to improve access to hearing devices and communication technologies.

Incidence and prevalence of hearing disabilities

The global prevalence of disabling hearing loss among all ages is estimated to be 8.36% in China/Eastern Europe and Central Asia, followed by South Asia at 7.37%, Asia Pacific at 6.90%, East Asia at 6.85%, and Latin American and Caribbean at 6.18% (WHO 2018a). The prevalence of disabling hearing loss in high-income countries was reported to be 4.57% (Table 5.1).

Thus, the global prevalence of hearing disability is estimated to be 6.1%, consisting of approximately 466 million individuals (World Health Organization, 2018a). There are 432 million (93% of 466 million) adults who have sustained disabling hearing loss, consisting of approximately 242 million males, 190 million females, and approximately 34 million (7%) children. The number of people with disabling hearing loss is estimated to grow over the years, consisting of at least 630 million by 2030 and more than 900

Table 5.1 The prevalence of disabling hearing loss among all ages, in millions and as percentage of population, overall and according to regions (World Health Organization, 2018a).

Selected Regions	*DHL All ages	
	Both sexes	
	millions	prevalence (%)
High-income	46.02	4.57
Central/Eastern Europe and Central Asia	34.57	8.36
Sub-Saharan Africa	49.66	4.55
Middle East and North Africa	16.55	3.17
South Asia	131.67	7.37
Asia Pacific	47.04	6.90
Latin America and Caribbean	40.19	6.18
East Asia	100.76	6.85
World	466.46	6.12

WHO global estimates on prevalence of hearing loss; https://www.who.int/pbd/deafness/WHO_GE_HL.pdf} World Health Organization; [2018]. Licence: CC BY-NC-SA 3.0 IGO.

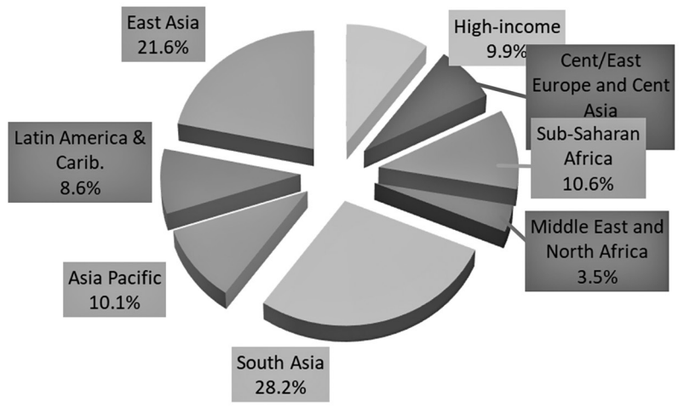

Figure 5.1 The distribution of disabling hearing loss across different regions of the world (World Health Organization, 2018a).

WHO global estimates on prevalence of hearing loss; https://www.who.int/pbd/deafness/WHO_GE_HL.pdf} World Health Organization; [2018]. Licence: CC BY-NC-SA 3.0 IGO.

million in 2050 with one-third of persons 65 and older being affected by disabling hearing loss. Disabling hearing loss is distributed unequally across the world, as shown in Figure 5.1.

The impact of hearing loss

The impact of a hearing loss affects children and adults in different ways. Children with hearing loss may experience the failure to develop spoken language and an inability to engage in conversations and listening to teachers in the classroom which is likely to lead to a significant delay in literacy and writing development. Difficulty learning in a typical classroom can result in difficulty in obtaining employment as adults and can lead to a significant cost to families in accessing specialized education. Adults with hearing loss may face difficulty understanding others in conversation and in noisy environments, leading to problems with social engagement, employment, and wellbeing.

Adults may also face unemployment leading to increased risk of criminal activity and substance abuse. They are more likely to require public assistance for housing and food due to their restricted ability in literacy, writing, and communication. Overall, hearing loss leads to significant effects on quality of life and increases social isolation that impacts on elderly individuals.

Key information for health professionals, social workers, community leaders, and educational practitioners

Identification of individuals with hearing loss

There is a need for health professionals and others to identify children and adults who have a hearing loss. Signs of a hearing loss appear when: listeners need to pay particular attention to understand a speaker; responses may not correspond to the topic of a conversation; individuals may speak too loudly; repetitions are requested; environmental sounds may not be recognized; individuals may avoid or disengage from social situations; individuals may have difficulty hearing in noisy environments; and younger children and older adults may not respond to sound stimuli.

Early hearing detection and intervention (EDHI) should include screening newborns at 1 month, identification of a hearing loss by 3 months followed by enrolment into early intervention services by 6 months. Early hearing detection and intervention for newborn infants is essential as it allows a health professional to provide information and support to parents as well as provide amplification technology for children as early as possible.

Newborn infants require technology to screen for hearing loss through automated auditory brain stem response screening or otoacoustic emission screening (Fligor & Levey, 2019). Identification of hearing loss is essential as it is estimated that 60% of paediatric hearing loss globally is preventable (World Health Organization, 2016). Checklists of auditory skills and language development can screen for typical development, but this approach does not have the same level of validity as technological screening. In

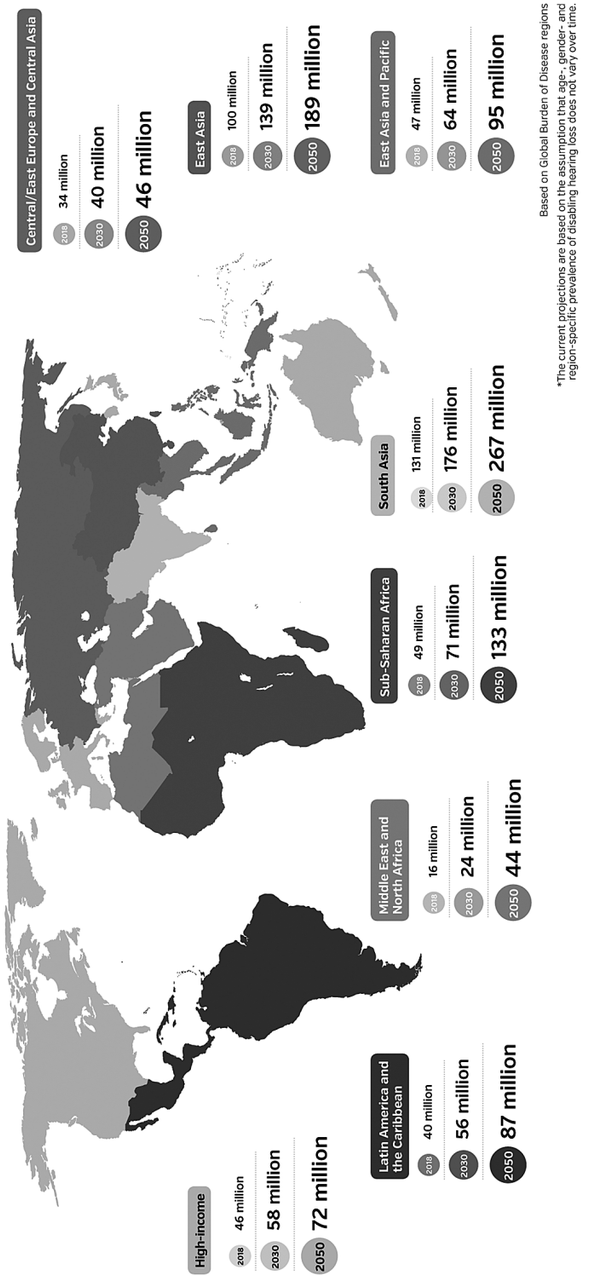

Figure 5.2 The current and projected number of people with hearing loss in different regions (World Health Organization, 2018a).

[WHO global estimates on prevalence of hearing loss; [https://www.who.int/pbd/deafness/WHO_GE_HL.pdf} World Health Organization; [2018]. Licence: CC BY-NC-SA 3.0 IGO.

addition, the health professional can provide information and amplification technology to adults as they develop a hearing loss.

The impact of hearing loss

The impact of hearing loss affects both children and adults. Children with intact hearing abilities from 6 to 36 months of age should be able to respond to their name and respond to environmental sounds (e.g., phone ringing, knocking on a door, footsteps, or vacuum cleaners). Additionally, school-age children with hearing loss may not attend to speakers in class, may have poor behaviour, and may fail to follow directions. Adults are typically aware that their hearing status has changed when they are having difficulty understanding other speakers, the telephone or television. They may also notice increasing difficulty in noisy environments.

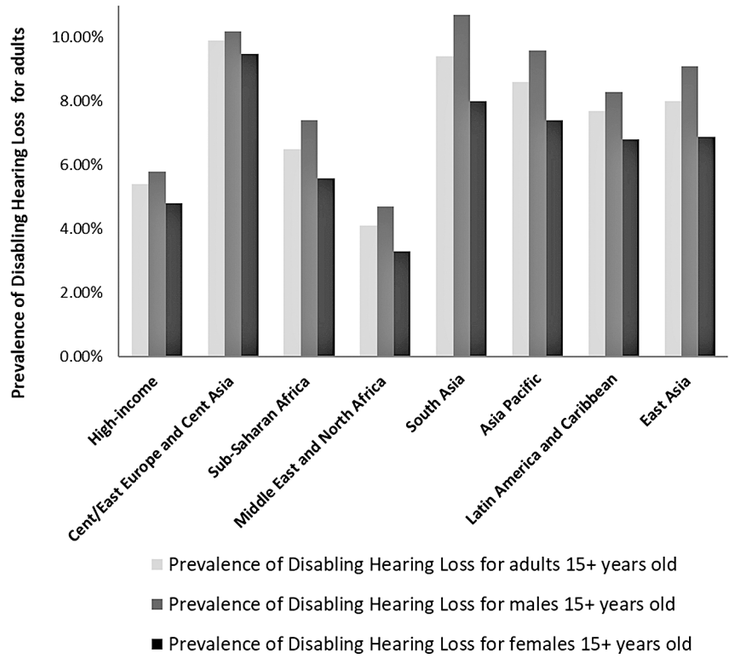

Figure 5.3 The prevalence of disabling hearing loss among adults (males, females and both together) across different world regions (World Health Organization, 2018a).

WHO global estimates on prevalence of hearing loss; https://www.who.int/pbd/deafness/WHO_GE_HL.pdf} World Health Organization; [2018]. Licence: CC BY-NC-SA 3.0 IGO.

Table 5.2 The prevalence of disabling hearing loss across the world for children, adult males and adult females (World Health Organization, 2018a).

Selected Regions	*DHL in children		*DHL in adults			
	Both sexes		Males		Females	
	millions	prevalence (%)	millions	prevalence (%)	millions	prevalence (%)
High-income	0.8	0.5	24	5.8	21	4.8
Central/Eastern Europe and Central Asia	1.2	1.5	16	10.2	17	9.5
Sub-Saharan Africa	8.9	1.9	23	7.4	18	5.6
Middle East and North Africa	1.4	0.9	9	4.7	6	3.3
South Asia	12.2	2.4	70	10.7	50	8.0
Asia Pacific	3.6	2.0	24	9.6	19	7.4
Latin America and Caribbean	2.6	1.6	20	8.3	17	6.8
East Asia	3.3	1.3	56	9.1	41	6.9
World	34.1	1.7	242	8.5	190	6.7

World Hearing Day, 2018, Hear the Future. https://www.who.int/news-room/events/detail/2018/03/03/default-calendar/world-hearing-day-2018-hear-the-future: World Health Organization; [2018]. Licence: CC BY-NC-SA 3.0 IGO.

The importance of identification

Once a hearing loss is determined, it is important to refer individuals with disabling hearing loss to habilitation/rehabilitation services that teach children and adults how to communicate successfully by compensating with utilizing auditory/spoken signals, lipreading, visual language, or combined methods, and general audiological management. Children with hearing loss can fall behind their peers in school and have difficulty in social interaction with other children. Adults with hearing loss may have occupational difficulties in addition to difficulties in social interaction.

What to do when a hearing loss has been identified

Permanent disabling moderate-to-severe hearing loss is likely to benefit from technology, either hearing aids or cochlear implants. Obviously, this is dependent upon personal parental/adult choice. Audiologists can offer amplification technology (hearing aids) and assist with teaching adaptation and how to use these appropriately.

Referral for medical management is another important approach to consider. Medical management will depend upon determination of the cause of hearing loss (e.g., noise exposure, ototoxicity, virus, or genetics) and may involve treatment which may include middle ear effusion (fluid), removing wax, tube insertion, antibiotics, surgery and/or medication.

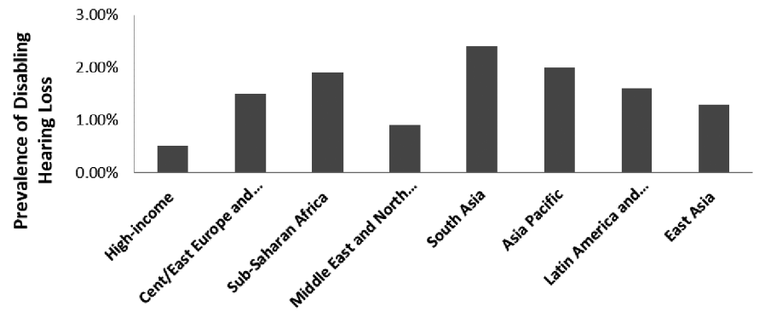

Figure 5.4 The prevalence of hearing loss in children (0–15 years) across all regions (World Health Organization, 2018a).

WHO global estimates on prevalence of hearing loss; https://www.who.int/pbd/deafness/WHO_GE_HL.pdf} World Health Organization; [2018]. Licence: CC BY-NC-SA 3.0 IGO.

How to help and support individuals with hearing loss

Healthcare professionals can provide screening to determine the presence of a hearing loss, using techniques to assess infants and children. Professionals can also play a role in the prevention of hearing loss by educating the public on the risks of hearing loss, referring patients for tests or treatment, monitoring patients taking ototoxic medicines, and providing support for those who need hearing devices or sign language. Unmanaged ear infections can cause permanent disabling hearing loss (Avnstorp, Homøe, Bjerregaard, & Jensen, 2016; Bluestone, 1996).

In early childhood, approximately 80–90% of children experience chronic otitis media before school age (Danishyar & Ashurst, 2021). Prevention of ear infections include the need to eliminate tobacco smoke within the child's environment, the control of allergies, the prevention of upper respiratory tract infections, and the need for physicians to check for enlarged adenoids that are often accompanied by mouth breathing and snoring.

It has been found that ototoxic hearing loss can be avoided by reducing or eliminating the prescription of antibiotics except in life threatening circumstances since over-prescription has been found to lead to hearing loss (Wilson, Tucci, Merson, & O'Donoghue, 2017).

Noise induced hearing loss (NIHL) is the second most common cause of adults' hearing impairment and frequently occurs in the workplace (Arenas & Suter, 2014; Caroll et al., 2017; Centers for Disease Control, 2017; Verbeek et al., 2014). NIHL can result from a single loud sound (e.g., explosion) or as a result of long-term exposure to loud sounds. Some countries have implemented policies to prevent occupational noise induced hearing loss. The use of protective devices and regular audiological monitoring can reduce this risk. Another source of NIHL is exceeding safe listening levels by users of personal listening devices (Fligor, Levey, & Levey, 2014). Over a

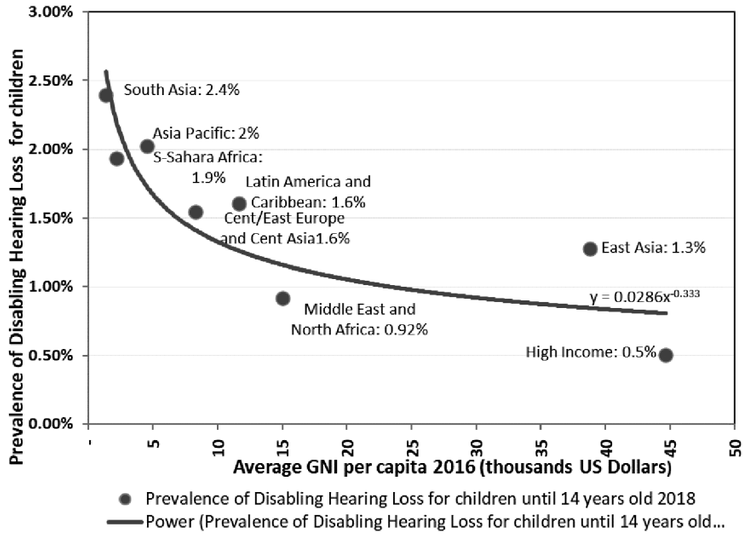

Figure 5.5 Showing that, in children, the prevalence of hearing loss decreases exponentially with an increase in national income (World Health Organization, 2018a).

WHO global estimates on prevalence of hearing loss; https://www.who.int/pbd/deafness/WHO_GE_HL.pdf} World Health Organization; [2018]. Licence: CC BY-NC-SA 3.0 IGO.

billion young people are at risk of hearing loss due to the way they listen to music on personal music players, in entertainment venues (concerts, sporting events, bars). Increasing awareness and appropriate legislation can reduce this risk.

Information for professionals working with individuals with hearing loss

It is predicted that, by 2050, 900 million people across the globe will have a disabling hearing loss (World Health Organization, 2018a). The possibility of hearing loss can be avoided or ameliorated through prevention and timely and appropriate interventions. However, it has been noticed that the chance of infections that affect hearing is greater in low resource environments.

At least 30% of hearing loss in children is caused by disease (e.g., measles, mumps, rubella, meningitis, and ear infection) and complications associated with birth (e.g., prematurity, low birth weight, asphyxia, neonatal jaundice, and the use of ototoxic medication for mothers and newborns). Ototoxicity occurs through chemicals or medications that can affect the inner ear function, the cochlea, and the vestibulo-cochlear nerve**.** Risk factors for hearing loss consist of genetics and the lack of immunization for maternal and childhood infections (Cheffins et al., 1998; Fortnum & Davis, 1993; Fowler et al., 1997; Gao et al., 2013; Klein, Koedel, Pfister, & Kastenbauer, 2003). As previously stated, other factors include the need to protect children from ear infections, exposure to excessive noise, and ototoxicity.

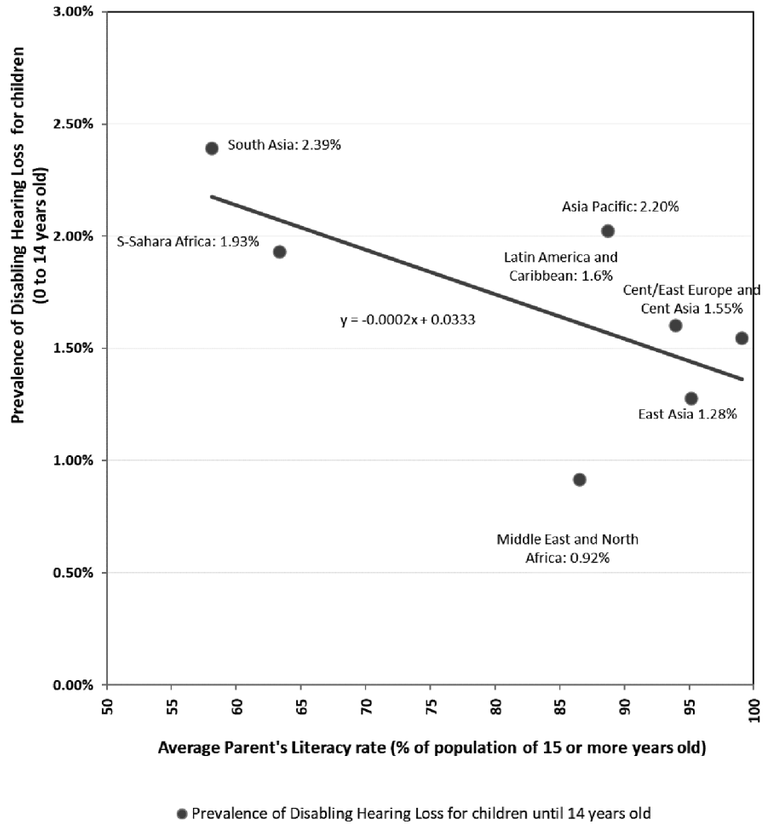

Figure 5.6 The prevalence of disabling hearing loss for children by parent's literacy rate (World Health Organization, 2018a).

World Hearing Day, 2018, Hear the Future.[https://www.who.int/news-room/events/detail/2018/03/03/default-calendar/world-hearing-day-2018-hear-the-future: World Health Organization; [2018]. Licence: CC BY-NC-SA 3.0 IGO.

Assessment of hearing loss

There is a need to increase screening for hearing loss for newborns, children, and adults, particularly in low- and middle-income countries. Screening for hearing loss in infants requires otoacoustic emissions and automated auditory brain stem response technology. App-based hearing tests for screening are available for screening older children and adults. If the results of a screening test indicate the possibility of hearing loss it should be followed up with full diagnostic audiologic assessment that may include air and bone conduction thresholds, otoacoustic emissions, tympanometry

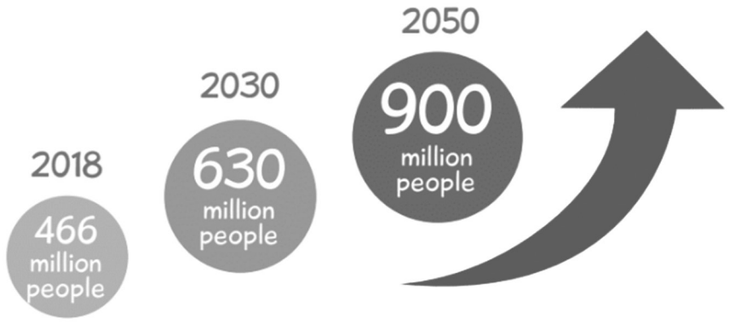

Figure 5.7 (Hear the Future, 2018).

WHO World Hearing Day, 2018, Infographic; https://www.who.int/docs/default-source/documents/world-hearing-day-2018-infographic.pdf?sfvrsn=54ccef8d_12}; World Health Organization; [2018]. Licence: CC BY-NC-SA 3.0 IGO.

(immittance, reflex), and speech testing. Examples of audiological assessment consist of the following (Fligor & Levey, 2019):

- Conventional audiometry (age 4 or 5): The child is asked to raise a hand or push a button every time he or she hears a tone.
- Conditioned play audiometry (CPA) (ages 2 to 5): The child is shown, nonverbally, how to wait, listen, and/or perform a repetitive play task, such as placing a peg in a pegboard every time they hear a tone.

Physiologic measures are also used in pediatric audiology. For example, tympanometry tests the movement of the eardrum which can indicate the presence of an ear infection or another problem in the middle ear. Older individuals may be assessed using a pure-tone audiogram. The pure-tone audiometry is a behavioral test used to measure hearing sensitivity. This measure involves assessment of both the peripheral and central auditory systems.

The importance of the identification of hearing loss

Important factors consist of screening and identifying hearing loss, establishing technology intervention and establishing rehabilitative intervention services to reduce the impact of hearing loss on communication and quality of life. It is essential to establish screening programmes for those at high risk. High risk populations include newborns, schoolchildren, and older adults. Other important approaches include the development of ear and hearing care services for people with hearing loss or ear diseases, making hearing devices available, and promoting communication through spoken language, sign language, and literacy materials. These approaches are essential

to assist in the prevention of hearing loss and depend on support from policymakers and health professionals.

Resources to assist when a hearing loss has been identified

When amplification technology is not available or not tolerated, habilitation/rehabilitation can provide people with the ability to communicate through lipreading, visual language, and visual supports such as captioning materials to provide communication. Other approaches involve developing rehabilitative intervention protocols, identifying financing, personnel, and training.

Referral to family-centered early intervention (FCEI) for families with children who are deaf or hard of hearing and which include information about family-to-family support may be useful. Furthermore, referral to services such as the Deaf Leadership International Alliance (2021) for information about deaf/hard of hearing leaders, advocates, mentors, and sign language instructors may be helpful.

Other guidelines are available from the American Academy of Audiology (2021). It is important to avoid restricting re/habilitative intervention protocols solely to spoken language approaches since amplification technology may not be available and people with hearing loss can benefit from visual language and support.

A key factor in the prevention of hearing loss

Professionals can also act as advocates in the prevention of hearing loss. For example, it is important to advocate for resources for hearing care with policymakers, opinion leaders and the media to improve awareness and promote behavioral change campaigns aimed at reducing noise and to advocate for government screening and awareness programmes.

Screening programmes can be developed for the identification of hearing loss in newborns, preschool and school-aged children and adults, including financing, personnel, training, and roll-out plans. It is important that healthcare professionals in low- and middle-income countries establish screening programmes for the detection of hearing loss. It is also important to be aware of existing available resources, such as trained audiologists and ear, nose, and throat (ENT) physicians, in order that individuals requiring these services can be directed to them (Goulious & Patuzzi, 2008; McPherson & Brouillette, 2008).

The World Health Organization (2021b) reports that 78% of low-income countries have fewer than one ENT specialist per million population, and 93% have fewer than one audiologist per million. The number of audiologists ranges from 0–5 per million people (in Taiwan, Botswana, Saudi Arabia, Germany, Spain, Italy, Switzerland, Norway, Madagascar, Nigeria, Mali, Myanmar, India, Laos, Bangladesh, Pakistan, Cambodia, Indonesia, Nicaragua, Libya, Egypt, Guatemala, Phillippines, Jordan, Namibia, Dominican Republic, Tonga, Thailand and Romania), to 5–25 audiologists (South Africa, Portugal, Ireland, Hong Kong, Russia, Mexico, Chile, Croatia, Mexico, Singapore, and the Netherlands), to 30–80 audiologists per million persons (Israel, Sweden, Australia, USA, Belgium, New Zealand, UK and Canada). The number of ENTs range from 0–10

per million in a similar group of countries with the lowest number of audiologists to 30–90 ENTs (Lithuania, Slovak Republic, Italy, Austria, Denmark, Norway, Sweden, Croatia, Spain, Belgium, Germany, Mexico, France, Poland, Brazil, Slovenia, USA).

It is important to become familiar with existing resources and consider how to support and extend these. Identification of financing, equipment needs, and training of personnel is vital for the development of successful programmes which can be accessed by increased numbers of the population. It is also essential to develop sites capable of audiologic diagnostic evaluations that follow evidence-based approaches. Other factors include the development of amplification protocols, equipment needs, and training health professionals.

There are over 400 million people across the globe who have the need for hearing aids. However, at least 83% of this population do not use hearing aids (Orji, Kamenov, Dirac, Davis, Chada, & Vos, 2020). There is a higher percentage (90%) who do not use hearing aids in African regions. This is not just a problem in low- and middle-income countries. Even in the U.S., only 33% of people who could benefit from a hearing aid have one. It has been estimated that if every single prevalent case in need would use a hearing aid, the burden of disease in this population would be reduced by 59% from the untreated 25 million individuals living with disabilities to 10.3 million of those living with disabilities. This would represent a reduction from 83% to 59%.

Recommended websites offering information on the prevention of hearing loss

There are available websites that provide information on prevention of hearing loss offered by the World Health Organization (2021c). These sites offer information on deafness, prevention of hearing loss, and address frequently-asked questions; the American Academy of Audiology Guidelines and Standards (2021) offers guidelines and standards; the International Society of Audiology (2021) offers information for professionals; the World Health Organization (2002) offers a manual for primary health workers; and the Joint Commission on Infant Hearing (2021) offers information on infant hearing.

Discussion

Hearing loss has a major impact on infants and children since it will affect their speech and language development, educational attainment, social development and is likely to have an impact on employment opportunities later in life. Early identification is an important responsibility of all of those who work with children and families. Promoting the need for appropriate screening and assessment is important and should lead to positive ongoing support and rehabilitation provided through specialist services and informed health, education and social workers.

Adults acquiring a hearing loss may have difficulty in their employment. In addition, there may be a reluctance to engage in social interaction. This has the potential to lead to social isolation. Governments, both national and local, need to promote public awareness of hearing loss and prevention. All efforts should be made to ensure that legislation is in place to reduce incidence of preventable hearing loss and support investment in technologies and therapies which can identify and remediate hearing difficulties.

References

American Academy of Audiology Guidelines and Standards (2021). Available at https://www.audiology.org/publications/guidelines-and-standards

Arenas, J. & Suter, A. (2014). Comparison of occupational noise legislation in the Americas: An overview and analysis. *Noise and Health*, *16*(72), 306–319.

Avnstorp, M.B., Homøe, P., Bjerregaard, P., & Jensen R.G. (2016). Chronic suppurative otitis media, middle ear pathology and corresponding hearing loss in a cohort of Greenlandic children. *International Journal of Pediatric Otorhinolaryngology*, *83*, 148–153.

Bluestone, C.D. (1996). Epidemiology and pathogenesis of chronic suppurative otitis media: Implications for prevention and treatment. *International Journal of Pediatric Otorhinolaryngology*, *42*, 207–223.

Carroll, Y.I., Eichwald, J., Scinicariello, F., Hoffman, H.J., Deitchman, S., Radke, M.S., Themann, C.L., & Breysse, P. (2017). Vital signs: Noise-induced hearing loss among adults — United States 2011–2012. Centers for Disease Control and Prevention. Available at https://www.cdc.gov/mmwr/volumes/66/wr/mm6605e3.htm

Centers for Disease Control and Prevention (2017). Too loud! For too long! Loud noises damage hearing. Available at https://www.cdc.gov/vitalsigns/hearingloss/index.html

Cheffins, T., Chan, A., Keane, R.J., Haan, E.A., & Hall, R. (1998). The impact of rubella immunisation on the incidence of rubella, congenital rubella syndrome and rubella-related terminations of pregnancy in South Australia. *British Journal of Obstetrics and Gynaecology*, *105*(9), 998–1004.

Danishyar, A. & Ashurst, J.V. (2021). Acute otitis media. *National Library of Medicine.* Available at https://pubmed.ncbi.nlm.nih.gov/29262176/

Deaf Leadership International Alliance (2021). Available at https://dlia.commons.gc.cuny.edu/

Fligor, B.J. & Levey, S. (2019). Language development and hearing. In S. Levey (Ed.), *Introduction to Language Development*, 2nd ed., pp.227–273. San Diego, CA: Plural.

Fligor, B.J., Levey, S., & Levey, T. (2014). Cultural and demographic factors influencing noise exposure estimates from use of portable listening devices in an urban environment. *Journal of Speech, Language, and Hearing Research*, *58*, 1–13.

Fortnum, H. & Davis, A. (1993). Hearing impairment in children after bacterial meningitis: Incidence and resource implications. *British Journal of Audiology*, *27*(1), 43–52.

Fowler, K.B., McCollister, F.P., Dahle, A.J., Boppana, S., Britt, W.J., & Pass, R.F. (1997). Progressive and fluctuating sensorineural hearing loss in children with asymptomatic congenital cytomegalovirus infection. *The Journal of Pediatrics*, *130*(4), 624–630.

Gao, Z., Wood, J.G., Burgess, M.A., Menzies, R.I., McIntyre, P.B., & MacIntyre, C.R (2013). Models of strategies for control of rubella and congenital rubella syndrome: A 40 year experience from Australia. *Vaccine*, *31*(4), 691–697.

Goulios, H. & Patuzzi, R.B. (2008). Audiology education and practice from an international perspective. *International Journal of Audiology*, *47*(10), 647–664.

Hearing First (2021). Every day, children with hearing loss are learning to listen, talk, and thrive. Available at https://www.hearingfirst.org/https://www.hearingfirst.org/

International Society of Audiology (2021). Available at www.nhsp.info

Joint Commission on Infant Hearing (2021). Available at www.jcih.org

Klein, M., Koedel, U., Pfister, H.W., Kastenbauer, S. (2003). Meningitis-associated hearing loss: Protection by adjunctive antioxidant therapy. *Annals of Neurology*, *54*(4), 451–458. doi: 10.1002/ana.10684

Kubba, H., MacAndie, C., Ritchie K., & MacFarlane, M. (2004). Is deafness a disease of poverty? The association between socio-economic deprivation and congenital hearing impairment. *International Journal of Audiology*, *43*(3), 123–125.

Mackenzie, I. & Smith, A. (2009). Deafness: The neglected and hidden disability. *Annals of Tropical Medicine and Parasitology*, *103*, 565–571.

MacQueen, K. (2012). Deafness and diminished hearing are rampant in the North. Available at https://www.macleans.ca/society/health/hard-of-hearing/

McPherson, B. & Brouillette, R. (2008). *Audiology in Developing Countries*. New York, N.Y.: Nova Science Publishers.

Olusanya, B.O., Neumann, K.J., & Saunders, J.E. (2014). The global burden of disabling hearing impairment: A call to action. *Bulletin of the World Health Organization*, *92*, 367–373.

Orji, A., Kamenov, K., Dirac, M., Davis, A., Chada, S., & Vos, T. (2020). Global and regional needs, unmet needs and access to hearing aids. *International Journal of Audiology*, *59*(3), 166–172.

Pascolini, D. & Smith, A. (2009). Hearing impairment in 2008: A compilation of available epidemiological studies. *International Journal of Audiology*, *48*, 1–13.

Smith, A. (2017). Public health planning for hearing impairment. *ENT and Audiology News, 26*(5). Available at https://www.entandaudiologynews.com/features/audiology-features/post/public-health-planning-for-hearing-impairment

Verbeek, J.H., Kateman, E., Morata, T.C., Dreschler, W.A., & Mischke, C. (2014). Interventions to prevent occupational noise-induced hearing loss: A Cochrane systematic review. *International Journal of Audiology*. Available at https://www.tandfonline.com/doi/full/10.3109/14992027.2013.857436

Wilson, B., Tucci, D., Merson, M., & O'Donoghue, G. (2017). Global hearing health care: New findings and perspectives. *Lancet*, *390*, 2503–2515.

World Health Organization (1995). WHA48.9 Prevention of hearing impairment. The Forty-eighth World Health Assembly. Available at https://www.who.int/pbd/publications/wha_eb/wha48_9/en/

World Health Organization (2002). Occupational health: A manual for primary health care workers. Available at https://www.who.int/occupational_health/publications/emhealthcarework/en/

World Health Organization (2005). World Health Assembly resolution WHA58.23 on disability, including prevention, management and rehabilitation. Available at https://www.who.int/disabilities/publications/other/wha5823/en/

World Health Organization (2013). Multi-country assessment of national capacity to provide hearing care. Available at https://www.who.int/pbd/publications/WHOReportHearingCare_Englishweb.pdf

World Health Organization (2016). Childhood hearing loss. Available at https://www.who.int/pbd/deafness/world-hearing-day/WHD2016_Brochure_EN_2.pdf

World Health Organization (2017a). Global costs of unaddressed hearing loss and cost-effectiveness of interventions. Available at https://apps.who.int/iris/bitstream/handle/10665/254659/9789241512046-eng.pdf;jsessionid=8D2D5C7324A289180E412FFD66F2E7A6?sequence=1

World Health Organization (2017b). Prevention of deafness and hearing loss. Available at https://apps.who.int/gb/ebwha/pdf_files/WHA70/A70_R13-en.pdf?ua=1

World Health Organization (2018a). WHO global estimates of prevalence of hearing loss. Available at http://www.who.int/pbd/deafness/estimates/en/

World Health Organization (2018b). Addressing the rising prevalence of hearing loss. Available at https://apps.who.int/iris/bitstream/handle/10665/260336/9789241550260-eng.pdf?sequence=1&isAllowed=y

World Health Organization (2018c). The prevalence of disabling hearing loss in children versus parents' literacy rates. Available at https://slide-to-doc.com/who-global-estimates-on-prevalence-of-hearing-loss

World Health Organization (2021a). Executive summary: World report on hearing. Available at https://cdn.who.int/media/docs/default-source/documents/health-topics/deafness-and-hearing-loss/world-report-on-hearing/wrh-executive-summary.en.pdf?sfvrsn=feb8d533_30&download=true

World Health Organization (2021b). WHO: 1 in 4 people projected to have hearing problems by 2050. Available at https://www.who.int/news/item/02-03-2021-who-1-in-4-people-projected-to-have-hearing-problems-by-2050