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Health education interventions for individuals with visual or hearing impairment: a scoping review

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Abstract

Background Visual impairment refers to a deficiency in one or more functions of the visual system, while hearing impairment refers to a loss of auditory function, defined either by its impact on communication and daily activities or by clinical thresholds of hearing ability. Individuals with these disabilities encounter various challenges including limited educational opportunities, restricted access to academic resources, and delays or shortages of support services. This study aimed to provide data for improving the health and well-being of individuals with visual or hearing impairments by analyzing health education interventions using classification criteria of the International Classification of Functioning, Disability and Health (ICF).

Methods The scoping review followed Arksey and O'Malley's methodology and adhered to Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews guidelines, organizing research questions by population, concepts, and contexts. Data included studies on health education interventions for individuals with visual or hearing impairments, sourced from Cochrane, Ovid MEDLINE, and Google Scholar. A specific search strategy with relevant keywords was used. The selection focused on intervention studies evaluating the effects of the intervention for these individuals globally. Two researchers independently reviewed full-text articles and extracted data into a standardized table, with results summarized using descriptive statistics.

Results The literature search identified 3,168 articles, 34 of which were selected for analysis (19 concerned individuals with visual impairments, while 15 studies concerned individuals with hearing impairments). Health education interventions for the visually impaired mainly focused on skill acquisition and development, primarily delivered through face-to-face sessions. Healthcare providers predominantly facilitated these interventions within healthcare institutions. Similarly, health education interventions for the hearing impaired primarily focused on acquisition and development, mainly through face-to-face interactions. The dropout rate in the interventions ranged from 0% to approximately 50%. Outcome variables included physical function, psychosocial factors, behavior-related variables, and knowledge-related variables derived from the ICF in both cohorts.

Conclusions This scoping review presented an examination of tailored health education interventions for individuals with visual or hearing impairments. Delivered largely through face-to-face sessions by healthcare providers, these interventions focused on skill acquisition and development, addressing physical function, psychosocial factors,

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behavior-related changes, and knowledge improvements. The wide range of dropout rates revealed barriers such as accessibility and sustainability. These findings emphasize the need for innovation and targeted strategies to improve the effectiveness and inclusivity of health education programs.

Keywords Health education programs, Hearing loss, Visually impaired persons, Scoping review, Intervention

Background

Disability is a significant global public health concern, accorded high priority by the World Health Organization (WHO) across domains encompassing public health, human rights, and developmental endeavors [1]. Notably, among the spectrum of disabilities, the prevalence of hearing and visual impairments progressively increases with advancing age [2, 3]. As of 2021, over 2.2 billion people worldwide were visually impaired [4], while more than 466 million people were hearing impaired [5]. The term "disability" encompasses the physical, social, or attitudinal challenges faced by those with hearing loss [5]. The International Classification of Functioning, Disability and Health (ICF) accounts for the environmental influencing factors of these challenges. Individuals with hearing thresholds above 20 dB may experience "difficulty hearing" or "deafness," depending on the severity. A threshold over 95 dB indicates complete hearing loss; the WHO has a standardized grading system to report the severity of hearing loss [5].

Visual impairment results from ocular diseases that affect one or more components of the visual system and its associated functions [4]. While there have been significant advancements in the understanding and definition of visual impairment over recent decades, clinical assessments frequently include additional visual functions such as visual field, contrast sensitivity, and color vision [4]. Conversely, population-based surveys generally assess visual impairment based solely on visual acuity, classifying its severity into categories such as mild, moderate, or severe distance vision impairment or blindness, and near vision impairment [4].

Hearing impairment refers to a loss of auditory function that may range from mild to profound, defined either by its impact on communication and daily life or by clinical thresholds of hearing ability assessed in decibels [5]. Dual sensory loss, often resulting from genetic conditions such as Usher's syndrome or prenatal factors such as rubella or cytomegalovirus infections, can also stem from birth-related complications such as hypoxia or hyperbilirubinemia, as well as childhood diseases such as meningitis. Subsequently acquired dual sensory loss, in various degrees of severity in relation to both vision and hearing acuity, is associated with aging and prevalent in older adults. Individuals with dual sensory loss may experience significant challenges in communication, mobility, and accessing information, as both sight and hearing are critical for interpreting the environment [6].

In 2018, the World Federation of the Deafblind (WFDB) conducted a global study on visual or hearing impairments, surveying 22 countries [7]. The study showed that 0.2% of the global population were living with severe impairments in both senses, while 2.1% were living with mild impairments [7]. Furthermore, the study highlighted a significant age-related increase in the prevalence of both visual or hearing impairments, escalating from less than 0.1% among individuals under 40 to 6% among those aged 75 and older [7]. The data also revealed a marginally higher prevalence of these impairments among women compared with men [7].

Visual or hearing impairments can hinder the ability to perform simple tasks such as listening, writing, reading, engaging in whispered conversations, and recognizing facial expressions [8]. Furthermore, the co-occurrence of visual or hearing impairments exacerbates challenges in functional tasks, increases the risk of communication and cognitive impairment, and complicates the learning process [9, 10]. Individuals affected by these conditions often experience the early onset of chronic diseases owing to compromised health conditions and encounter significant barriers to accessing healthcare services and rehabilitation facilities [11].

Empowering patients with disabilities or chronic conditions to self-manage their health enhances their overall quality of life and improves health-related outcomes [12]. However, facilitating effective patient self-management requires multifaceted support across diverse domains [13]. Moreover, individuals with disabilities require tailored interventions that consider their unique characteristics, particularly considering their underutilization of services, such as health education or healthcare facility visits [14]. Health professionals with expertise in medical care, rehabilitation, and ancillary services play a pivotal role in assessing the health status of individuals with disabilities, elucidating the underlying causes of disabilities and diseases, and administering the requisite treatment [15]. Healthcare professionals can help people with visual or hearing impairments acquire health-related knowledge, manage their health, and improve their well-being through health education interventions/initiatives [16].

To effectively implement health education interventions for individuals with disabilities, it is essential to consider various factors. These include adapting educational methodologies to the degree and characteristics of the disability, providing customized programs equipped with the necessary information and skills for specific

services, and the sensitivity and educational awareness of health personnel [17]. Considering the diverse characteristics of disabilities and the unique challenges presented by individuals with disabilities, existing research on health education interventions for people with disabilities can be inherently complex. This complexity tends to result in individuals with disabilities receiving lower-quality health services compared to those without disabilities, leading to various health-related issues [17].

People with disabilities, such as those with chronic diseases, require ongoing management and complex treatment [1], which can be challenging to achieve through medical services [2]. Murtagh analyzed 22 studies examining how health management systems can enhance chronic disease management among patients with diabetes, obstructive pulmonary disease, and Parkinson's disease. This analysis, employing a scoping literature review approach, suggested avenues for improving health outcomes based on future population needs [18]. Agarwal et al. reviewed 65 studies on mobile health applications supporting chronic disease management using a scoping literature review method. There was no single framework identified that encompasses all dimensions of mobile health apps, but future evaluation methods could benefit from a more specific approach that balanced standardized quality criteria with the specific needs of various types of health apps [19].

The WHO established the ICF to provide a unified framework for understanding and categorizing functioning and disability [20]. The ICF offers consistent terminology and a theoretical foundation for evaluating health and disability, with dynamic interventions highlighted within health conditions, environmental effects, and personal factors that integrate both social and medical models into a biopsychosocial perspective [20].

Individuals with disabilities encounter diverse challenges that impede their access to healthcare services, including limited educational opportunities stemming from sensory impairments, constrained access to educational resources, delays or lack of support services, and bureaucratic hurdles complicating educational initiatives. Additionally, regulatory and financial barriers further exacerbate these challenges [21]. Owing to these challenges, most literature reviews on individuals with visual or hearing impairments have primarily addressed health issues specific to their disabilities, such as promoting oral health [22, 23] and enhancing cognitive abilities [16, 24]. Comprehensive studies to promote overall health are limited, and conducting such studies is difficult.

Therefore, this study aimed to bridge this gap through systematically investigating the current status of health education interventions for the visually and hearing impaired using a scoping review methodology. This methodological framework was adopted to facilitate a comprehensive assessment of current research trends and their status. This study also proposes future research directions deemed necessary.

Methods

Design

The scoping review employed in this study conforms to the rigorous methodology outlined by Arksey and O'Malley [25] and further elucidated by Levac et al. [26]. In contrast to systematic literature reviews that amalgamate individual research findings or yield integrated estimates, scoping reviews are employed to scrutinize and deliberate upon specific attributes and concepts within research, with the assessment of the risk of bias being deemed non-essential [25]. This study extracted and analyzed literature related to the implementation of health education interventions for individuals with visual or hearing impairments. A health education intervention is a systematically designed educational activity aimed at changing the health behaviors of individuals or groups [27]. Such interventions are intended to provide health information, enhance the understanding of psychological and social influencing factors of health behaviors, and promote effective behavior change.

The health education interventions considered in this study were undertaken for various purposes, such as prevention, treatment, management, or rehabilitation, and could include health education, community programs, campaigns, and workshops. Five steps (specifying the research question, identifying relevant literature, selecting studies, mapping out the data, and summarizing, synthesizing, and reporting the results), were followed based on the six-step research procedures for scoping reviews recommended by Arksey and O'Malley [25]. We omitted the sixth step concerning expert advice because the concept was clear, and the authors had experience in health education interventions [28]. The specific reporting guidelines for the study adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) [29].

Identifying the research questions

Following the guidelines, the research questions were organized in terms of population groups, concepts, and contexts. The primary research question of this study was: "What are the features of health education interventions." The secondary research questions of this study were: "What design have been applied to health education interventions for individuals with visual or hearing impairments?"; "What are the content and methods of the interventions used in health education for individuals with visual or hearing impairments?"; and "What are the duration, frequency, and timing of the interventions used

in health education for individuals with visual or hearing impairments?"

Identifying relevant studies

The data in this study encompassed research papers that implemented health education interventions for individuals with visual or hearing impairments. Databases included Cochrane, Ovid MEDLINE, and Google Scholar for grey literature. The search strategy used keywords and key phrases. The search terms were integrated to include "disabled," "handicap," "hearing impairment," "deaf," "visual impairment," "blind," "health education," "program," and "intervention" as the main terms. Two researchers independently collected data through the database search after setting the endpoint to June 22, 2023, without limiting the starting point. Additional Files 1 and 2 present the complete search strategy executed in Cochrane and Ovid MEDLINE. Subsequently, by analyzing words in titles and abstracts, we reviewed the titles and abstracts from the initial search results to identify relevant terms and topics. Finally, we conducted a comprehensive search using search terms related to population groups, concepts, and contexts to perform a more thorough and inclusive search.

Study selection criteria

The population of interest included individuals with visual or hearing impairments, who underwent health education interventions. The concept of interest was health education interventions, specifically, neuro-motor, sensory, acquisition–developmental, biomechanical, cognitive–psychosocial, and visual–perceptual interventions. The context of interest was the scope of health education interventions conducted for individuals with visual or hearing impairments. We defined the characteristics of the interventions to include design, type, face-to-face versus remote delivery, the facilitator (e.g., nurses, clinical personnel, paramedical practitioners, non-healthcare workers), location, duration, frequency, timing, and measurement variables.

The study aimed to assess the effect of the interventions on health education for individuals with visual and hearing disabilities. Only papers published in English were included in the analysis. The included papers had to describe primary research using various study design approaches, including experimental studies, prospective cohort studies, and quasi-experimental studies. We aimed to review the interventions of health-related education implemented for individuals with visual and hearing disabilities. The papers needed to be accessible in full text, and all relevant papers published up to June 2023 were considered without specifying a starting period. The full texts of the articles were screened according to eligibility criteria. Two researchers (SH, GB) independently reviewed the abstracts and full texts, and eligible studies were entered into a data extraction spreadsheet. If a consensus could not be reached, a third study group member (YS) was consulted. Studies without interventions, websites, pamphlets, or other forms of passive educational materials, and literature reviews were excluded.

Charting the data

The general characteristics of the studies, such as publication year, participants, study design, types of intervention, facilitator, dose of intervention, outcome variables, and main results, were documented and coded using a Microsoft Excel spreadsheet. Given the study's focus on gathering all health intervention studies involving individuals with visual or hearing impairments, excluding or ranking papers based on their quality was considered inappropriate. Therefore, no methodological quality evaluation of the included literature was conducted [30].

Collating, summarizing, and reporting the results

The data analysis and synthesis were conducted as follows. First, information regarding the publication year and study design was assessed. Second, characteristics related to the intervention, including the type of intervention, interventionist, location, participants, and duration, were evaluated. Specifically, the intervention classification was undertaken according to an approach delineated by Kreider et al. [31], which involved categorizing interventions based on their respective purposes, including neuro-motor, sensory, acquisition–developmental, biomechanical, cognitive–psychosocial, and visual–perceptual dimensions. Neuro-motor interventions targeted motor skills by altering muscle activation. Sensory interventions included sensory integration interventions and strategies for modifying or manipulating sensory inputs [31]. Acquisition–developmental interventions included mastery of age-appropriate behaviors, skills, or tasks. Cognitive–psychosocial interventions involved analyzing, planning, and regulating behaviors, emotions, and activity performance [31]. Visual–perceptual interventions included visual information types and presentations to improve understanding [31]. The interventions were classified and presented in terms of whether they involved a face-to-face approach, group and individual interventions, interventionists, and intervention locations. Studies utilizing two or more intervention approaches were categorized as multiple-intervention studies. Third, following the classification criteria of the ICF provided by the WHO [20], the outcome variables were classified as follows: Body function: mental functions, sensory functions and pain, and neuromusculoskeletal and movement-related functions; Activities and participation: learning and applying knowledge, communication, mobility, self-care, and major life areas; and

Environmental factors: products, technology, and attitude (Fig. 1). The results are summarized using descriptive statistics, including frequencies and percentages.

Results

Literature search

Figure 2 presents the specific flowchart for selecting the target theses. A total of 3,168 papers were retrieved through the data search. After excluding 42 duplicate papers, the abstracts of 3,126 papers were reviewed. During the abstract review, 3,077 papers that did not meet the selection criteria were excluded, leaving 49 papers for further examination. The remaining papers were scrutinized to determine their adherence to the selection criteria. Subsequently, 11 studies without full-text availability, three that were not intervention studies, and one that did not target person, were excluded. Ultimately, 34 papers, comprising 19 and 15 studies focused on the visually and hearing impaired, respectively, were included in the final analysis. No study found combined visual and hearing impairment, whether or not it was intended.

General characteristics of each study

A total of 34 articles were selected for the final analysis. Table 1 presents the summarized research-related characteristics, while Additional File 3 describes the specific details of individual studies. The selected studies were published between 2001 and 2023. Among the studies, 44.1% (15) had a one-group intervention design, and 55.9% (19) had a control group. Among the studies with a control group, three articles [32–34] randomly allocated groups.

Characteristics of intervention

Table 2 outlines the analysis of various intervention characteristics, including the type of intervention (neuro-motor, sensory, acquisition–developmental, cognitive–psychosocial, visual–perceptual), mode of delivery (face-to-face or non-face-to-face), facilitator's profession (nurses, clinical personnel, paramedical practitioners, non-healthcare workers), location of intervention (healthcare center, home, educational institution), sample size, total duration of intervention, and dosage (frequency and duration) for both visual and hearing categories.

Body Function		
	Mental functions	Cognitive functions such as attention, memory, and problem-solving.
	Sensory functions and pain	Includes hearing, seeing, and the experience of pain.
	Neuromusculoskeletal and movement-related functions	Pertains to movement, muscle strength, and coordination.
Activities and Participation		
	Learning and applying knowledge	Includes cognitive tasks related to education, work, and daily learning.
	Communication	Involves both verbal and non-verbal communication abilities.
	Mobility	Encompasses moving around and the ability to travel.
	Self-care	Basic tasks such as dressing, eating, and hygiene.
	Major life areas	Encompasses aspects of work, family, and social life.
Environmental Factors		
	Products and technology	Tools, devices, and other products that may support or hinder function.
	Attitude	The societal or individual perceptions and biases that may affect a person's participation or abilities.

Fig. 1 Outcome variables according to International Classification of Functioning Disability and Health (ICF) classification criteria
Source: World Health Organization. Towards a common language for functioning, disability, and health: ICF. The international classification of functioning, disability and health. 2002. Available from: https://cdn.who.int/media/docs/default-source/classification/icf/icfbeginnersguide.pdf. Accessed 20 May 2024

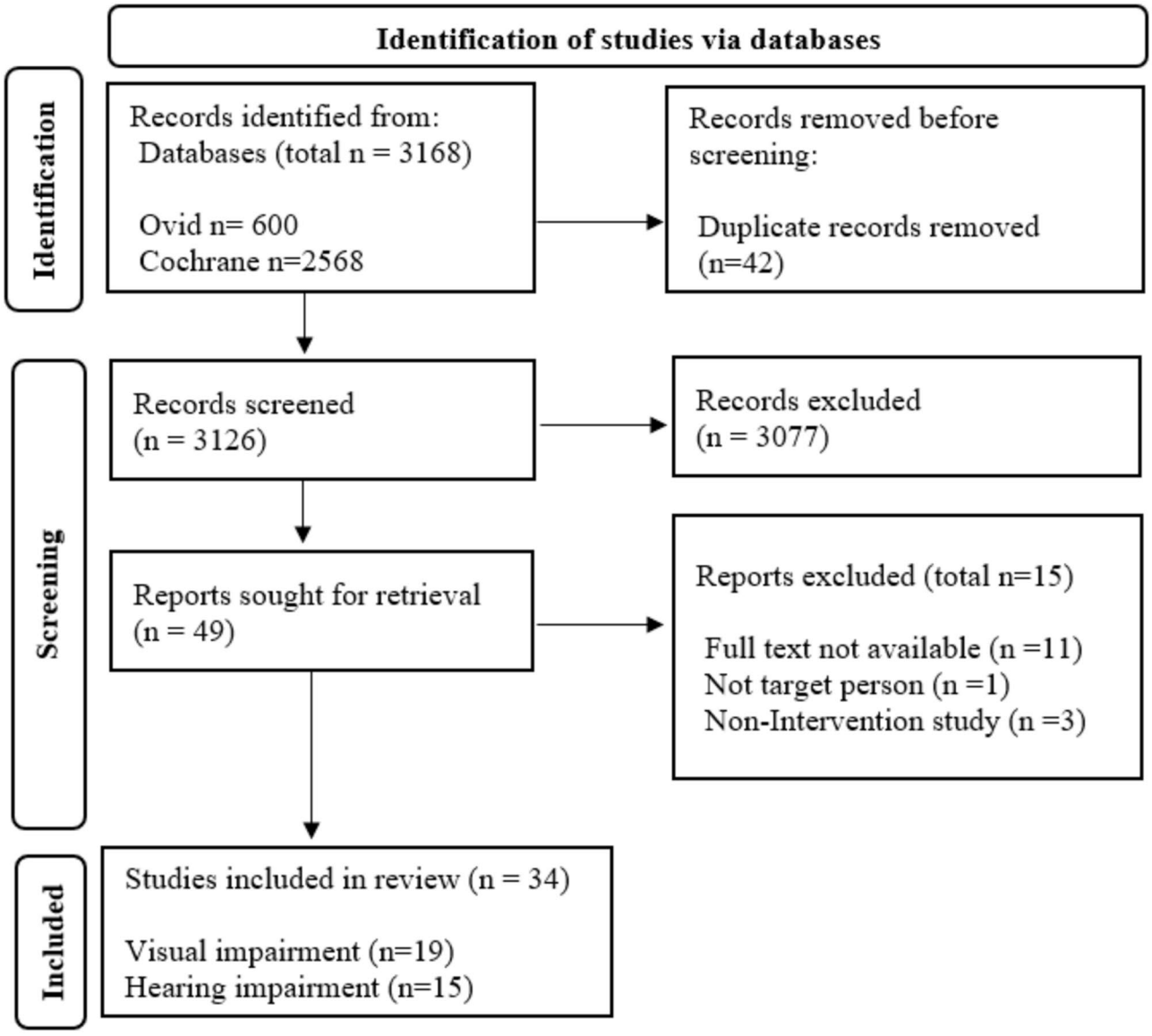

Fig. 2 Flow diagram of study selection
Source: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021;372:n71. Available from: https://www.bmj.com/content/bmj/372/bmj.n71.full.pdf

Table 1 Study characteristics (*N* = 34)

Characteristics		Reference no.			
		Visual		Hearing	
		n	Reference No: 32 ~ 50	*n*	Reference No: 51 ~ 65
Publication year	Before 2009	5	46–50	4	62–65
	2011–2019	10	36–45	8	54–61
	2020–2023	4	32–35	3	51–53
Study design	RCT	2	33, 46	1	53
	Non-RCT	9	32, 34, 36, 40, 41, 43, 45, 48, 50	7	54, 55, 57, 60, 61, 62, 64
	One-group	8	35, 37, 38, 39, 42, 44, 47, 49	7	51, 52, 56, 58, 59, 63, 65

RCT: Randomized controlled trial

Source: Developed by the authors

Table 2 Types of intervention (*N* = 34)

Characteristics	Categories	Reference no.			
		Visual		Hearing	
		n	Reference No: 32 ~ 50	*n*	Reference No: 51 ~ 65
Type of intervention	Neuro-motor	4	32, 33, 38, 50	1	60(multiple)
	Sensory	0	-	2	54, 62
	Acquisition–developmental	8	33, 37, 39(multiple), 40, 44, 46–48	9	51, 52, 55–57, 58(multiple), 59, 61, 64
	Cognitive-psychosocial	6	36, 38(multiple), 41, 43, 45, 49	5	53, 58(multiple), 61(multiple), 63, 65
	Visual–perceptual	1	42	0	-
Face-to-face vs. Non-face-to-face	Face-to-face	17	32–34, 36, 37(multiple), 38, 39, 41–50	13	52, 54–65
	Non-face-to-face	3	35(Mobile), 37(multiple, Telephone), 40(Mobile)	2	51(Video), 53(Video)
Individual vs. Group	Individual	13	34, 35, 37, 39–42, 44–48, 50	9	52, 54, 56, 57, 60 62-65
	Group	4	32, 33, 36, 43	5	51, 53, 55, 58, 59
	Both	2	38, 49	1	61
Facilitators	Healthcare provider -nurse	4	37, 39, 40, 47	0	-
	Healthcare provider-clinical person	2	44, 48	6	52–54, 59, 61, 63
	Healthcare provider-Paramedical Practitioner	4	41, 45, 46, 49	0	-
	Non-healthcare worker	5	32, 34, 35, 38, 43	7	51, 55, 57, 58, 60, 62, 64
	N/A	4	33, 36, 42, 50	2	56, 65
Intervention locations	Healthcare center	9	32, 35, 40, 41, 43–45, 49, 50	5	52, 54, 58, 59, 61
	Home	6	32, 35, 36, 37, 45, 46	3	62, 64, 65
	Educational institution	3	36, 42, 46	4	51, 57, 60, 63
	N/A	1	33	3	53, 55, 56

N/A = not available

Source: Developed by the authors

Interventions for participants who are visually impaired

When categorizing studies conducted on participants who are visually impaired by intervention type, eight out of the 19 studies focused on acquisition and development, followed by cognitive–psychosocial themes in six, neuro-motor aspects in four, and visual–perceptual considerations in one. The majority of the studies (17 articles) involved face-to-face interventions. Non-face-to-face interventions used smartphones [35, 36] and conventional phones [37] as educational media, with study [37] categorized in both face-to-face and phone-based intervention groups. Thirteen studies implemented individual educational interventions, four involved group educational interventions, and two employed an integration of individual and group educational interventions.

More than half of the studies (10 articles) were intervention studies conducted by healthcare providers. The interventionists included four nurses, four paramedic practitioners, two clinical personnel, five non-healthcare workers. Medical institutions or centers (nine articles) were the most common settings for interventions, followed by homes or residential facilities (six articles), and educational institutions (three articles).

Interventions for participants who are hearing impaired

Among the 15 studies of literature on participants who are hearing impaired, acquisition–development was the most common category of intervention, including nine acquisition–development, five cognitive–psychosocial, two sensory, and one neuro-motor. These numbers include studies with overlapping interventions, where a single study may address multiple intervention categories.

Most of the studies (13 out of 15 articles) were conducted through face-to-face interventions. In the case of non-face-to-face interventions, video education [34, 38] was used as the educational medium. In nine studies, individual educational interventions were conducted; five used group educational interventions and one used a combined educational method. In seven studies, the interventions were performed by a healthcare provider who worked as clinical personnel. Most interventions were conducted in healthcare centers (five studies), followed by educational institutions (four studies), and homes or residential facilities (three studies) (see Table 2).

Number of participants

For participants with visually impairment, the number of participants ranged from a minimum of one participant [39] to a maximum of 391 participants [33] (Additional File 3). Conversely, for hearing impaired studies, the number of participants ranged from a minimum of 10 participants [40] to a maximum of 728 participants [41] (Additional File 3). Additionally, the duration of the interventions varied. Among the 34 studies targeting individuals with visual or hearing impairments, 22 studies lasted more than 8 weeks, two studies [42, 43] lasted exactly 8 weeks, and six studies [32, 44–48] lasted less than 8 weeks.

Frequency of interventions

Regarding intervention frequency, three studies [44, 49, 50] implemented interventions once a month, whereas one administered interventions twice a month [41]. Furthermore, six studies [32, 43, 51–54] conducted interventions twice a week, and five studies [34, 37, 45, 47, 55] conducted interventions once a week. The analysis revealed diverse patterns in the number of sessions. Some studies reported sessions lasting less than half an hour, whereas eight studies indicated time durations ranging from 30 min to one hour per session. Additionally, two studies [48, 56] allocated exactly one hour per session, while six studies extended beyond one hour per session (refer to Table 3).

The effectiveness and drop-out rate of intervention

Of the 19 studies conducted on participants with visual impairment, 18 reported significant changes in some or all measurement variables, including visual function, behavior change, quality of life, self-efficacy, and self-management. Changes in the measurement variables were not described in one study [57]. The dropout rate among participants with visual impairment ranged from 0 to 50% among 11 studies, excluding nine that did not report dropout rates. Reasons for dropping out included abandonment (refusal), health problems or death, absence of intervention, language barriers, and loss of follow-up (see Additional File 3).

Eight of the 15 studies on hearing impairment reported significant changes in some or all measured variables, including speech perception, auditory responses, knowledge, academic self-concept, perceptual effort, quality of life, and health screening. Two studies [45, 54] did not describe any changes, whereas one lacked information on changes in measurement variables [42]. The dropout rate for hearing impaired participants varied between 0 and 47.4% in eight studies, while seven studies were excluded for not providing dropout rate data. Reasons for dropping out included nonconformity with subject selection criteria, refusal to participate, health issues or mortality, family caregiving responsibilities, lack of intervention adherence, changes in contact information, and data loss (see Additional File 3).

Table 3 Doses of intervention (*N* = *34*)

Characteristics	Categories	Reference no.			
		Visual		Hearing	
		n	Reference No:32 ~ 50	*n*	Reference No:51 ~ 65
Intervention duration varied	2wks ~ 8wks	2	33, 48	4	58, 60, 64, 66
	8wks	0	-	2	52, 62
	8wks ~ 24month	13	32, 34, 36–43, 45, 46, 49	9	51, 53–57, 59, 61, 63
	N/A	4	35, 44, 47, 50	0	-
Dose frequency	Once a month	3	34, 48, 50	0	-
	Twice a month	0	-	1	57
	Once a week	2	37, 43	3	53, 58, 64
	Twice a week	2	33, 45	4	54, 55, 61, 62
	3 to 7 times a week	3	32, 38, 46	3	60, 63, 65
	N/A	9	35, 36, 39–42, 44, 47, 49	4	51, 52, 56, 59
Time	Less than half an hour	2	37, 41	1	53
	30 min to 1 h	5	32, 33, 38, 45, 46	3	57, 60, 63
	1 h	0	-	2	56, 65
	More than an hour	1	43	5	55, 58, 61, 62, 64
	N/A	11	34, 35, 36, 39, 40, 42, 44, 47–50	4	51, 52, 54, 59

N/A = not available

Source: Developed by the authors

Table 4 Characteristics of measured variables with respect to the domains of the ICF framework (*N* = 34)

Domains	Types	Reference no.			
		Visual		Hearing	
		n	Reference No: 32 ~ 50	*n*	Reference No: 51 ~ 65
Body function	Sensory function	6	32, 35, 40, 42, 44, 50	8	52, 54, 55, 59, 60, 62, 65
	Neuro-musculoskeletal and movement related function	3	33, 34, 38	0	-
	Mental function	3	38, 41, 43	1	64
Activity and Participation	Self-care	1	37	0	
	Learning and applying knowledge	2	39, 47	3	51–53
	Communication	1	39	4	57, 58, 63, 64
	Major life area	3	35, 40, 41	3	58, 60, 64
Environmental factor	Products and technology	0	-	2	52, 61
	Attitude	7	34, 36, 43, 45, 46, 48, 49	1	56
Impairment		1	39	1	61

Source: Developed by the authors

Outcome variables

The studies conducted on the visually impaired investigated several outcome variables, including body function, activity and participation, environmental factors, and impairment. Body function was examined in twelve articles, focusing on aspects such as sensory function [35, 36, 50, 57–59], neuro-musculoskeletal and movement-related function [32, 49, 60], and mental function [55, 61, 62]. Activity and participation, including self-care [37], learning and applying knowledge [39, 61], communication [61], and major life areas [35, 36, 62], were assessed in six articles. Additionally, environmental factors such as attitudes [33, 44, 49, 51, 55, 63, 64] were investigated in seven articles. Impairment was explored in one article [61] (see Table 4).

Studies on individuals with hearing impairments measured a range of variables across multiple domains, including body function, activity and participation, environmental factors, and levels of impairment. Body function was examined in nine articles, focusing on sensory function [42, 43, 46, 48, 52, 53, 65] and mental function [47]. Activity and participation were explored in eight articles, including learning and applying knowledge [34, 38, 42], communication [40, 41, 45, 47], and major life areas [45–47]. Environmental factors, investigated in three articles, encompassed products and technology [42, 54] and attitudes [56]. Additionally, impairment was addressed in one article [54] (see Table 4).

Discussion

This scoping review provided a comprehensive analysis of health education interventions for individuals with visual or hearing impairments. A total of 34 studies were reviewed, with 19 focusing on individuals with visual impairments and 15 on those with hearing impairments.

This study revealed that health education interventions for individuals with visual or hearing impairments varied widely, but that these could be categorized into neuro-motor, sensory, acquisition–developmental, cognitive–psychosocial, and visual–perceptual interventions. The analysis indicated that, among the five types of intervention, acquisition-developmental interventions were widely applied in research on both visual and hearing impairments. Neuro-motor interventions were predominantly observed in studies focused on visual impairments, while sensory interventions were more frequently conducted in studies addressing hearing impairments.

The goal of acquisition–developmental intervention is to help individuals acquire essential skills that they lack, through systematic teaching and therapeutic interventions [14, 16]. Among the health education interventions for the visually and hearing impaired, 17 of 34 studies involved planned education interventions for skills and knowledge on sensory functions necessary for daily life, chronic disease management, and rehabilitation training, comprising the greatest number of interventions. For example, visual training conducted for six months resulted in increased eye movement functions [58] and health education interventions that consisted in providing information and skills in relation to regrading optical aids and hand-stand magnifiers for visually impaired older adults improved their perceived security in daily occupation performance [64].

Cognitive–psychosocial health education interventions were identified in 11 of 34 studies to improve emotion, thought, and behaviors such as depression, self-efficacy, and social interaction. Neuro-motor health education interventions target neurological and motor systems for enhancement through education, activities, and therapeutic practices, aiming to improve coordination between the brain, nervous system, and muscles. Four studies on visual impairment and one on hearing impairment used neuro-motor interventions, revealing that neuro-motor interventions were more challenging

to implement effectively for visually impaired individuals compared to those with hearing impairments [46, 50]. These interventions typically require medical professionals' assistance, leading to the need for more extensive research in relation to visually impaired individuals. Sensory education interventions for the hearing impaired, involving studies on speech perception and word-based auditory training, were also identified [43, 52].

Most interventions incorporated face-to-face sessions; however, some utilized digital platforms such as smartphones and conventional phones, which were included in five studies. Earlier studies, such as those by Murtagh et al. and Agarwal et al. highlighted the importance of comprehensive intervention strategies, particularly focusing on chronic disease management through integrated care systems and mobile health applications [18, 19]. Among the studies included in the analysis, a reminder recall service using mobile devices for visually impaired individuals was reported to increase medical appointment participation rates [36]. Additionally, an education intervention using videos for hearing-impaired individuals was found to enhance their conception of academic confidence and effort regarding treatment [34]. The potential for non-face-to-face interventions using technology was underexploited. Among the 34 studies, only five studies that attempted to provide customized education by utilizing mobile devices or video recordings for the convenience of the participants were identified. Expanding the use of mobile and other digital technologies is likely to help address accessibility issues and provide more flexible learning environments for participants. While the educational methods utilizing these technologies tended to be applied to children and adolescents, previous research has increasingly highlighted the potential of technology to enhance health education and management, particularly for populations facing accessibility challenges [31]. These studies underscore the positive impact on health outcomes when interventions are tailored to the population's specific needs, including those with disabilities.

Regarding the effectiveness of the interventions, most studies reported positive outcomes, demonstrating significant improvements in various outcome variables. These included improvements in physical functions such as balance and flexibility, psychological factors such as depression and anxiety, and behavioral changes in terms of self-management practices. These outcomes were likely influenced by the duration of the studies and the individualized interventions. The duration of the education interventions varied, with one study including an intervention involving only one 60-minute session plus one week of homework [63], while 28 studies conducted educational interventions lasting over months. Additionally, 21 of the 34 studies implemented individualized education rather than group sessions. This individualized approach by healthcare providers could have contributed to the positive outcomes in the research findings.

Despite the positive outcomes, the dropout rate varied, ranging from 0 to 50% for the visually impaired, and from 0 to 47.4% for the hearing impaired. The high dropout rates in several studies [38, 55, 58, 61] and challenges in participant engagement observed in this study are consistent with previous findings [25]. Most studies did not comprehensively explain their dropout rates, making it difficult to propose strategies for reducing dropout rates. However, commonly reported issues such as transportation accessibility for individuals with disabilities are presumed to have played a role, especially as 50% of the studies included in the analysis were conducted at healthcare centers. Previous research has often cited multiple reasons for high dropout rates, including logistical issues and health-related problems [17]. In one study characterized by a high dropout rate that involved health education interventions on perceived security levels during routine occupations among individuals diagnosed with age-related macular degeneration, 35.3% of the participants had dropped out owing to health-related issues [64]. Conversely, Matsuguma et al. (2019) reported that leveraging psychological strength yielded notable enhancements in self-esteem, with a zero dropout rate in that study [63]. Overall, the reasons for dropping out included health-related issues, lack of adherence to intervention protocols, and logistical problems such as communication barriers, transportation accessibility to the location, and data loss. These recurring issues highlight the persistent gap in the design of interventions that adequately address the barriers faced by individuals with sensory impairment.

This review highlights several challenges associated with implementing health education interventions for individuals with visual or hearing impairments. First, the need for highly customized interventions to meet the specific needs of participants was evident. Most of the studies showed positive effects on physical, mental, and functional outcomes through using face-to-face, individualized approaches. This customization requires careful consideration of the intervention setting, the type of facilitators involved, and the delivery method. Second, keeping participants engaged and retained in the interventions was a significant challenge, attributable to the personal and logistical barriers faced by individuals with impairments. Strategies to enhance engagement and minimize dropout rates are essential to ensure the effectiveness of these interventions.

While the findings of this scoping review aligned with those of previous research in several aspects, key divergences were also identified, offering valuable insights into research on visual and hearing impairments. A significant finding of this study was that classification based on

ICF classification criteria proved useful for analyzing and comparing research trends related to these impairments. Unlike previous reviews that have broadly addressed disabilities, this review specifically focused on visual and hearing impairments, enabling a more nuanced understanding of the unique needs of individuals with these impairments and of intervention strategies that are likely to be more effective. Specifically, this study provided a nuanced classification of interventions (neuro-motor, sensory, acquisition–developmental, biomechanical, cognitive–psychosocial, and visual–perceptual) and specific outcomes in relation to these interventions, which has been lacking in previous reviews. This detailed analysis can help tailor more precise intervention strategies and improve future research and practice.

Limitations

This study did not include an analysis based on the age of the participants, nor did it classify interventions for individuals with visual or hearing impairments according to the degree of impairment, prevention, rehabilitation, or clinical treatment. Consequently, this study could not fully consider the needs of individuals with sensory impairments across their entire lifespan. Additionally, the categorization of interventions was based on available information, such as face-to-face versus non-face-to-face engagement, educational methods, and individual versus group education, rather than specific intervention objectives.

We propose several areas for future research and practical application. Non-randomized controlled trial (RCT) and one-group designs were relatively more common than RCT studies in the research designs. This suggests that caution is needed when interpreting the findings presented by individual studies. This review was unable to identify any studies on dual sensory loss (visual and hearing loss). Efforts should be made to explore educational content and methodologies for individuals with dual sensory loss, even if they are complex and challenging, through case studies or other approaches. Additionally, future research is needed to quantitatively analyze the various effects of different intervention methods (individual vs. group) using meta-analysis approaches. Given the underutilization of technology observed in this and previous studies, there is a critical need for further research on how digital tools can be optimized for health education interventions for individuals with sensory impairments. To address high dropout rates, future studies should consider longitudinal designs that investigate the long-term engagement and effectiveness of health education interventions. Lastly, considering the importance of classification, contextualizing research findings within ICF-based Comprehensive and Brief Core Sets for Hearing Loss, Vision Loss, and Dual Sensory Loss can enhance the clarity and applicability of the ICF framework [66]. Future studies should systematically apply these Core Sets to refine methodologies and address challenges such as the limited use of technology and high dropout rates when using longitudinal designs and innovative digital interventions.

Conclusion

This scoping review highlighted that health education interventions for individuals with visual or hearing impairments have primarily focused on acquisition-development and cognitive-psychosocial interventions, often delivered through individualized, face-to-face methods. However, due to the limited number of RCTs and high dropout rates, the findings should be interpreted with caution. In conclusion, there is a clear need for personalized, tailored educational strategies that consider the communication needs, accessible environment, lived experiences, and other accommodation needs of people with visual and hearing impairments. The findings emphasize the importance of ongoing innovation and research to refine these strategies, ensuring they are accessible, engaging, and effective for this population.

Supplementary Information

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Supplementary Material 1

Supplementary Material 2

Supplementary Material 3

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Author contributions

YS supervised the entire study process and contributed to the critical revision of the manuscript. YS, JS and GK conceived the idea, performed the analysis for included study, and drafted this study. JS and GK selected and searched the relevant papers. JS and GK assessed each study. YS, JS and GK are the guarantors of the overall content. JS and GK provided the code for analysis. All authors revised and approved the final manuscript.

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Data availability

Original data generated and analyzed during this study are included in this published article or in the data repositories listed in References.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests
The authors declare no competing interests.

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References

1. World Health Organization. Global report on health equity for persons with disabilities. 2022. https://www.who.int/teams/noncommunicable-diseases/sensory-functions-disability-and-rehabilitation/global-report-on-health-equity-for-persons-with-disabilities. Accessed 20 May 2024.
2. Flaxman SR, Bourne RR, Resnikoff S, Ackland P, Braithwaite T, Cicinelli MV, et al. Global causes of blindness and distance vision impairment 1990–2020: a systematic review and meta-analysis. Lancet Glob Health. 2017;5(12):e1221–34. https://doi.org/10.1016/S2214-109X(17)30393-5
3. Homans NC, Metselaar RM, van der Dingemanse JG, Brocaar MP, Wieringa MH, et al. Prevalence of age-related hearing loss, including sex differences, in older adults in a large cohort study. Laryngoscope. 2017;127(3):725–30. https://doi.org/10.1002/lary.26150
4. World Health Organization. World report on vision. 2019. https://www.who.int/publications/i/item/9789241516570. Accessed 20 May 2024.
5. World Health Organization. World report on hearing. 2021. https://www.who.int/publications/i/item/9789240020481. Accessed 20 May 2024.
6. Heine C. Dual sensory loss. In: Pachana NA, editor. Encyclopedia of geropsychology. Singapore: Springer; 2017. pp. 692–8. https://doi.org/10.1007/978-981-287-082-7_265
7. World Federation of the Deafblind. Second Global Report. 2023. https://wfdb.eu/wp-content/uploads/2023/03/ENG_WFDB-2nd-Global-Report_-FINAL-V6.pdf. Accessed 20 May 2024.
8. Davidson JG, Guthrie DM. Older adults with a combination of vision and hearing impairment experience higher rates of cognitive impairment, functional dependence, and worse outcomes across a set of quality indicators. J Aging Health. 2019;31(1):85–108. https://doi.org/10.1177/0898264317723407
9. Albers MW, Gilmore GC, Kaye J, Murphy C, Wingfield A, Bennett DA, et al. At the interface of sensory and motor dysfunctions and Alzheimer's disease. Alzheimers Dement. 2015;11(1):70–98. https://doi.org/10.1016/j.jalz.2014.04.514
10. Maharani A, Dawes P, Nazroo J, Tampubolon G, Pendleton N, group S-CW. Visual and hearing impairments are associated with cognitive decline in older people. Age Ageing. 2018;47(4):575–81. https://doi.org/10.1093/ageing/afy061
11. World Health Organization. WHO global disability action plan 2014–2021: Better health for all people with disability. 2015. https://apps.who.int/iris/bitstream/handle/10665/199544/?sequence=1. Accessed 20 May 2024.
12. World Health Organization. Report of the global survey on the progress in national chronic diseases prevention and control. 2007. Available from: https://www.who.int/publications/i/item/9789241595698. Accessed 20 May 2024.
13. Taylor SJ, Pinnock H, Epiphaniou E, Pearce G, Parke HL, Schwappach A, et al. A rapid synthesis of the evidence on interventions supporting self-management for people with long-term conditions (PRISMS practical systematic review of self-management support for long-term conditions). Health Serv Deliv Res. 2014;2(53):1–580. https://doi.org/10.3310/hsdr02530
14. Kim SH, Lee YH, Oh WC, Hwang JH, Oh MA, Lee MK et al. The survey of status for the disabled (2020). Ministry of Health and Welfare. 2017. Available from: https://www.mohw.go.kr/board.es?mid=a10411010100%26bid=0019. Accessed 20 May 2024.
15. Shakespeare T, Iezzoni LI, Groce NE. Disability and the training of health professionals. Lancet. 2009;374(9704):1815–6. https://doi.org/10.1016/S0140-6736(09)62050-X
16. Dawes P, Wolski L, Himmelsbach I, Regan J, Leroi I. Interventions for hearing and vision impairment to improve outcomes for people with dementia: a scoping review. Int Psychogeriatr. 2019;31(2):203–21. https://doi.org/10.1017/S1041610218000728
17. Cieza A, Kamenov K, Sanchez MG, Chatterji S, Balasegaram M, Lincetto O, et al. Burden of disability in children and adolescents must be integrated into the global health agenda. BMJ. 2021;372. https://doi.org/10.1136/bmj.n9
18. Murtagh S, McCombe G, Broughan J, Carroll Á, Casey M, Harrold Á, et al. Integrating primary and secondary care to enhance chronic disease management: a scoping review. Int J Integr Care. 2021;21(1):4. https://doi.org/10.5334/ijic.5508
19. Agarwal P, Gordon D, Griffith J, Kithulegoda N, Witteman HO, Sacha Bhatia R, et al. Assessing the quality of mobile applications in chronic disease management: a scoping review. NPJ Digit Med. 2021;4(1):46. https://doi.org/10.1038/s41746-021-00410-x
20. World Health Organization. Towards a common language for functioning, disability, and health: ICF. The international classification of functioning, disability and health. 2002. Available from: https://cdn.who.int/media/docs/default-source/classification/icf/icfbeginnersguide.pdf. Accessed 20 May 2024.
21. Aron L, Loprest P. Disability and the education system. Future Child. 2012;22(1):97–122. Available from: https://www.jstor.org/stable/41475648. Accessed 20 May 2024.
22. Bhadauria US, Gupta V, Arora H. Interventions in improving the oral hygiene of visually impaired individuals: a systematic review. Health Soc Care Community. 2022;30(4):e1092–100. https://doi.org/10.1111/hsc.13517
23. Moin M, Saadat S, Rafique S, Maqsood A, Lal A, Ahmed N, et al. Impact of oral health educational interventions on oral hygiene status of children with hearing loss: a randomized controlled trial. Biomed Res Int. 2021;1:1–8. https://doi.org/10.1155/2021/5185613
24. Lawrence BJ, Jayakody DM, Henshaw H, Ferguson MA, Eikelboom RH, Loftus AM, et al. Auditory and cognitive training for cognition in adults with hearing loss: a systematic review and meta-analysis. Trends Hear. 2018;22:1–20. https://doi.org/10.1177/2331216518792096
25. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. Int J Soc Res Methodol. 2005;8(1):19–32. https://doi.org/10.1080/1364557032000119616
26. Levac D, Colquhoun H, O'Brien KK. Scoping studies: advancing the methodology. Implement Sci. 2010;5:1–9. https://doi.org/10.1186/1748-5908-5-69
27. Johnson J, Breckon D. Managing health education and promotion programs: leadership skills for the 21st century. Jones & Bartlett Publishers; 2007. 1–9. https://books.google.co.kr/books?hl=ko%26lr=%26id=s3l-hPlXihkC%26oi=fnd%26pg=PP2%26dq=Johnson+J,+Breckon+D.+Managing+health+education+and+promotion+programs:+leadership+skills+for+the+21st+century.+Jones+%26+Bartlett+Publishers%3B+2007.+1-9.%26ots=bFEbozqQkY%26sig=CW5Wvljk1rliCKhJAwBnkfZ1ffE#v=onepage%26q%26f=false Accessed 10 September 2024.
28. Jacobs S. A scoping review examining nursing student peer mentorship. J Prof Nurs. 2017;33(3):212–23. https://doi.org/10.1016/j.profnurs.2016.09.004
29. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. Ann Intern Med. 2018;169(7):467–73. https://doi.org/10.7326/M18-0850
30. Tricco AC, Lillie E, Zarin W, O'Brien K, Colquhoun H, Kastner M, et al. A scoping review on the conduct and reporting of scoping reviews. BMC Med Res Methodol. 2016;16(15):1–10. https://doi.org/10.1186/s12874-016-0116-4
31. Kreider CM, Bendixen RM, Huang YY, Lim Y. Review of occupational therapy intervention research in the practice area of children and youth 2009–2013. Am J Occup Ther. 2014;68(2):e61–73. https://doi.org/10.5014/ajot.2014.011114
32. Kurz A, Lauber B, Franke S, Leukel C. Balance training reduces postural sway and improves sport-specific performance in visually impaired cross-country skiers. J Strength Cond Res. 2021;35(1):247–52. https://doi.org/10.1519/JSC.0000000000002597
33. La Grow SJ, Robertson MC, Campbell AJ, Clarke GA, Kerse NM. Reducing hazard related falls in people 75 years and older with significant visual impairment: how did a successful program work? Inj Prev. 2006;12(5):296–301. https://doi.org/10.1136/ip.2006.012252
34. Asogwa UD, Ofoegbu TO, Eseadi C, Ogbonna CS, Eskay M, Nji GC, et al. The effect of a video-guided educational technology intervention on the academic self-concept of adolescent students with hearing impairment: implications for physical education. Medicine. 2020;99(30):1–8. https://doi.org/10.1097/MD.0000000000021054
35. Lai KY, Pathipati MP, Blumenkranz MS, Leung L-S, Moshfeghi DM, Toy BC, et al. Assessment of eye disease and visual impairment in the nursing home population using mobile health technology. Ophthalmic Surg Lasers Imaging Retina. 2020;51(5):262–70. https://doi.org/10.3928/23258160-20200501-03

36. Tan AC, Man R, Wong CW, Lee SY, Lamoureux EL, Ang M. Randomized controlled trial evaluating a novel community eye care programme for elderly individuals with visual impairment. Clin Exp Ophthalmol. 2018;46(6):593–9. https://doi.org/10.1111/ceo.13140
37. Li J, Gu L, Guo Y. An educational intervention on foot self-care behaviour among diabetic retinopathy patients with visual disability and their primary caregivers. J Clin Nurs. 2019;28(13–14):2506–16. https://doi.org/10.1111/jocn.14810
38. Esmeray N, Yanikkerem E. The effect of education given to women with hearing impairments on the behaviours of pap smear screening. Eur J Cancer Care. 2022;31(2):1–13. https://doi.org/10.1111/ecc.13550
39. Wright LS. Training a patient with visual impairment on continuous ambulatory peritoneal dialysis. Nephrol Nurs J. 2005;32(6):677. https://pubmed.ncbi.nlm.nih.gov/16425813/. Accessed 23 May 2024.
40. Wu J-L, Yang H-M, Lin Y-H, Fu Q-J. Effects of computer-assisted speech training on Mandarin-speaking hearing-impaired children. Audiol Neurootol. 2007;12(5):307–12. https://doi.org/10.1159/000103211
41. Sugaya A, Fukushima K, Kasai N, Ojima T, Takahashi G, Nakagawa T, et al. Effectiveness of domain-based intervention for language development in Japanese hearing-impaired children: a multicenter study. Ann Otol Rhinol Laryngol. 2014;123(7):500–8. https://doi.org/10.1177/0003489414525023
42. Venail F, Picot MC, Marin G, Falinower S, Samson J, Cizeron G, et al. Speech perception, real-ear measurements and self-perceived hearing impairment after remote and face-to-face programming of hearing aids: a randomized single-blind agreement study. J Telemed Telecare. 2021;27(7):409–23. https://doi.org/10.1177/1357633X19883543
43. Humes LE, Burk MH, Strauser LE, Kinney DL. Development and efficacy of a frequent-word auditory training protocol for older adults with impaired hearing. Ear Hear. 2009;30(5):613–27. https://doi.org/10.1097/AUD.0b013e3181b00d90
44. Pankow L, Luchins D, Studebaker J, Chettleburgh D. Evaluation of a vision rehabilitation program for older adults with visual impairment. Top Geriatr Rehabil. 2004;20(3):223–32. https://journals.lww.com/topicsingeriatricrehabilitation/fulltext/2004/07000/evaluation_of_a_vision_rehabilitation_program_for.10.aspx. Accessed 20 May 2024.
45. Oberg M, Bohn T, Larsson U, Hickson L. A preliminary evaluation of the active communication education program in a sample of 87-year-old hearing impaired individuals. J Am Acad Audiol. 2014;25(2):219–28. https://doi.org/10.3766/jaaa.25.2.10
46. Rajendran V, Roy FG, Jeevanantham D. A preliminary randomized controlled study on the effectiveness of vestibular-specific neuromuscular training in children with hearing impairment. Clin Rehabil. 2013;27(5):459–67. https://doi.org/10.1177/0269215512462909
47. Hickson L, Worrall L, Scarinci N. A randomized controlled trial evaluating the active communication education program for older people with hearing impairment. Ear Hear. 2007;28(2):212–30. https://doi.org/10.1097/AUD.0b013e31803126c8
48. Burk MH, Humes LE, Amos NE, Strauser LE. Effect of training on word-recognition performance in noise for young normal-hearing and older hearing-impaired listeners. Ear Hear. 2006;27(3):263–78. https://doi.org/10.1097/01.aud.0000215980.21158.a2
49. Clark AM, Ferrell KA, Smyth C, Spicer CL, Morgese ZL, Puchalski CB, et al. Early intervention increased food acceptance in children with visual impairment. Infants Young Child. 2021;34(2):109–21. https://doi.org/10.1097/IYC.0000000000000188
50. Soong GP, Lovie-Kitchin JE, Brown B. Does mobility performance of visually impaired adults improve immediately after orientation and mobility training? Optom Vis Sci. 2001;78(9):657–66. doi:1040-5488/01/7809-0657/0.
51. Taylor L, Poland F, Harrison P, Stephenson R. A quasi-experimental feasibility study to determine the effect of a systematic treatment programme on the scores of the Nottingham adjustment scale of individuals with visual field deficits following stroke. Clin Rehabil. 2011;25(1):43–50. https://doi.org/10.1177/0269215510375918
52. Bugannim Y, Roth DA-E, Zechoval D, Kishon-Rabin L. Training of speech perception in noise in pre-lingual hearing impaired adults with cochlear implants compared with normal hearing adults. Otol Neurotol. 2019;40(3):e316–25. https://doi.org/10.1097/MAO.0000000000002128
53. Talebi H, Moossavi A, Lotfi Y, Faghihzadeh S. Effects of vowel auditory training on concurrent speech segregation in hearing impaired children. Ann Otol Rhinol Laryngol. 2015;124(1):13–20. https://doi.org/10.1177/0003489414540604
54. Laplante-Levesque A, Hickson L, Worrall L. What makes adults with hearing impairment take up hearing aids or communication programs and achieve successful outcomes? Ear Hear. 2012;33(1):79–93. https://doi.org/10.1097/AUD.0b013e31822c26dc
55. Ueda Y, Tsuda A. Differential outcomes of skill training, group counseling, and individual cognitive therapy for persons with acquired visual impairment. Jpn Psychol Res. 2013;55(3):229–40. https://doi.org/10.1111/jpr.12010
56. Sommers MS, Tye-Murray N, Barcroft J, Spehar BP. The effects of meaning-based auditory training on behavioral measures of perceptual effort in individuals with impaired hearing. Semin Hear. 2015;36(4):263–72. https://doi.org/10.1055/s-0035-1564454
57. Coulmont M, Fougeyrollas P, Roy C. Can we associate the hours of clinical services at the rehabilitation outcomes? The case of the visual impairment rehabilitation program. Health Care Manag. 2013;32(2):154–66. https://doi.org/10.1097/HCM.0b013e31828ef643
58. Fazzi E, Micheletti S, Calza S, Merabet L, Rossi A, Galli J, et al. Early visual training and environmental adaptation for infants with visual impairment. Dev Med Child Neurol. 2023;63(10):1180–93. https://doi.org/10.1111/dmcn.14865
59. Kooiker MJ, van der Pel JJ. The relationship between visual orienting responses and clinical characteristics in children attending special education for the visually impaired. J Child Neurol. 2015;30(6):690–7. https://doi.org/10.1177/0883073814539556
60. Dijkhuizen A, Waninge A, van der Hermans S, Krijnen WP. Progressive resistance training for persons with intellectual disabilities and visual impairment. J Appl Res Intellect Disabil. 2019;32(5):1194–202. https://doi.org/10.1111/jar.12610
61. Dale NJ, Sakkalou E, O'Reilly MA, Springall C, Sakki H, Glew S, et al. Home-based early intervention in infants and young children with visual impairment using the developmental journal: longitudinal cohort study. Dev Med Child Neurol. 2019;61(6):697–709. https://doi.org/10.1111/dmcn.14081
62. n der Aa HP, van Rens GH, Comijs HC, Margrain TH, Gallindo-Garre F, Twisk JW, et al. Stepped care for depression and anxiety in visually impaired older adults: multicentre randomised controlled trial. BMJ. 2015;28(351):1–9. https://doi.org/10.1136/bmj.h6127
63. Matsuguma S, Kawashima M, Sano F, Tsubota K. Cannot see? Use your strengths!! A randomized controlled trial of strengths intervention for improving self-esteem among visually impaired individuals. Clin Rehabil. 2019;33(10):1596–606. https://doi.org/10.1177/0269215519858871
64. Ivanoff SD, Sonn U, Svensson E. A health education program for elderly persons with visual impairments and perceived security in the performance of daily occupations: a randomized study. Am J Occup Ther. 2002;56(3):322–30. https://doi.org/10.5014/ajot.56.3.322
65. Kuk F, Keenan DM, Lau C, Crose B, Schumacher J. Evaluation of a localization training program for hearing impaired listeners. Ear Hear. 2014;35(6):652–66. https://doi.org/10.1097/AUD.0000000000000067
66. Danermark B, Granberg S, Kramer SE, Selb M, Möller C. The creation of a comprehensive and a brief core set for hearing loss using the international classification of functioning, disability and health. Am J Audiol. 2013;22(2):323–8. https://doi.org/10.1044/1059-0889(2013/12-0052)

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