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Review Article

Method of health education for deaf: A systematic review

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Abstract

Background and aims: Healthcare establishments must treat people who are deaf or hard of hearing equally. As several experimental studies have yielded different outcomes, some studies on health education techniques must be conducted to examine the effects of health education on hearing loss. This study outlines how researchers educate deaf people about health issues.

Methods: This study was conducted in June 2023 in Jambi, Indonesia. A comprehensive search strategy for each database was developed using the following search terms: "deaf," "hearing impairment," "health education," "adolescent," and "adult." A comprehensive assessment of the references from all the studies included in the analysis was also conducted. The forthcoming PRISMA 2020 rules are approaching. Researchers employ Roanalyze to analyze the potential for bias in a study and use the Critical Appraisal Skills Programme (CASP) to evaluate the authenticity of the study. The writers autonomously acquired the data, whereas external sources reassessed and evaluated the results.

Results: The review database successfully incorporated twenty-one studies relevant to its themes and objectives. Sign language plays a crucial role in health education by enhancing communication and literacy for deaf individuals through visual learning methods and telemedicine.

Conclusion: Sign language plays an essential role in health education, as it improves accessibility for deaf individuals by utilizing visual aids and multimedia-based approaches to learning.

Keywords: Health education, Deafness, Health literacy, Systematic review

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Introduction

An estimated 430 million individuals globally experience deafness, with a hearing loss of over 40 dB. The World Health Organization forecasts that this figure will increase to 700 million annually. Communication barriers impede deaf individuals' access to healthcare and Information, thereby increasing their vulnerability to maladies due to their ignorance of preventative and early detection strategies. Inadequate communication results in misconceptions, inability to adhere to instructions, subpar patient compliance, and erosion of trust in the healthcare system. For communities of the deaf, being deaf is not a disability that needs to be corrected but rather an alternative way of being (1). Global data on the population of individuals who identify as members of the deaf community are limited. However, data from Canada indicate that they constitute approximately 1 in 1000 of the population (2).

Deaf patients may have challenges when interacting with healthcare providers due to their inadequate understanding of medical information, and negative past experiences that impact their trust (3) and the lack of a variety of specialties in culturally relevant sign language interpretation at clinics (4-6). For most deaf individuals, finding a provider with access to an interpreter is difficult (7,8). A persistent obstacle to care access for numerous deaf individuals continues to be the scarcity of deaf specialists despite the positive results they have produced (9).

The hard-hearing/deaf population experiences significant health inequalities, including barriers to acquiring and accessing high-quality health services and attaining optimal health outcomes, based on previous findings (10-12). Communication with health experts is challenging for deaf people (13). A lack of awareness and focused training in culturally appropriate communication with deaf individuals among healthcare professionals and a lack of access to sign language interpreters are among these fundamental issues (14). Healthcare institutions are not the only sources of Information available for people who are identified as being deaf (D/deaf). The lack of access to environmental discourse, public health messaging, and hearing-based mass media has a detrimental effect on their capacity to maintain good health (15). Unfortunately, public health services are often not adequately suited to this demographic, which can result in unanticipated and perhaps detrimental outcomes (16).

According to earlier studies, those who are deaf or have hearing impairments have worse health outcomes than those with normal hearing (3). According to research on chronic illnesses, those who are deaf or hard of hearing are more likely to experience chronic conditions,

including diabetes and hypertension, for the rest of their life (17). In addition, compared to the general population, deaf people have a higher prevalence of mental illnesses such as depression and anxiety (18,19). In addition, the risk of suicide is higher in people with normal hearing (20). Ultimately, compared to the hearing population as a whole, deaf people perceive their health more negatively. In recent years, research teams worldwide have begun to describe and evaluate interventions to address and reduce health and healthcare inequalities for d/Deaf people, particularly by increasing their health literacy (21). Through increased access to health information or developing particular health. Health facilities for deaf or deaf people (22). This systematic review aimed to review studies focusing on health education interventions for people with hearing loss. The results of this study will describe the types or methods researchers use to deliver health information to deaf individuals.

Methods

This systematic review aimed to explore studies focusing on health education interventions for individuals with hearing loss. The main goal of this research project is to provide a thorough overview of the various types and modes of delivery that researchers use to provide deaf people with health literacy.

Study protocol

Our study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines for research methodology (23). We performed a systematic review of randomized controlled trials (RCTs) that examined how health education affects people who are deaf or have hearing loss. To ensure the relevance of the studies included in the review, only papers written in English that were fully accessible were considered. The PICOS (Population, Intervention, Comparisons, Outcomes, Study Design) criteria for the selected studies are summarized in Table 1.

Eligibility criteria

We removed articles uploaded to Reference, web-based reference management software, and duplicates. Next, we disseminated it to the team members and assigned an initial title and abstract review to a single reviewer. Two reviewers conducted a full-text review. Additional reviewers were prepared to reach a consensus. Articles included in the study were adolescents or older (according to WHO age classification), if the intervention was a single intervention or a combination if the research was conducted in a clinic or community, and if the complete text existed in English. We excluded articles not available in English, observational studies, theses, conference abstracts, commentaries, and editorials because they consisted of presentation posters.

Table 1. Studies criteria based on PICOS

Criteria	Inclusion criteria
Population	Patients with hearing impairment comprise the entire trial population, i.e., all cases are eligible despite differences in treatment situation (outpatient or inpatient), gender, educational attainment, or citizenship.
Intervention	Health education has been considered in every area of study. Specific techniques do not limit delivery methods.
Comparisons	Regulated interventions include all conventional health education techniques.
Outcomes	Knowledge, attitude, practice
Study design	All of the RCT studies

Information source

A database search for articles published in peer-reviewed journals was conducted in June 2023 by a university librarian. The databases searched were Medline, ScienceDirect, Journal Storage (JSTOR), the Wiley Online Library, and Cumulated Index in Nursing and Allied Health Literature (CINAHL). A database was selected based on the comprehensive literature coverage in the relevant field. The considerations used in this research to determine the source of the journal database are relevant to the health science discipline, fields and coverage relevant to health science, and consideration of quality and peer review. Access to full-text articles is an important consideration.

Search strategy

The keyword searches formulated a targeted search methodology for each database. The keywords employed were "Deaf," "Hearing impairment," "Health education," "Adolescent," and "adult" (see Box 1). A thorough examination of all the studies included in the analysis was performed. Only papers published in English were included in this study.

Data extraction

The authors independently gathered Information from relevant research by implementing the Cochrane Data Extraction and Assessment Form. All authors reached a consensus to resolve conflicts of interest. The extracted information comprised authorship, publication year, country of origin, research design, sampling methodology, assessment indicators, and primary findings.

Quality assessment

The quality of the studies was independently assessed by two authors using the Critical Appraisal Skills Program (CASP) for Randomized Controlled Trials (Critical Appraisal Skills Program, 2022). This tool comprises 11 questions divided into four sections with the choices of Yes, No, and Cannot Tell Checklist columns. We categorized the quality of the studies into high, medium, and low levels. In high-quality studies, YES answers ranged from 10 to 11/11. In high-quality studies, the YES answers were 7–9/11; in low-quality studies, the YES answers were ≤ 6/11.

Box 1. Search syntax

Keywords using the Boolean operator
"Persons With Hearing Impairments" OR "Deafness or Hearing Loss, Bilateral" OR "Hearing Loss" OR "Deaf Persons" OR "Hard of Hearing Persons" OR "Hearing Disabled Persons" OR "Hearing Impaired Persons" OR "Bilateral Deafness" OR "Deaf Mutism" OR "Deaf-Mutism" OR "Deafness, Acquired" OR "Hearing Loss, Complete" OR "Hearing Loss, Extreme" OR "Prelingual Deafness" **AND** "Communication Aids for Disabled" or "Sign Language" "Communications Media" or "Self-Help Devices" or "Education, Distance" or "Digital Divide" "Internet" or "Technology" "Technological or Development" or "Instructional Films and Videos" or "Video Games" or "Audiovisual Aids" or "Mainstreaming (Education)" or "Teaching Materials" or "Hypermedia" or "Patient Education Handout" OR "Augmentative and "Communications Systems" or "Communication Aids for Handicapped" or "Communication Boards" or "Speech Synthesizers" or "TDD" or "TTY Telephone" or "Telecommunications Devices for the Deaf Telecommunication" or "Text Telecommunication Devices" or "Text Telephone" or "Assistive Devices" or "Assistive Technology" or "Correspondence Courses" or "Distance Education" or "Distance Learning" or "Arts, Industrial" or "Industrial Arts" or "Audio-Video Demonstration" or "Audiovisual Demonstration" or "Instruction" or "Computer Games" or "Audio-Visual Aids" or "Visual Aids" or "Mainstreaming" or "Hypermedium" or "Consumer Handout" or "Consumer Information Handout" **AND** "Health Education" or "Education of Hearing Disabled" or "Health Communication" "Teaching" or "Learning" or "Education, Special" or "Population Education" or "Patient Education as Topic" or "Community Health Education" or "Education, Community Health" or "Education, Health" or "Health Education, Community" or "Education of Persons with Hearing Impairments" or "Education of Persons with Hearing Impairments" or "Academic Training" or "Educational Technics" or "Educational Techniques" or "Pedagogy" or "Teaching Methods" or "Technics, Educational" or "Techniques, Educational" or "Training Activities" or "Training Technics" or "Training Techniques" or "Memory Training" or "Phenomenography" or "Special Education" or "Education of Patients" or "Education, Patient"

Risk of bias assessment

The risk of bias was evaluated using the Cochrane ROB 2 instrument developed by Sterne et al in 2019. This instrument categorizes outcomes into five domains: development measurement, selection of the reported result, randomization process, deviation from intended interventions, and absence of outcome data. Researchers calculated the risk of bias rating using five separate ratings and applied the ROB-2 methodology. The classification of bias evaluations for each domain was high, moderate, and low. The bias assessment results are presented using the RoB visualization tool as a traffic light plot.

Results

Study selection

Forward and backward searches of pertinent papers in the utilized databases yielded 1385 publications in the literature search results. We conducted a comprehensive evaluation of 164 documents. After thoroughly examining each complete text, we ascertained that 129 articles were required to meet the eligibility criteria. After the initial examination, only 21 articles met the criteria for further analysis. The findings obtained by extracting the data that aligned with the predetermined eligibility criteria are displayed in Table 2. A thematic examination was used to examine the data. The search results were connected to the flowchart for PRISMA 2020. (Figure 1).

General characteristics of the included studies

Most studies eligible for analysis in this review were conducted in the United States (n = 18), and each study was conducted in Saudi Arabia, India, and Brazil. Most of the experimental studies reviewed in this study used the pre-post approach (n = 13), and the remaining eight were randomized controlled studies. Health education topics discussed in each study included cancer (n = 15), mental health (n = 3), dental health (n = 1), alcohol addiction (n = 1), and emergency cardiopulmonary resuscitation (CPR) (n = 1). The types of cancers that have become health topics include cervical cancer, breast cancer, colorectal cancer, prostate and testicular cancer, skin cancer, ovarian cancer, and lung cancer. Overall, the participants in these studies were 2,978 deaf adolescents and adults. The interventions used in the experimental groups included video (n = 12), telehealth/teleconferencing (n = 4), PowerPoint presentations, brochures, and face-to-face meetings (n = 5).

Summary of quality appraisal and risk of bias assessment result

The quality of the studies assessed based on the CASP showed that two were in the high-quality category (24,42), while the others were in the medium-quality category. The details of this study are presented in Table 3.

Based on the risk of bias assessment using the Cochrane Risk of Bias (RoB) 2 tool, it was found that there were two studies in the low risk of bias category (24,42), three studies in the high risk of bias category (28,43,45), and the rest in the Some Concerns category. Figure 2 summarizes the RoB assessment in a traffic light plot, visually representing the processing procedure outcomes.

The effect of the intervention on the outcome of each study

The use of Video Media as a source of health literacy suggests that most of the outcomes of the studies included in this review were knowledge of patients with the disease and experience of deafness. From several studies, it is known that there is a change in participant knowledge from baseline or pre-intervention to post-intervention with an average change in mean knowledge score + 1.93 (24), 18.5 – 20.6 (26) 4.5 – 5.6 (27), 2.16 – 2.39 (29)15.2 – 18.4 (30), 28.55 – 35.55 (32), 3.49 – 7.58 (33) 2.5 – 8.7 (34), 13.3 – 16.76 (36), 13.27 – 15.47 (37), 8.62 – 9.71 (39) 6.59 – 11.86 (40), 78.67 – 86.02 (41), 16.345 (42). Meanwhile, the two studies did not provide a mean value of knowledge in general, but descriptively, the participants' knowledge increased (25). In CPR emergency education, Galindo-Neto et alfound that video combined with practical demonstrations could increase the knowledge of deaf participants ($P < 0.001$) (44).

At a follow-up two months after the intervention, several studies showed that the participants' knowledge decreased, although not significantly. The value of the decrease included -0.1 (24,27), -1.3 (30), -2.8 (32), -2.05 (33) 0.22 (40). Other studies on participant knowledge have not been conducted (25,26,29,34,36,41,42)

Table 2. Extraction data of eligible studies

Author, Country	Study design	Participants	Health education theme	Types of intervention	Evaluation	Main findings
Choe et al (24), US	RCT	Control = 58 Experimental = 72	Cervical cancer	Control = Clinical trials education Experimental = cervical cancer video	Questionnaires	- The immediate mean scores adhering to the intervention were as follows: control group (+0.17; intervention group, $P \leq 0.05$; +1.93). - Two months following the intervention, we recorded the mean scores for the control group ($P \leq 0.05$) and the intervention group (-0.1; +0.98).
Cumberland et al (25), US	RCT	Intervention = 90 Control = 92	Breast cancer	DVD and Brochures	Questionnaires	- The intervention group was more likely to note the DVD (94%) and the control group the PowerPoint presentation (79%) than written materials (46% intervention, 54% control) or group discussion (51% intervention, 77% control) - Most intervention group (98%) and control group (90%) participants were interested in watching a signed DVD
Palmer et al (26), US	RCT	Intervention = 50 Control = 50	Cancer	37.3 minutes Video education by deaf people.	Quizzes	The intervention group obtained a mean score of 20.4 with the bilingual approach and 20.6 with the monolingual approach following the intervention.
Shabaik et al (27), US	RCT	144 deaf adults	Colorectal cancer	Experiment group: The 60 minutes colorectal cancer education video Control group: The National Cancer Institute's clinical trials PowerPoint education program: The Basics	Post-test after two months	- The mean score of the intervention group in three intervals: before intervention 4.5, immediately after intervention 5.6, and 2 months after intervention 5.2; and in the control group: before intervention 4.2, immediately after intervention 4.5, and 2 months after intervention 4.4
Crowe (28), US	Pre-post	24 deaf or hard-of-hearing participants	Mental illness	30-minute or 60 min Telepsychiatry sessions using American Sign Language Face-to-Face Psychotherapy Group Telepsychiatry Experimental Groups	MOMSA questionnaire, coping abilities, Psychiatric symptoms	- Comparing face-to-face psychotherapy and telepsychiatry, we did not observe a statistically significant difference in coping abilities (t = −1.182, 14; $P = 0.072$). - A statistically significant distinction between telepsychiatry and face-to-face psychotherapy was observed in the psychiatric symptomology (t = 4.037, 13; $P = 0.0001$). - 81.82% (n = 9) of participants reported satisfaction with the services provided by most face-to-face psychotherapy, while satisfaction with telepsychiatry was 100% (n = 6).
Engelberg et al(29), US	Pre-post	62 deaf adults	Cancer	Paired video health Messages and jokes via email	Online Questionnaire	- From baseline (M = 6.63, SD = 2.16) to immediately post-test (M = 8.84, SD = 2.39), participants' knowledge increased significantly (M = 6.63, SD = 2.16; −8.695, $P < 0.001$). - There was no statistically significant difference between the post-test scores and the 1-week follow-up (M = 8.63, SD = 2.35, t = 1.01; $P = 312$.
Folkins (30), US	Pre-post	102 deaf adults	Prostate and testicular Cancer	The 52-minute ASL video	Questionnaire: Two months follow-up up	- The average knowledge score two months after the educational intervention was 17.1 ($P = 0.05$). The average score prior to the intervention was 15.2. The average score following the intervention was 18.4.
Gournaris and Leigh(31), US	RCT	40 deaf individuals	Mental health	Telepsychotherapy: Video conference	Questionnaire	- Signs of comprehension were lower in the F2F condition (M = 6.75, SD = 3.46) than in the VMC condition (M = 9.07, SD = 4.57). - F2F communication (M = 3.35, SD = 1.88) while VMC communication (M = 3.12, SD = 1.57) were comparable; F = 0.594; 0.446 (1,39).
Harry et al (32), US	RCT	136 deaf individuals	Skin cancer	The 60-minute Skin cancer education video	Skin Cancer Knowledge Questionnaire	- Before educational intervention, the control group's mean score was 27.93, while the intervention group achieved 28.55. - The average score following the educational intervention was 28.77 for the control group and 35.55 for the intervention group. - The average score two months after the educational intervention was 28.82 for the control group and 32.75 for the intervention group.
Hickey et al (33), US	Pre-post	122 deaf women	Breast cancer	Breast cancer education video	Questionnaire about breast cancer knowledge	- Prior to educational intervention, the mean score was 3.49 ± 1.88. Following educational intervention, the mean score increased to 7.58 ± 2.27. - The average score at the two-month follow-up was 5.53 ± 2.35.
Jensen et al (34), US	Pre-post	55 deaf women, 52 hard-hearing women	Ovarian cancer	Educational video	Questionnaire: Cancer knowledge survey	- Following the intervention, there was a significant increase in general cancer knowledge across two groups of individuals, one consisting of deaf individuals and the other consisting of hearing individuals ($P = 0.034$ and $P < 0.001$, respectively). - The ovarian cancer knowledge score and overall knowledge score of deaf women increased after the educational intervention, surpassing the knowledge score of hearing women before the intervention (17.3 ± 3.5 compared to 15.5 ± 2.5, $P = 0.004$; 21.2 ± 4.1 compared to 19.5 ± 2.8, $P = 0.021$, respectively).

Table 2. Continued.

Author, Country	Study design	Participants	Health education theme	Types of intervention	Evaluation	Main findings
Kushalnagar et al (35), US	Pre-post	703 deaf adults who are smokers	Lung cancer	Videoconference	Self-administration questionnaire	- Degrees of freedom individuals with lung disease were approximately 3.6 times more likely than the general population to request lung cancer screening (adjusted OR: 3.604; 20.005). - Deaf older persons with a history of smoking, either in the past or present, are twice as inclined to inquire about lung cancer screening compared to those who were never smokers.
Sacks et al (36), US	Pre-post	Hearing and deaf men- 90:85	Testicular cancer	Testicular cancer video in ASL	cancer knowledge questionnaire	- Prior to the implementation of the intervention, there was a significant disparity in the overall knowledge between hearing and deaf men (deaf men 13.3 ± 3.15 vs. hearing men 14.91 ± 2.1, $P < 0.001$). - The total knowledge score of two groups, deaf and hearing, increased substantially in the immediate aftermath of the educational intervention (16.76 ± 2.79 ($P < 0.001$) for deaf men and 18.73 ± 1.8 ($P < 0.001$) for hearing men out of a possible 21 points.
Wilson & Wells (37), US	Pre-post	55 deaf adults	Mental health	Telehealth	Depression knowledge questionnaire	- The post-test scores for the two conditions differ significantly. The mean pretest scores for the telehealth group were 13.27 (SD = 4.92), and for the control group, 13.07 (SD = 4.53). The mean post-test scores for the telehealth group were 15.47 (SD = 5.14), and for the control group, 15.76 (SD = 5.55).
Wilson (38), US	Pre-post	95 alcoholic deaf adults	Alcohol addiction	the online Deaf off Drugs and Alcohol (DODA) program and SUD services	Six-months follow up	- The individual showed no significant difference between sites (F = 0.10, n.s.) or interaction between time and site (F = 1.21, n.s.) and had a significant pre-post difference in Rosenberg Self-Esteem Scale (RSES) scores (F = 11.75, $P = 0.002$). - Participants exhibited a notable increase in self-esteem during the follow-up period compared to their initial participation. - At follow-up, participants in the DODA study reported abstaining from alcohol consumption in the previous 30 days, with no statistically significant difference ($\chi 2 = 1.99$, n.s.).
Yao et al (39), US	Pre-post	Deaf: 127 women Hearing: 106 women	Cervical cancer	the cervical cancer education video	A survey using a questionnaire was conducted immediately after the intervention.	- The cumulative knowledge of deaf and hearing women differed before the intervention: 8.62 ± 1.55 for deaf women and 9.97 ± 0.94 for hearing women ($P < 0.001$). - The learning outcomes of deaf women improved marginally more than those of hearing women (0.46 vs. 1.09; $P < 0.001$) after an educational intervention.
Kaskowitz et al (40), US	Pre-post	121 deaf men	Prostate cancer	PowerPoint presentation	A post-test survey immediately after the intervention continued with FGD	- Before intervention, the average score was 6.59 out of 21. - After educational intervention, the mean score was 11.86 ($P = 0.05$). - In a 2-month follow-up, the mean knowledge score was 12.08 ($P < 0.05$).
Sadler et al (41), US	Pre-post	123 deaf women	Breast cancer	Breast cancer education program using ASL assistance	FGD	- After two decades, the average score has decreased from 78.67 ± 26.72 before intervention to 86.02 ± 22.84 after early detection of breast cancer ($P = 0.037$). - The mean knowledge score of survival rate among women 20 years after receiving a delayed diagnosis of breast cancer (before intervention: 36.46 ± 34.72; post-intervention: 10.98 ± 26.87; $P < 0.001$)
El Sayed et al(42), Saudi Arabia	Pre-post	33 deaf and hard hearing married female students	Cervical cancer	45 - 60 minutes the sign language educational sessions	Post-test was conducted two months after intervention using a CC knowledge quiz	- Before and after the intervention, we observed significant disparities ($P < 0.05$) in the participants' knowledge. - There was a notable increase in the total knowledge score following the intervention (FET = 16.345, $P = 0.000$).
Hashmi et al (43), India	RCT	Control = 91 deaf adolescents Experimental = 87 deaf adolescent	Dental health	Control: conventional visual method, using only posters without the use of sign language Experimental: using sign language (Indian)	Close-ended questionnaire	- After 12 weeks, the OHI-S scores of the sign language group decreased from 2.85 ± 0.86 to 1.71 ± 0.87. - The user did not provide any text. The average scores for OHI-S in the control group decreased from 2.83 ± 1.11 to 2.31 ± 1.13. A P-value of less than 0.05 indicated that the observed difference in scores showed statistical significance. - The user did not provide any text. The average reductions in OHI-S, PI, and GI scores in the sign language group were 1.13 ± 0.81, 0.66 ± 0.31, and 0.58 ± 0.32, respectively.
Galindo-Neto et al (44), Brazil	RCT	Control = 57 Intervention = 56	CPR	Control: CPR in an expository class with practical demonstration Intervention: Video and lecture with a practical demonstration of CPR	Immediately after intervention and after 15 days	- We found statistically significant differences between the knowledge-based questions that CG and IG asked about victim positioning ($P = 0.002$) and rotation ($P < 0.001$) on the pretest and post-test that were given 15 days apart. - Analyzing skill-related items between CG and IG at the pretest and post-test after 15 days revealed a statistically significant difference ($P = 0.006$) in the item speed ranging from 100 to 120.

Table 3. Summary of study quality assessment

Author	Questions										
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
Choe et al (24), 2009	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y
Cumberland et al (25), 2018	Y	N	Y	N	Y	N	Y	N	Y	Y	Y
Palmer et al (26), 2017	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y
Shabaik et al (27), 2010	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y
Crowe (28), (2019).	Y	Y	Y	N	Y	Y	Y	N	N	Y	Y
Engelberg et al (29), 2019	Y	N	Y	N	N	N	Y	Y	Y	Y	Y
Folkins et al (30), 2005	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y
Gournaris and Leigh (31), (2019).	Y	N	Y	N	Y	N	Y	N	Y	Y	Y
Harry et al (32), 2012	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y
Hickey et al (33), 2013	Y	N	Y	Y	N	N	Y	Y	Y	N	Y
Jensen et al (34), 2013	Y	N	Y	Y	Y	N	Y	N	Y	N	Y
Kushalnagar et al (35), 2018	Y	N	Y	N	N	N	N	N	Y	N	Y
Sacks et al (36), 2013	Y	N	Y	N	Y	N	Y	Y	Y	Y	Y
Wilson & Wells (37),2009	Y	N	Y	N	N	N	Y	Y	Y	Y	Y
Wilson (38), (2011)	Y	N	Y	N	N	N	Y	Y	Y	Y	Y
Yao et al (39), 2012	Y	N	Y	N	N	N	Y	Y	Y	Y	Y
Kaskowitz et al (40), 2006	Y	N	Y	N	Y	Y	Y	Y	Y	Y	Y
Sadler et al (41), 2012	Y	N	Y	N	Y	Y	Y	N	Y	Y	Y
El Sayed et al (42), 2022	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
Hashmi et al (43), 2018	Y	Y	N	Y	N	Y	N	Y	N	Y	Y
Galindo-Neto et al (44), 2020	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y

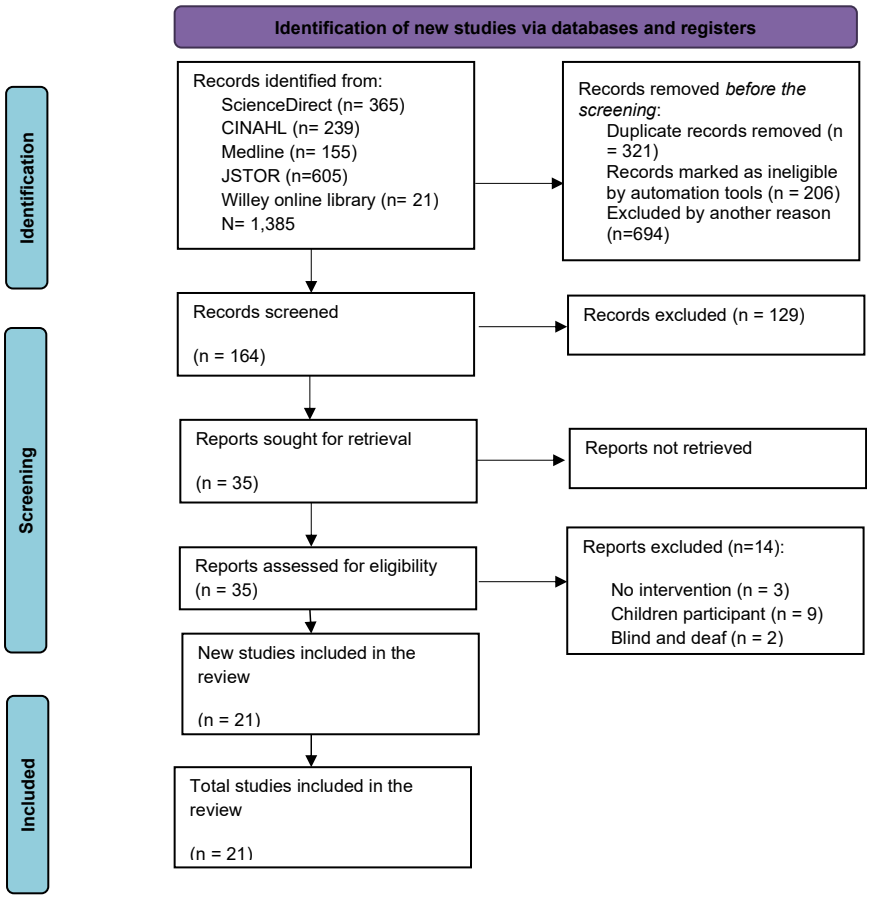

Figure 1. A literature search in the PRISMA flow chart.

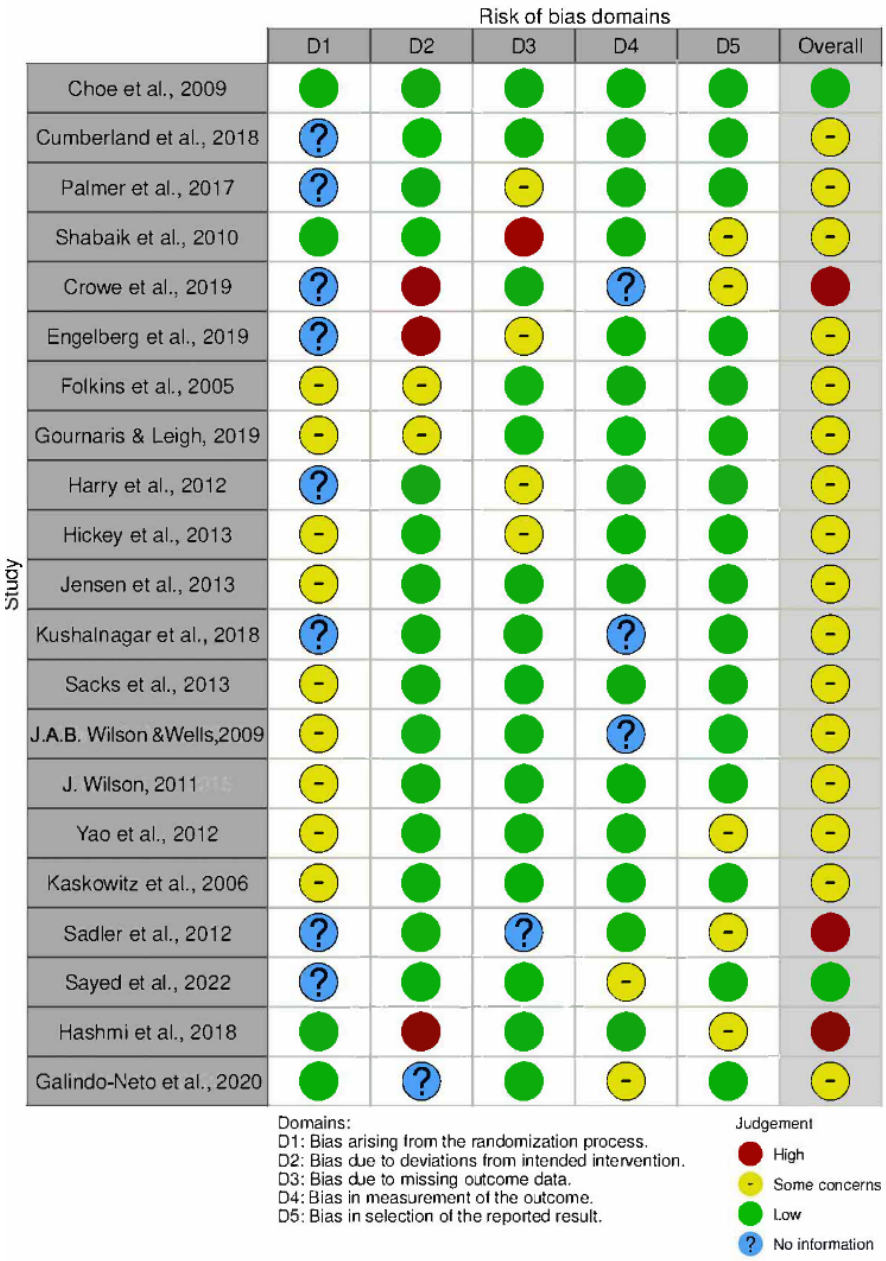

Figure 2. Summary of the RoB assessment in traffic light plot

Telemedicine is a potentially effective strategy for augmenting health literacy. The results of further research examined in this article indicate that participants' attitudes and behaviors are linked to the effects of these interventions. Studies have shown a direct relationship between the capacity to control one's well-being and the utilization of telemedicine. The study's findings indicated that those in the intervention group who got telepsychiatry demonstrated superior health management abilities compared to those in the control group who received conventional face-to-face therapy (28). A separate study examined the communication abilities and subjective experiences of deaf individuals using both face-to-face and video-mediated communication (VMC) modalities, in which The F2F condition, with a mean of 6.75 and a standard deviation of 3.46, showed lower signs of understanding compared to the VMC condition, which had a mean of 9.07 and a standard deviation of 4.57. Participants perceived that reading the instructor's fingerspelling in the F2F condition, with a mean of 9.47 and a standard deviation of 0.933, was superior to the VMC condition, with a mean of 8.97 and a standard deviation of 1.59. Statistical analysis revealed a significant difference between the two conditions, with a t-value of 2.360 and a p-value of 0.023. Furthermore, the participants reported a higher level of comprehension of the instructor in the F2F condition ($M = 9.65$, $SD = .580$) than in the VMC condition ($M = 9.30$, $SD = 1.04$; $t\ (1, 39) = 2.80$; $p = .009$). People were much better at talking and expressing themselves verbally in the face-to-face (F2F) condition ($M = 9.52$, $SD = 1.53$) than in the VMC condition ($M = 9.12$, $SD = 1.65$), $t\ (1, 39) = 2.393$, $p = .022$

(31)

In the context of telemedicine, the use of video media in the form of American Sign Language (ASL) has been observed to demonstrate a higher inclination among deaf individuals to inquire about lung cancer compared to those who do not utilize this technology (35). Wilson in their study found that using the telemedicine method (DODA Program), participants reported no alcohol intake in the past 30 days at follow-up ($\chi^2 = 1.99$) (38). A study on dental health in India found that OHI-S scores reduced from 2.85 to 1.71 in the sign language group after 12 weeks. In the control group, the mean scores for OHI-S reduced from 2.83 to 2.31 (43).

Discussion

The findings of this review underscore the significance of community-based sign language interpreters in guaranteeing healthcare equity for individuals who are deaf or hard of hearing. Telemedicine can provide accessibility to mitigating the scarcity of sign language interpreters in certain rural or socioeconomically disadvantaged regions. The average rating bias rate for the intervention is acceptable. However, further research is required to assess the magnitude of the effects of the current therapies. Deaf individuals face unique challenges when it comes to receiving health education. Due to communication barriers, traditional methods of health education may not be effective for deaf individuals. Therefore, it is essential to utilize specific methods of health education that are accessible and cater to the needs of deaf individuals (46).

Activities that facilitate individuals who are deaf or hard of hearing to access health information and to engage in conversations should be attributed to interventions aimed at improving health communication. These interventions should incorporate interpreter-assisted access and visual learning skills (33). To enhance educational technology, health professionals and researchers should consider the limited health literacy and communication abilities of those who are deaf and integrate best practices accordingly because health literacy remains inadequate among deaf individuals despite their high level of education. Health literacy underscores the criticality of providing sufficient educational resources and Information in this domain.

It is essential to permit accessible modes of communication, including short-sentence translations, sign language, and images, to provide technological solutions to those who are deaf or hard of hearing. Features that typically enable this adjustment are multimedia, software, or educational videos, which can enhance the appeal and enjoyment of learning. Evidence confirms that educational films are the predominant form of educational technology used in health education for people who are deaf or hard of hearing. Furthermore, 17 papers specifically examined scientific inquiries into the utilization of films, providing evidence to support their efficacy and practicality. The findings offered by this resource reveal a notable enhancement in learning and showcase the efficacy of this technological alternative. A study conducted in the United States showed a statistically significant improvement in the learning outcomes of deaf or hard-of-hearing people with limited educational backgrounds when exposed to bilingual videos with English subtitles and sign language, validating the effectiveness of this strategy.

Additionally, interactive educational software and computer-assisted instruction have proven effective health education methods for individuals with hearing impairments. These methods provide interactive and engaging learning experiences, allowing individuals to participate in their education. Overall, the method of health education for individuals who are deaf or hard of hearing should prioritize accessible modes of communication, utilize multimedia and interactive technology, and promote bilingualism and the use of sign language to enhance learning outcomes and ensure equal access to health education for this population.

Videos provide a range of techniques for visualizing phenomena, including simulations, models, and demonstrations. These methods facilitate the comprehension of concepts through mental images or visual associations, which are more immersive and lifelike than verbal descriptions. Specifically, educational films enhance instruction and learning quality while developing a greater desire to acquire knowledge, preserve Information, and demonstrate distinct teaching abilities. The availability of accessible videos is particularly appealing for individuals who are deaf or have hearing impairments, as it facilitates the simultaneous and joyful utilization of various educational materials that enhance learning and sign language. Furthermore, video utilization in health education facilitates the communication and support of Information by professionals who must be well-versed in sign language. Furthermore, it enables widespread distribution of Information in settings devoid of personnel.

Two studies in this review highlighted the effective utilization of printed materials for deaf health education. It is essential to highlight that individuals who are deaf or have hearing difficulties benefit from visual learning and using sign-language texts to enhance their understanding. Therefore, utilizing diverse and suitable technologies may provide circumstances that facilitate significant knowledge acquisition. Therefore, printed materials can be an educational resource for teaching and learning. Deaf educators prioritize using uncomplicated ideas and concise expressions to enhance students' comprehension. The majority of individuals who are not deaf hold the misconception that their hearing impairments exclusively hinder them from perceiving and comprehending written material. This assumption is invalid, as those who are deaf or hard of hearing may face difficulties comprehending Information due to the language barrier associated with spoken or written language, even when provided

with visual aids. Specific individuals who are deaf may experience challenges in reading and comprehending Information, irrespective of their proficiency in written language, due to the size of their writing. It is essential to emphasize the need for caution when utilizing written text in educational technologies and activities designed to promote the health of deaf individuals.

Several computer-mediated resources, including telehealth, websites, and online courses, are employed to educate deaf individuals on health matters in addition to print and video technology, as revealed in this study. This alternative employs distance education as a pedagogical approach. It facilitates learning by actively involving students in interactive scenarios that connect previously acquired knowledge with new Information. They are applying computer-mediated technologies to distance learning challenges and developing educational materials for pupils. They facilitate concurrently applying multiple teaching resources, including videos, photos, texts, animations, and dramatizations. A study conducted in Iran involving 82 deaf adolescents supported this benefit, demonstrating that the use of information technology can significantly improve the academic performance of deaf pupils.

Consequently, health education practitioners face the demanding task of providing training, mentoring, and Information to deaf individuals as their rightful entitlement. Research indicates that delivering health education to the deaf community through written, digital, or audio-visual media designed to accommodate their distinct communication and understanding requirements can significantly impact them. This strategy can effectively resolve this issue.

The findings of this review emphasize the empirical support for approaches to deaf health education. This study has shown that various technological modalities, such as educational videos, are often beneficial in supporting health education for deaf individuals. This finding suggests that future studies should explore the use of these technological resources further. Furthermore, it has been noted that there is still a need for more technology available in sign language for many health themes, and these technologies are primarily found in a limited number of nations. Hence, future research must focus on the identified shortcomings and encourage institutions conducting the studies to collaborate with foreign partners to conduct multicentric studies and advance current knowledge and practices.

Limitations

The selection process does not limit the study's quality to a high category because doing so would reduce the number of eligible studies. Inevitably, this will have an impact on the interpretation. The availability of open-access academic journals and specialized health issues such as reproductive health remains quite limited.

Conclusion

The research incorporated in this study has yielded that the health literacy media that have demonstrated efficacy in assisting those with hearing impairments are sign language films and online media. Following closely behind are printed materials and computer-funded technology, which are the most prevalent forms of health education for individuals who are hard of hearing or deaf. Ongoing research centers on cancer, mental health, dental health, reproductive health, emergency cardiopulmonary resuscitation, and CPR. Studies indicate that deaf individuals can comprehend and effectively utilize technological Information in health education. Moreover, subsequent surveillance conducted several months after the operation detected outcome alterations. The study emphasizes the necessity of implementing sustainable health education programs tailored to those with hearing impairments. Researchers in this domain should also consider the consequences of individuals utilizing these instructional tools. This limitation is because most publications solely assess knowledge and do not scrutinize behavior, attitudes, or practice alterations.

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Competing Interests

The authors declare that there is no conflict of interest.

Ethical Approval

Ethical considerations in this study included obtaining permission from the Ethics Committee of Poltekkes Kemenkes Jambi (No. LB.02.06/2/037/2021).

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