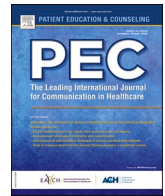




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Health disparities and health literacy challenges experienced by individuals with hearing loss: A scoping review

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ABSTRACT

Objective: The purpose of this scoping review is to explore health disparities and health literacy challenges encountered by U.S. adults with hearing loss when trying to seek specialized care and access to medical devices such as hearing aids.

Methods: The Arksey and O'Malley (2005) York methodology was used for this review: (1) identifying research questions; (2) searching for relevant studies; (3) selecting studies relevant to the research questions; (4) charting the data; (5) collating, summarizing, and reporting results.

Results: A total of 52 articles were retained for analysis. Significant associations were reported between health literacy and health disparities when assessing the relationship between health literacy and poor health outcomes, social support surrounding health, communication with health professionals, accessibility of health information, immediacy of care, income, healthcare costs, age, and gender.

Conclusion: Findings will inform evidence-based strategies to increase equitable access to affordable and quality care among patients with hearing loss.

1. Background

The WHO defines hearing loss as a person “not able to hear as well as someone with normal hearing, meaning hearing thresholds of 20 dB or better in both ears”. [1] This can extend to the point of profound hearing loss, also known as deafness, with deficits greater than 81 decibels. [2] Currently, the global prevalence rate of hearing loss is estimated to be around 20 %, with an expected additional increase of 1 billion individuals over the next 30 years. [2] Hearing loss has a wide range of presentations including uni or bilateral, symmetrical, or asymmetrical, progressive or sudden, and fluctuating or stable, among others. [3] People can also be affected by different degrees of this medical condition, anywhere between mild hearing loss that makes soft sounds hard to hear, to profound hearing loss, where said person will not detect any speech or very loud sounds. [3] All of these categories can be traced back to four etiologies: conductive hearing loss, sensorineural hearing loss, mixed hearing loss, or Auditory Neuropathy Spectrum Disorder. [3] .

Over 15 % of American adults report some difficulty hearing. In 2019, 13.0 % of adults aged 18 and over reported some difficulty

hearing, while 1.6 % either had a lot of difficulty hearing or could not hear at all, even when using a hearing aid. [91] Rates of hearing loss were mostly prevalent in older populations, as 64 % of Americans over the age of 70 experience clinical grade loss. [4–6] In fact, between the years of 20–69, age was the largest predictor of hearing loss [7], with 26.8 % of those aged 65 and over reporting some difficulty hearing, and 4.1 % having a lot of difficulty or could not hear at all. [92] Additionally, as of July 2022, roughly 118,100 devices have been implanted in adults and 65,000 in children in the United States. [93] Recent work in the field shows that those in the hearing loss community face a large number of factors that may lead to treatment disparities such as difficulty scheduling appointments, [8] lower income or socioeconomic position, [9] less access to care based on their location, [10] racial barriers, [11] or even dealing with the challenges imposed by the COVID-19 pandemic. [12].

Low health literacy is one risk factor exacerbating disparities in accessing healthcare services in patients with hearing loss. [13,14] Studies have shown that patients with low health literacy present with a greater degree of hearing loss, causing difficulties navigating the

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healthcare systems. [13–15] In Europe, a regional survey highlighted the dire need for an online awareness campaign across five countries due to the limited understanding of individuals with hearing loss on how to use hearing aids and how to manage their condition. [94] Low health literacy was also highlighted as a major influential factor of exacerbation of experienced health disparities in U.S. individuals with hearing loss. McKee et al. noted in their study that 48 % of the participants who were deaf had inadequate hearing literacy and were 6.9 times more likely to have low health literacy than those with adequate hearing. [16] Another study revealed that 31.6 % of participants who were deaf had a comprehension "below ninth grade," and surprisingly, 29.6 % of those individuals had at least a high school diploma, while 21.7 % had a college degree. [13] In addition to their low health literacy, individuals with hearing loss were likely to have higher medical costs, higher rates of depression, episodic memory loss, loneliness, and social isolation. [15,17] Gender disparities were also apparent, with older males having twice the risk of experiencing health literacy barriers as compared to their female counterparts. [15,17] Overall, these patients' quality of life is significantly impacted. [14].

Moreover, a national cross-sectional study surveyed 406 U.S. healthcare professionals to explore their hearing health and literacy perceptions. [18] Only 1 % of providers ranked hearing loss as most important compared to other health conditions, like Alzheimer's disease and cancers. [18] About 54 % acknowledged the association of hearing loss with depression, but few were aware of the relationship between falls, dementia, low income, and decreased job opportunities. [18] Not only were these findings valid for physicians, but other studies noted similar perspectives among adults in the U.S. [19] Results from these studies demonstrate the limited training and knowledge health care professionals and hospitals have, as well as the lack of general awareness in the U.S in recognizing hearing loss as disability and a healthcare priority. [18,19] It also highlights the need for appropriate measures to communicate and minimize barriers and misunderstandings between patients and providers. [14,15] Along with this limitation, very few studies discuss effective design strategies to approach the inequities experienced by this population. [14] There is a need to identify and

understand the current healthcare disparities experienced by individuals with hearing loss, including health literacy, with the goal of eliminating such disparities by implementing evidence-based interventions to reduce such a public health burden. [14–20].

The purpose of this scoping review is to explore the different types of health disparities encountered by U.S. adults with hearing loss when trying to seek specialized care and access to medical devices such as hearing aids. It will also assess the role of health literacy in exacerbating existing healthcare disparities in this population. Findings from this review will inform evidence-based strategies and frameworks to increase equitable access to affordable and quality care among patients with hearing loss.

2. Methods

A multidisciplinary team of professionals in the fields of medicine, public health, and health education led the review. A research librarian (MK) with expertise in scoping and systematic review guidelines carried out the search strategy across all databases (Supplementary Material 1). The study sections were developed using the PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews) as a checklist reference. [21] The review followed the York methodology by Arksey and O'Malley (2005) [22] and incorporated recommendations from the Joanna Briggs Institute (JBI) [23] for the extraction, analysis, and presentation of results in scoping reviews. Additionally, this scoping review was registered in October 2023 as part of the Open Science Framework (OSF) registries in the Generalized Systematic Review Registration category. [24].

2.1. Step 1. Identify research questions

Three guiding questions were created for this review: (1) What type of health disparities do older adults, greater than 18 years of age, with hearing loss encounter when seeking specialized care and access to medical devices such as hearing aids?; (2) What is the role of health literacy in exacerbating existing healthcare disparities in older adults,

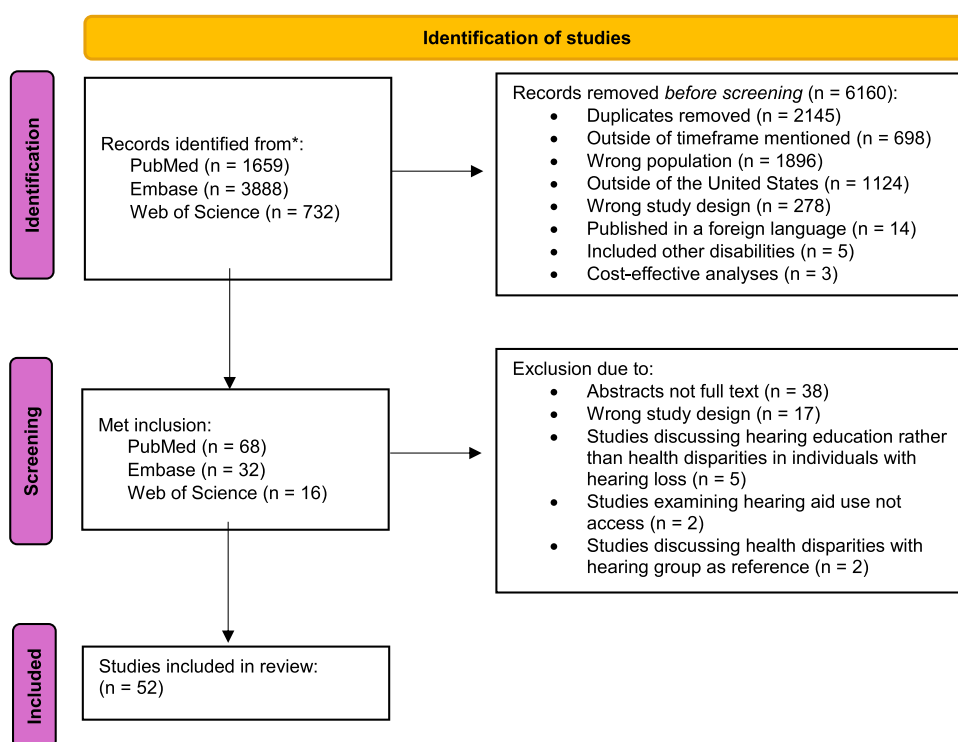


Fig. 1. PRISMA Flow Chart.

greater than 18 years of age, suffering from hearing loss?; (3) What are the lessons learned to increase equitable access to affordable and quality care among older adults, greater than 18 years of age, with hearing loss?

2.2. Step 2. Search for relevant articles

Key terms were developed with the help of a research librarian (MK). Search terms addressed hearing loss, hearing aids, hearing impairment, transitory deafness, hearing defect, healthcare disparities, adult, and healthcare inequities (Supplementary Material 1). Three databases were then used to search the available published peer-reviewed articles on the topic (PubMed, Embase, and Web of Science). These databases were selected due to their breadth and comprehensive coverage of the needed literature. The Rayyan software was used to accumulate and narrow studies generated from the targeted search. Literature review was completed from July of 2023 to September of 2023. Screening of articles was split into three groups of two between the six authors (JS and DL, VJ and SF, MR and JB) with oversight by senior author (LS). Disagreements were removed and resolved after blinding via consensus and discussion with senior author.

2.3. Inclusion criteria

Included in this study were males and females with hearing loss categorized as sensorineural, conductive, mixed, or partial and total hearing loss. Participants had to be older than 18 years of age with no upper limit for the age range. Articles included case reports, observational studies, and experimental studies. All articles had to be in English, and from the United States. Dates ranged from 2010 to present which encompassed up until July of 2023.

2.4. Exclusion criteria

Excluded were studies of patients with congenital hearing loss, and those that included participants under 18 years of age. Scoping reviews, systematic reviews, narrative reviews, and published abstracts were also excluded. Articles were also excluded if published before 2010, were carried out outside the U.S., or were published in foreign languages.

2.5. Step 3. Selection of studies relevant to the research question

All co-authors (JS, DL, VJ, MR, JB, SF) extracted and summarized the data from relevant sources. Senior author (LS) reviewed all the tabulated data to resolve discrepancies and access for accuracy. Summary tables included one evidence table describing study characteristics (Table 1). Table 2 included articles that assessed the role of health literacy in exacerbating disparities in hearing loss patients by looking at the type of methodology used in the study, seeing whether the measurement tool was validated or not, if any constructs were used, the mode of administration, if any relevant theoretical frameworks were being followed, and whether there was any significant or non-significant association between health literacy and health disparities reported in the studies. Table 3 is a lesson-learned table, which was carried out through qualitative content analysis to identify similar themes regarding future directions across each study.

2.6. Steps 4 and 5. Data charting and collation, summarization, and reporting of results

Study characteristics were tabulated for primary author, year, study design, sample size, study population, age range, study purpose, type of social determinant of health (SDOH), and health disparities (Table 1). Table 2 was tabulated for primary author, year, type of methodology used to measure health literacy, constructs measured in the study, whether the methodology was validated, the mode of administration, theoretical frameworks used, the role of health literacy on hearing loss,

and the association between health literacy and health disparities (significant/non-significant). The three phases of qualitative content analysis for the results of primary qualitative research described by Elo and Kyngas (2008) [25] were applied: i) preparation, ii) organizing, and iii) reporting (Table 3).

3. Results

The initial study extraction resulted in 6279 studies from PubMed (n = 1659), EMBASE (n = 3888), and Web of Science (n = 732). Studies were excluded if they were not in the timeframe mentioned (n = 698), addressed the wrong population (n = 1896), were conducted outside of the United States (n = 1124), had the wrong study design (n = 278), were published in a foreign language (n = 14), included other disabilities (n = 5), or were cost-effectiveness analyses (n = 3). Duplicated studies were deleted (n = 2145). One hundred and sixteen studies met inclusion criteria from PubMed (n = 68), EMBASE (n = 32), and Web of Science (n = 16). An additional 64 studies were excluded following a full study review due to 1) being abstracts not full text (n = 38), 2) having the wrong study design (n = 17), 3) discussing hearing education rather than health disparities in individuals with hearing loss (n = 5), 4) examining hearing aid use not access (n = 2), or 5) discussing health disparities with hearing group as a reference (n = 2). A total of 52 eligible studies were retained for analysis. [11,12,15,26–74].

The 52 retained studies were published between 2010 and 2023. Most studies (35/52, 67 %) were published in 2018 or later (n = 35). Study designs included cross-sectional studies (n = 36); retrospective cohort studies (n = 7); qualitative studies (n = 3); pilot studies (n = 2); randomized controlled study (n = 1); usability study (n = 1); editorial (n = 1); and case series (n = 1). Sample size ranged from n = 12 to n = 8027,938 individuals with hearing loss (Table 1).

Major SDOH Explored and Health Disparities Experienced in Individuals with Hearing Loss Various social determinants of health were explored including age (n = 47), gender (n = 43), race/ethnicity (n = 40), access to care (n = 33), socioeconomic status (n = 32), education (n = 29), relationships (n = 12), language (n = 3), and access to technology (n = 2). Health disparities experienced by individuals with hearing loss included access to hearing loss healthcare and providers (n = 20), health literacy and access to health information (n = 9), mental health issues (n = 9), chronic diseases (n = 6), communication (n = 5), health risk behaviors (n = 4), emergency department utilization (n = 4), access to sexual healthcare (n = 3), maternal/fetal health outcomes (n = 2), domestic violence (n = 1), occupational discrimination (n = 1), poly-pharmacy (n = 1), and inclusion in precision medicine studies (n = 1) (Table 1).

3.1. Health literacy assessment tools, constructs, and frameworks

Of the fifty-two studies that were included in this study, fourteen (27 %) utilized a methodology to measure health literacy (Table 2). Health literacy was measured using diverse tools including Short Test of Functional Health Literacy in Adults (n = 2), ASL Newest Vital Sign (n = 2), Flesch-Kincaid Grade Level formula (n = 1), Flesch Reading Ease Scale (n = 1), SMOG (n = 1), Fry Graph (n = 1), Rapid Estimate of Adult Literacy in Medicine (n = 1), and the Health Information National Trends Survey (n = 1), amongst others. Major constructs measured include definition of hearing loss, knowledge of link between hearing loss and other health and social issues (n = 2), functional health literacy (n = 3), reading literacy, word length and syllable count (n = 2), word recognition (n = 1), knowledge of cancer genetics and of genetics counseling (n = 1), understanding and use of a nutrition facts label (n = 1), engagement in health-related social media activities (n = 1), and confidence in one's ability to fill out medical forms (n = 1). Several of the tools were validated (n = 10). Modes of administration varied between online (n = 3), electronic (n = 1), in-person (n = 5), computer-based (n = 4), video format (n = 1), questionnaires (n = 2), telephone

Table 1
Study Characteristics.

Article #	Primary Author/Year	Study Design	Sample Size	Study Population	Age Range	Study Purpose	Type of SDOH	Health Disparities
1	Argenyi et al., 2019	Cross-sectional Study	n = 340	The Health Information National Trends Survey in ASL	> 18 years old	To investigate both the likelihood of HIV screening uptake among deaf adults in the past year and over one year ago, and the relationship between social media use and HIV screening uptake among deaf adult ASL users	Age, gender, race, education, Have a regular provider, sexual orientation	HIV/STD Screening
2	Barnett et al., 2011	Cross-sectional Study	n = 339	Deaf individual in Rochester NY	> 18 years old	To develop and administer an ASL-accessible health survey to estimate deaf individuals' health status and health risk and to compare results with data from the local general population as a means of identifying health inequities	Age, sex, race, Household income, highest level of education, marital status, age of onset of deafness	Obesity, partner violence, and Suicide
3	Bernstein et al., 2023	Cross-sectional Study	n = 5270	NHANES study	> 18 years old	Assess the relationship between insurance status and prior audiogram, and hearing aid use among subjects with hearing loss	Insurance status, sex, age, race, education, marital status, income, MI, HF, Heart disease, stroke, cancer, diabetes, hearing loss	Insurance status
4	Carlson et al., 2022	Cross-sectional Study	n = 1250	Convenience sample of self-reported individual in USA	50 – 80 years old	To characterize current awareness, perceptions, and literacy surrounding hearing loss among the adult population in the United States	Age, gender, race, education, employment status, health insurance, glasses	Likelihood to get screened for hearing loss, health issues related to hearing loss
5	Chan et al., 2017	Cross-sectional Study	n = 336	Patients receiving hearing aids at either a metropolitan or rural otolaryngology fitting center	> 18 years old	To compare the timing of hearing aid acquisition between adults in rural and urban communities	Age, commute to audiologist, sex, race, education, income, insurance status	Timing of hearing aid acquisition
6	Cortina et al., 2023	Cross-sectional Study	n = 8875	NIH all of us research program (diverse group of 1 million participants around US)	> 18 years old	To explore how gender and low-income status independently influence general health care access in patients with hearing loss	Age, gender, race, income, education, health insurance	Gender and low income impact, General health care access in hearing loss
7	Davis et al., 2023	Retrospective Cohort study	n = 349	Adults referred to the CI center for their first cochlear implantation candidacy evaluation between April 2017 and July 2019 in North Carolina	~ 63 years old	To understand the influence of extended travel time to a cochlear implant (CI) center or lower socioeconomic status (SES) on patient appointment attendance for candidacy evaluations, and CI recipients' adherence to post-activation follow-up recommendations that support optimal outcomes	Age, travel time, insurance, SES as evaluated by social deprivation index	Travel time and SES for CI patients

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Table 1 (continued)

Article #	Primary Author/Year	Study Design	Sample Size	Study Population	Age Range	Study Purpose	Type of SDOH	Health Disparities
8	Garofalo et al., 2021	Cross-sectional Study	n = 267	National, Internet-based survey of people with disabilities	> 18 years old	To Understand views and concerns about precision medicine research in deaf and hard of hearing individuals to inform processes to foster inclusion in future studies and reduce health disparities	Age, sex, race, ethnicity, education, income, residence, employment status	Disparity in inclusion in precision medicine studies
9	Hay-McCutcheon et al., 2018	Cross-sectional Study	n = 80	Adults over 60 with either normal hearing or bilateral hearing loss	> 60 years old	To explore the extent to which hearing loss affected positive social interactions in older adults living in rural and urban communities	Age, hearing aid use, income, race, education	Rural vs urban community
10	Hay-McCutcheon et al., 2021	Cross-sectional Study	n = 134	Participants were recruited from rural and urban counties in West Central and South Alabama, and had varying degrees in access to healthcare	20 –92 years old	To understand the challenges that those with hearing loss living in rural and urban communities experience and to examine the feasibility of using primary care physicians to assist with improving access to hearing healthcare in rural communities	Gender, income, race, residency, hearing loss, hearing aid use	Rural vs urban community
11	Heiman et al., 2015	Cross-sectional Study	n = 282	Deaf participants from the greater Rochester, NY area who participated in the 2008 DeafHealth	18 –64 years old	To characterize the self-reported sexual behaviors of Deaf individuals	Gender, age, race, marital status, education, income	Differences in condom use and HIV testing
12	Hixon et al., 2016	Cross-sectional Study	n = 91	Adult cochlear implant recipients at the tertiary referral center coming from extremely rural counties, moderately rural counties, and urban counties	> 18 years old	To compare the timing and impact of hearing healthcare of rural and urban adults with severe hearing loss who use cochlear implants	Gender, Race, Age, Education, Employment, Income, Insurance status	Difficulty performing job, prevent hiring, causing loss of Job, Prevent Promotion, Cause Discrimination in Workplace, Desire to complete higher education, Prevent from completing education in past
13	Hughes et al., 2018	Case Series	n = 204	Patients with sudden sensorineural hearing loss (SSNHL) in the Department of Defense electronic medical record (AHLTA) between March 1, 2012, and September 30, 2015	4 - 92 years old	To evaluate provider compliance with the 2012 clinical practice guideline and identify areas for improvement in the pathways from the primary care physician to the otolaryngologist	Gender, Age	Time from onset of symptoms to evaluation by primary care, emergency department, audiology, and otolaryngology providers and treatments
14	Ingram et al., 2016	Qualitative Study	n = 20	Hard of hearing (HOH) older adults from a U.S.–Mexico border community from Nogales, Arizona	> 50 years old	To use findings to develop an integrated public health approach that incorporates the clinical science of audiology within a broad social–ecological framework	Gender, Age, race, access to care	Financial resources for hearing aids, Language barriers, cost, and distance from specialists affect access to care, patient–provider communication (including hearing loss), providers felt limited in their ability to respond because of lack of equipment

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Table 1 (continued)

Article #	Primary Author/Year	Study Design	Sample Size	Study Population	Age Range	Study Purpose	Type of SDOH	Health Disparities
15	James et al., 2022 a.	Editorial	n = 151	Older adults with hearing loss	> 60 years old	To look at self-perceived communication at three months using a community health worker-delivered personal sound amplification products (PSAPs) To look at physical health, depression, social isolation, loneliness, and self-efficacy in using the PSAPs	Income, Insurance Status	or scope of practice, lack of insurance coverage for hearing aids, providers expressed skepticism regarding both patient motivation to seek care and the medical system to respond, Income restrictions, technology access (computer, smartphone, digital literacy), insurance coverage
16	James et al., 2022 b.	Retrospective Cross-sectional Study	n = 108 (DHH-ASL); n = 358 (DHH English speakers)	Patients who are deaf and hard of hearing (DHH) American sign language user (ASL) and DHH English speakers from a large academic medical center in the southeast United States between June 2011 and April 2020	21 –92 years old (DHH-ASL); 18 –106 years old (DHH English speakers)	To assess indicators of emergency department care-seeking and quality outcomes among DHH patients, segmenting by language modality	Age, Race, Gender, Insurance Status	Outcomes measures to compare disparities between DHH and non-DHH: Emergency Severity Index, Triage pain, Length of Stay, ED Revisits
17	James et al., 2022c.	Pilot Study	n = 92	Deaf ASL users who lived in Florida (self-identifying as Deaf, hard of hearing, DeafBlind (being Deaf with blindness/low vision), DeafPlus (being Deaf with additional disabilities), or hearing impaired)	> 18 years old	To compare health care use and health risk behaviors among Deaf ASL users and hearing English speakers in Florida To identify the greatest health concerns of the Deaf community.	Age, Gender, Race, Ethnicity, Education, Employment Status, Income, Insurance Status	Health insurance, Routine checkups, HIV testing, smoking, binge drinking, overweight/obese, use of ER, mental health (PHQ–2), denied interpreter at medical facility. <u>Concerns of Population:</u> mental health, specific condition, weight management, sexual health, diabetes management/prevention, Cardiovascular health
18	James et al., 2022 d.	Retrospective Cross-sectional Study	n = 277 (DHH-ASL); n = 1000 (DHH English-speaking)	Deaf and Hard of Hearing (DHH) ASL user and DHH - English speaking patients within the academic medical center's EHR system in the southeastern US, between June 1, 2011, and April 3, 2020	> 18 years old	To examine inequities with ED utilization outcomes among DHH patients compared to non-DHH English-speaking patients. To better understand ED utilization rates, modeling the frequency of ED encounters To describe the conditions for which	Age, Gender, Race, Ethnicity, Insurance status	Smoking and emergency department utilization (diagnosis in ED: ranged from injury, medical, mental health/substance use, or maternal/neonatal)

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Table 1 (continued)

Article #	Primary Author/Year	Study Design	Sample Size	Study Population	Age Range	Study Purpose	Type of SDOH	Health Disparities
19	Kushalnagar et al., 2015	Usability Study	n = 32	Deaf students who know ASL, who had an Associate degree program at NTID in Fall 2012 or were enrolled in an intensive English course based on English placement test scores in Spring 2013	> 18 years old	DHH patients seek ED care To obtain ASL users' perspective on the navigation of these ASL- accessible websites, finding the health information that they needed, and perceived ease of understanding ASL video content	Age, Gender, Race, Family HX of Deafness, health literacy	Accessing health information, using the website, perceived ease of understanding health information in ASL
20	Kushalnagar et al., 2018	Cross-sectional Study	n = 642	Deaf adult signers were recruited across the USA	18–95 years old	To evaluate whether deaf people who retrospectively reported reduced access to understanding caregiver's basic communication have greater risk for food insecurity later in life	Age, Gender, Race, Education Level, Employment Status, Income, Marital Status, LGBTQ, Dx of depression, have deaf parents	Food security, Depression, and communication regarding caregiver who took care of them the most
21	Kushalnagar et al., 2019	Cross-sectional Study	n = 529	Deaf women in the U.S from Health Information National Trends Survey - ASL (HINTS-ASL) from February 2017 through August 2017 and October 2017 to May 2018	Pap smear: 21 –65 years old Mammogram: 40 –74 years old	To assess whether disparities for cancer screening adherence persist for Deaf women compared with the general population To assess whether racial and ethnic disparities continue to exist among Deaf women.	Age, Race, Ethnicity, Education, Income, Marital Status, Health Insurance, Family Hx or Hx of cancer, parent's deaf	Cervical Cancer screening, Mammogram Cancer screening. Regular Provider visits, Communication modality with doctor, use of hearing device
22	Kushalnagar et al., 2017	Cross-sectional Study	n = 38	Deaf- ASL undergraduate students	~ 22 years old	To examine whether stronger interactive health literacy with friends is associated with higher critical health literacy skills	Age, Gender, Race, hearing level, Parent hearing status	Health literacy in communicating with peers and family members
23	Lin et al., 2021	Cross-sectional Study	n = 12,140	Medicare beneficiaries utilizing Part A or Part B Medicare from the 2016 MCBS public-use data which were collected from January 2016 through early January 2017	> 65 years old or age < 65 years with a qualifying disability	To use the Medicare Current Beneficiary Survey (MCBS) to investigate the association between healthcare seeking behaviors and perceived functional hearing status using a nationally representative sample of Medicare beneficiaries	Age, Race, Ethnicity, Education, Marital status, Incomes, Health status, Functional limitations (i.e. ADLs), Hx of dementia or Alzheimer's, Hx of depression	Avoid seeing the doctor, Delaying seeing the doctor when feeling sick, worrying about health more than others their age, Keeping to him/herself when feeling sick
24	Mahmoudi et al., 2018	Retrospective cohort study	n = 1336	Medical Expenditure Panel Survey from the Agency for Healthcare Research and Quality	65 –85 years old	To examine the mean treatment outcomes of hearing aid use on health service cost and use	Age, sex, race/ ethnicity, physical limitations, language, region of country, education level, federal poverty level	Health service costs and hospitalizations/ED visits
25	Mahmoudi et al., 2019	Retrospective cohort study	n = 114,862	Clinformatics DataMart Database (OptumInsight)	66 –80 + years old	To examine the association of three common conditions among adults aged 66 years and older who were diagnosed with hearing loss: Alzheimer's disease/dementia, depression/anxiety, and injuries related to falls	Age, sex, race/ ethnicity	Delay in diagnosis of Alzheimer's/dementia, depression/anxiety, and injuries related to falls

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Table 1 (continued)

Article #	Primary Author/Year	Study Design	Sample Size	Study Population	Age Range	Study Purpose	Type of SDOH	Health Disparities
26	Mahmoudi et al., 2021	Cross-sectional study	n = 19,736	2013 –2014 Medical Expenditure Panel Survey	50 –85 years old	To examine whether hearing loss is associated with poorer access to care	Age, sex, marital status, physical limitations, race/ethnicity, education attainment, household income	Access to care (unmet medical needs, delays in getting medical care, unmet prescriptions, delays in getting needed prescriptions Literacy about cochlear implants
27	Marinelli et al., 2022	Cross-sectional study	n = 15,138	MarkeTrak National Survey with Dynata sample sources	34 –68 years old	To better characterize existing literacy surrounding cochlear implants among the general adult population in the United States	Age, sex, race/ethnicity	Increased risk for cardiovascular disease
28	McKee et al., 2014	Cross-sectional study	n = 302	Deaf Health Survey (2008), adapted and translated BRFSS administered in sign language	18 –88 years old	To examine whether educational attainment and/or annual household income were inversely associated with cardiovascular risk in a sample of Deaf ASL users	Educational attainment, annual household income, age, sex, race/ethnicity	ED usage of deaf ASL users compared to hearing peers
29	McKee et al., 2015	Retrospective cohort study	n = 400	Medical records from large non-hospital affiliated primary care-based outpatient health center in Rochester, New York region	18 –60 + years old	To compare ED use between deaf and non-deaf patients	Age, gender, insurance type, educational attainment, race, ethnicity	Health literacy scores compared to educational literacy, educational attainment, and cardiovascular health knowledge; health literacy among Deaf ASL users compared to hearing participants
30	McKee et al., 2015	Cross-sectional study	n = 405	Residents of greater Rochester, New York metropolitan statistical area recruited at health fairs, flyers at different community locations, distribution of flyers and information through community organizations, and community health clinics	40 –70 years old	To assess the prevalence and correlates of inadequate health literacy among Deaf ASL users and hearing English speakers	Age, sex, educational attainment, household income, race/ethnicity	Maternal/fetal health outcomes
31	Mitra et al., 2016	Cross-sectional study	n = 3266,577	2008 –2011 Nationwide Inpatient Sample of the Healthcare Cost and Utilization Project in 2015	18 –34 years old	To compare birth outcomes in women with hearing loss and without	Maternal age, racial and ethnic identity, type of health insurance, comorbidity, region of hospital, median household income for mother's ZIP code	Maternal/fetal health outcomes
32	Mitra et al., 2021	Cross-sectional study	n = 8027,938	2007 –2016 Healthcare Cost and Utilization Project National Inpatient Sample	Women of menstrual age	To compare pregnancy complications and neonatal outcomes between deliveries to deaf and hard of hearing women and non-deaf and hard of hearing women using national hospitalization discharge record data	Age, sex, race, health insurance, income, zip code	Maternal/fetal health outcomes
33	Nair & Cienkowski, 2010	Qualitative Study	n = 12	Patients scheduled for hearing orientation	57 –85 years old	To examine the grade level of language used in verbal and	Literacy	Understanding of one-on-one counseling and

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Table 1 (continued)

Article #	Primary Author/Year	Study Design	Sample Size	Study Population	Age Range	Study Purpose	Type of SDOH	Health Disparities
34	Neuhauser et al., 2013	Qualitative Study	n = 80	Emergency preparedness materials (EPM) for Deaf/HH and older adult populations from CBOs and from public health departments from local and national websites	N/A	written communication samples during routine hearing aid orientation appointments To explore issues related to EPM for Deaf/HH and older adult populations, to assess the availability and readability of materials for these populations, and to recommend improvements	Literacy	hearing aid instruction guides Access to and understanding of emergency preparedness materials
35	Nieman et al., 2016	Cross-sectional Study	n = 1544	Older adults (aged 70 +) with audiometry and hearing care data from the 2005 –2006 and 2009 –2010 NHANES	> 70 years old	To examine hearing health care disparities, specifically, recent hearing testing and regular hearing aid use, among older adults using nationally representative data and to explore whether the associations differ by race/ethnicity	Age, Race/ethnicity, Marital status, Poverty income ratio (PIR), Insurance status, Noise exposure history, Utilization of hearing protection, General health condition, Health care utilization	Access to and utilization of hearing testing and hearing aids
36	Nieman et al., 2017	Prospective Randomized Control Pilot Study	n = 15	Individuals with clinically significant hearing loss and no hearing aid use who live in one of three buildings in a subsidized, independent housing community for low- and middle-income older adults in Baltimore, Maryland	> 60 years old	To evaluate the feasibility, acceptability, and preliminary efficacy of a new intervention, HEARS (Hearing Equality through Accessible Research & Solutions)	Age, Race/ethnicity, Gender, Education, Literacy, Living arrangement, Household income, Technology use, Hearing history, Access to hearing aids	Communication function and social-emotional function for patients with hearing loss
37	Palmer et al., 2017	Parallel 2:1 Randomized Controlled Study	n = 150	Adult Deaf ASL-users with computer and internet access	> 18 years old	To compare the effectiveness of cancer genetics information presented in two modalities, a bilingual ASL with English closed captioning modality and a monolingual English text modality	Age, Race/ethnicity, Gender, Education, Literacy, Occupation, Cultural affiliation	Cancer genetics knowledge, confidence, and intentions
38	Pandhi et al., 2011	Retrospective Cohort Study	n = 6524	Men and women who graduated from Wisconsin high schools in the spring of 1957 and 1958 and their randomly selected siblings who responded to both the telephone and mail surveys and who answered questions about their hearing capability	> 40 years old	To investigate whether older adults who are hard-of-hearing are more likely than other adults to report experiencing difficulties and delays in accessing care and decreased satisfaction with access to care	Age, Gender, Marital status, Education, Total Household Income, Type of Health Insurance, Urban or rural residence	Ease of and satisfaction with access to care
39	Panko et al., 2021	Cross-sectional Study	n = 178	Hearing and deaf participants who had agreed to be re-	> 18 years old	To compare COVID-19-related information access	Age, Race/ethnicity, Gender,	Access to COVID-19 related information and

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Table 1 (continued)

Article #	Primary Author/Year	Study Design	Sample Size	Study Population	Age Range	Study Purpose	Type of SDOH	Health Disparities
				contacted via email from a prior health literacy study that recruited from HMC at Flint, MI, NTID in Rochester, NY, and the Sinai Deaf Health program in Chicago, IL		and COVID-19 knowledge (identification of accurate symptoms, preventive strategies, and planned health care navigation) between deaf participants who use ASL and participants who can hear	Education, Health literacy, Income	Knowledge of COVID-19 symptoms, preventive strategies, and planned health care navigation
40	Perrodin-Njoku et al., 2022	Cross-sectional Study	n = 735	Black hearing English speakers who completed the National Cancer Institute Health Information National Trends Survey (HINTS) and Black DHH adults who responded to the HINTS-ASL Medicare beneficiaries	> 18 years old	To describe the lifetime prevalence for certain medical conditions within a sample of Black deaf and hard-of-hearing (DHH) Americans, and to compare their lifetime prevalence rates with Black hearing Americans	Age, Gender, Education, BMI	Lifetime prevalence for certain medical conditions
41	Rhee, 2020	Cross-sectional Study	n = 5519	Deaf individuals whose primary language is ASL	> 65 years old	To investigate the prevalence of depression and factors associated with depression in older adults with hearing impairment	Sex, Race/Ethnicity, and Insurance status	Depression
42	Ryan & Kushalnagar, 2018	Cross-sectional Study	n = 515	Non-institutionalized civilian population in the USA	> 18 years old	To explore whether engagement in social eHealth activities on social network sites is linked to online communication with health care providers in a deaf population	Access to Technology, Age, Education, and Gender	Communication Barriers; Access to online healthcare providers
43	Scinicariello et al., 2019	Cross-sectional Study	n = 3316	US adults with health insurance	20 –69 years old	To explore the association between hearing loss and depression	Age and Sex	Depression
44	Simpson et al., 2018	Matched Cohort Study	n = 904,750	Adults with moderate to moderately severe symmetrical sensorineural hearing loss who were referred to a public or private audiological clinic	> 65 years old	To investigate the average costs of US healthcare for older adults with and without hearing loss	Age, Sex, Race/Ethnicity and Insurance status	Cost of healthcare; Medicaid/Medicare Coverage
45	Tavanai et al., 2023	Matched Cohort Study	n = 114	Adult patients who underwent cochlear implantation at evaluation at UT Southwestern Medical Center from 2009 –2018	55 –85 years old	To explore differences in self-perception, communication difficulties, and depression between older adults who use hearing aids and those that do not	Age and Sex	Handicap, communication, and depression
46	Tolisano et al., 2020	Retrospective Cross-sectional Study	n = 823	Adult patients who underwent audiometric testing and filled a health literacy questionnaire from 2018 –2019	> 18 years old	To identify the demographic makeup of patients sent for cochlear implant evaluation and identify the resulting rate of cochlear implantation surgery	Age, Sex, Race/Ethnicity, Language, Marital status and Insurance status	Access to cochlear implantation referral and surgery
47	Tran et al., 2020	Cross-sectional Study	n = 1376	Adult patients who underwent audiometric testing and filled a health literacy questionnaire from 2018 –2019	> 18 years old	To examine the relationship between health literacy and severity of hearing loss among patients at first presentation and rate, as well as health literacy and the rate of adoption of hearing aids	Age, Sex, Marital status, Education, Race/Ethnicity, Language, Employment status and Insurance status	Health literacy and hearing loss healthcare services

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Table 1 (continued)

Article #	Primary Author/Year	Study Design	Sample Size	Study Population	Age Range	Study Purpose	Type of SDOH	Health Disparities
48	Wells et al., 2020 a	Cross-sectional Study	n = 20,244	Individuals with AARP Medicare supplement plan across America who completed telephone survey	> 65 years old	among hearing aid candidates To explore physical and psychosocial conditions and health outcomes associated with HL, and the benefits associated with hearing aid use among older adults	Income, gender, age, social support	Depression, mobility limitations, polypharmacy
49	Wells et al., 2020 b	Cross-sectional Study	n = 19,223	Individuals with AARP Medicare supplement plan across America who completed telephone survey	> 65 years old	To explore characteristics associated with limited health literacy and medical costs and gaps in care based on health literacy, hearing loss, hearing aid use	Age, gender, race, income, zip code	Medical costs
50	Willink, 2020	Cross-sectional Study	n = 10,510	Individuals who responded to Medicare Current Beneficiary Survey in 2017	> 65 years old	To examine how hearing loss impacts Medicare beneficiaries in understanding the program and their ability to compare and review plan options and satisfaction with available information	Age, sex, race, education, income	Insurance, chronic conditions
51	Willink et al., 2021	Cross-sectional Study	n = 7361	Adults enrolled in Medicare with self-reported trouble hearing and/or hearing loss	> 65 years old	To describe characteristics and health care utilization patterns in people who do not use hearing aids	Age, gender, race, education, income	Chronic conditions, number of ADLs
52	Yi et al., 2022	Cross-sectional Study	n = 10,301	Individuals who responded to Medicare Current Beneficiary Survey in 2016 –2018	> 65 years old	To examine individual-level factors associated with hearing aid use by race and ethnicity	Age, gender, education, residence	Chronic conditions, number of ADLs, Medicaid eligibility, seen hearing healthcare provider

(n = 1), or via Medicare (n = 1). Only 14 % of studies (n = 2) used a framework, with those used including the Integrated Health Literacy conceptual model (n = 1), Social Cognitive Theory (n = 1), Community engagement approach (n = 1), and Human factors approach (n = 1) (Table 2).

3.2. Role of health literacy in exacerbating health disparities in U.S. adults with hearing loss

There were significant associations between health literacy and health disparities when assessing the relationship between health literacy and poor health outcomes, social support surrounding health, communication with health professionals, accessibility of health information, immediacy of care, income, healthcare costs, age, and gender (n = 13). However, some studies did find this relationship to be non-significant (n = 5) (Table 2).

3.3. Lessons learned

Major themes were highlighted from lessons learned across studies pertaining to health literacy and disparities in patients with hearing loss and impairment (Table 3). Many studies in the review highlighted gaps in the health literacy of patients with hearing loss and provided future directions for research and clinicians to bridge communication and education gaps via social media, videos and use of the internet. Additionally, studies assessed variable disparities comprising barriers to care

in patients with hearing loss. Such barriers included rural geography, transportation difficulties, and financial obstacles. These barriers were not limited to hearing care, but additionally highlighted the impact social determinants of health in the hearing impaired had on their reproductive, mental, cardiovascular, and primary care (Table 3).

4. Discussion

The impact of SDOH has exacerbated health inequities within hearing loss management and treatment accessibility and affordability. [75] There is a higher prevalence of HL in older adults, with most disparities existing regarding access to care. [75,76] For instance, regarding COVID-19 vaccination, there has been a lower initiation rate with adults with hearing loss, potentially because of low prioritization and neglected data collection efforts towards this population. [77] Furthermore, low quality and less safe healthcare access in patients with hearing loss can be aggravated when low socioeconomic status, limited insurance status, low education status, and even a patient’s native language come into play. [75,76,78,79] In deaf Black Americans, there have been lower hypertension rates; however, this is likely due to underdiagnosis as an effect of low health literacy, poor provider-physician communication, and potentially not having regular providers. [80] Language barriers have been linked to patients not seeking hearing screening, while lower educational attainment and socioeconomic position have been associated with low compliance with hearing loss treatment, like hearing aid use, leading to an overall lower prognosis with cochlear implants. [79].

Table 2
Health Literacy Assessment Tools, Constructs, and Frameworks for Individuals with Hearing Loss.

Article #	Primary Author/Year	Type of Methodology Used to Measure Health Literacy	Constructs Measured	Validated	Mode of Administration	Theoretical Framework Used	Role of Health Literacy	Association between Health Literacy and Health Disparities
1	Carlson et al., 2022	Questions with categorical responses to assess knowledge of hearing loss, link between hearing loss and other health and social issues, impact of hearing loss on health, safety, and quality of life, frequency of hearing loss evaluation, and steps to restore hearing loss	Defining Hearing Loss Timing of Last Hearing Test Knowledge of link between hearing loss and other health and social issues Impact of hearing loss on health, safety, and quality of life Reasons for not having hearing evaluated more often Steps used to restore or protect/preserve hearing health	No	Online survey	N/A	When evaluating awareness surrounding associations between hearing loss and other health and social issues, less than one- fourth indicated strong awareness about links between hearing loss and depression, employability and income, fall risk, dementia, and type 2 diabetes. While most patients acknowledge the potential impacts of hearing loss on safety, quality of life, and health, less than half believe that hearing loss is treatable and less than 20 % believe that hearing loss is preventable.	Significant (poorer understanding of “normal” hearing levels; lack of knowledge about existing treatment options for the management of hearing loss)
2	Kushalnagar et al., 2015	7-minute short form of the Test of Functional Health Literacy in Adults (S-TOFHLA; 36 items)	Functional Health literacy defined as ability to read and comprehend health information in the English language	Yes	Electronic survey	The Integrated Health Literacy conceptual model	Participants who chose ASL as their preferred language had lower health literacy scores. Lower health literacy group to report greater difficulty with using the website than the adequate health literacy group. Participants with low level of health literacy rated the same website as difficult to find information as compared to adequate and expert health literacy groups. Low health literacy commented that they gave up looking for information if the website was to complex. The lower health literacy group demonstrated a greater preference for one person explaining the health problem.	Non-significant (no difference across health literacy group emerged for any of the website)
3	Kushalnagar et al., 2017	7 min Short Test of Functional Health Literacy in Adults (S-TOFHLA, 36 items)	Functional health literacy, Interactive Health Literacy (discussed with family and/or	Yes	Online questionnaires/In-person survey with a research assistant who	N/A	Importance of socializing with health-literate, accessible peers to improve the health	Non-Significant (Discussion of medical history with family or functional health literacy)

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Table 2 (continued)

Article #	Primary Author/Year	Type of Methodology Used to Measure Health Literacy	Constructs Measured	Validated	Mode of Administration	Theoretical Framework Used	Role of Health Literacy	Association between Health Literacy and Health Disparities
		Two Questions for Interactive Health literacy 90 s video for Critical Health Literacy	friends), and Critical Health Literacy		scored responses with a rubric criteria		literacy and health outcomes of deaf people.	Significant (Greater frequency of health-related discussions with friends)
4	McKee et al., 2015	ASL-NVS (Newest Vital Sign)	Numeracy, document literacy, and reading literacy	Yes	Computer interface	N/A	Correlation between health literacy and cardiovascular health knowledge, deaf participants were 6.9x more likely than hearing participants to have inadequate health literacy.	Significant (Cardiovascular health knowledge)
5	Nair & Cienkowski, 2010	Flesh-Kincaid Grade Level formula	Word length & Syllable count	Yes	In-person counseling session OR Microsoft Word (Computer-based)	N/A	With low health literacy, hearing-impaired patients are at a disadvantage and face a communication gap when meeting their healthcare needs.	Significant (Communication gap in accessing needed healthcare services)
6	Neuhauser et al., 2013	Flesch Reading Ease Scale; Fry Graph; SMOG	Average sentence length & average syllables per word; Number of sentences and syllables per 100 words; Number of sentences and number of polysyllabic words	Yes	EPM OR Readability software (computer-based)	N/A	There exists an important gap between the estimated health literacy abilities of Deaf/HH and older populations and the kind of EPM they can currently access local CBOs and health departments.	Significant (EPM accessibility)
7	Nieman et al., 2017	Rapid Estimate of Adult Literacy in Medicine (REALM-R)	Word recognition	Yes	In-person assessments	Social Cognitive Theory; Community engagement approach; Human factors approach	Having a community-delivered training session not only reduces hearing handicap but also improves communication function and decreases depressive symptoms.	Significant (Depression, Communication function)
8	Palmer et al., 2017	Pre-test/post-test surveys (Twenty-five true/false items)	Knowledge of cancer genetics and of genetics counseling	No	Online survey	N/A	Effective access to language-concordant preventive health information is an important step towards reducing healthcare disparities for Deaf ASL-users and helping them understand and apply cancer genetics information	Significant (Cancer genetics knowledge)
9	Panko et al., 2021	Newest Vital Sign (NVS) or NVS-ASL	Understanding and use of a nutrition facts label	Yes	Computer-based survey	N/A	Participants who are deaf have more risk factors for low health literacy but reported more COVID-19 preventions strategies compared	Significant (Difficulty accessing COVID-19 information, Immediacy of healthcare seeking with suspected COVID-19) Non-significant

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Table 2 (continued)

Article #	Primary Author/Year	Type of Methodology Used to Measure Health Literacy	Constructs Measured	Validated	Mode of Administration	Theoretical Framework Used	Role of Health Literacy	Association between Health Literacy and Health Disparities
10	Ryan & Kushalnagar, 2018	The Health Information National Trends Survey	Engagement in health-related social media activities; Electronic Communication with Health Care Provider or Staff; Deaf-Specific and Health-Related Characteristics	Yes	Video Format Survey	N/A	to their peers who are hearing Engagement in online social activity, sharing medical topics, and participating in an online support group were positively associated with online communication with healthcare providers/staff	(Ability to identify COVID-19 symptoms) Significant (Engagement in online social activity, sharing medical topics, and participating in an online support group)
11	Tavanai et al., 2023	Self-Assessment Communication Questionnaire, Hearing Handicap Inventory in the Elderly Screening, and Geriatric Depression Scale	Communication/emotional/social effects of hearing loss, self-perceived hearing handicap, and depression	Yes	Self-Reported Questionnaire and in-person Interviews	N/A	Use of hearing aids was positively associated with higher self-perceived handicap scores than in the non-hearing aid group, although there were no significant differences in communication difficulties or depression between the two groups	Significant (self-perceived handicap) Non-Significant (Depression & Communication problems)
12	Tran et al., 2020	Brief Health Literacy Screen and audiometric testing	Health literacy and hearing loss	Yes	Questionnaire and in-person audiologic evaluation	N/A	Patients with low health literacy were more likely to present with more severe hearing loss. Patients with low health literacy were more likely to be hearing aid candidates than those with adequate health literacy. Health literacy was not associated with likelihood of hearing aid adoption.	Significant (Severe hearing loss & Hearing aid candidacy) Non-Significant (Likelihood of hearing aid adoption)
13	Wells et al., 2020 b	One item on confidence in filling out medical forms	Confidence in one's ability to fill out medical forms	No	Telephone survey	N/A	Hearing loss, especially unaided severe, was associated with low health literacy (LHL), as were memory loss, depression, loneliness, older age, and male gender. People with aided severe hearing loss and LHL had higher annual medical costs than those with adequate health literacy. Similarly, those with no hearing loss and LHL had higher annual medical costs than those with adequate health literacy.	Significant (older age, male gender, lower income, health conditions and hearing loss, higher medical costs)

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Table 2 (continued)

Article #	Primary Author/Year	Type of Methodology Used to Measure Health Literacy	Constructs Measured	Validated	Mode of Administration	Theoretical Framework Used	Role of Health Literacy	Association between Health Literacy and Health Disparities
14	Willink, 2020	Medicare current beneficiary survey	Ability to compare and review information about their healthcare, information seeking behaviors	No	Medicare survey	N/A	Hearing loss patients had increased odds of reporting difficulty understanding Medicare (as a proxy for health literacy)	Significant (Information comprehension, seeking services through Medicare)

Multiple studies found that participants with hearing loss had lower scores of health literacy. [11,16,29,44,45,57,58,60,62,65,68,70–72] While one study concluded that using online resources to find health-related information was more difficult for those with hearing loss [44], another study found that online social engagement and online support groups were beneficial in helping participants with hearing loss get the information they need to manage their health. [65] Participants do report having difficulty with comprehension of knowledge related to their health and insurance, [57,71,72] but found that having support from health care systems, community-based organizations or social support systems ameliorated the gap in knowledge. [59,60] Two studies found that socializing with health-literate and accessible peers and having in-person interactions with health care professionals was beneficial to improving health literacy. [11,47] Another two studies discussed the correlation between low health literacy and low health knowledge among those with hearing loss, particularly due to the lack of proper programming and interventions that provide language-concordant education to these populations. [59,60].

There is substantial evidence to support that low health literacy is associated with not only poorer health outcomes, particularly in systemically marginalized populations, but also with poorer access to care. This has been shown to be due to insurance coverage, difficulty finding providers, and socioeconomic factors as mediators of this relationship. [81–84] While there is limited research in the specificity of this relationship between health literacy and healthcare access due to varying definitions of the variables, many previous studies found that healthcare access, which can be impacted by health literacy, is a determinant of health status. [84] This relationship is especially seen in vulnerable communities, as low socioeconomic status, comorbidities, and poor access to health care were all associated with low health literacy. [82] Particularly in populations of Deaf ASL users, the prevalence of inadequate health literacy is substantial compared to that of English speaking communities. [16] In these communities, patients with low health literacy are more likely to present with higher degrees of hearing loss, and thus are more likely to obtain hearing aids. [70] However, other studies have found mixed results about the association between health literacy and hearing aid use. [85] As this scoping review showcased the relationship seen across numerous studies between health literacy and specialized health care access, it is evident that there exists a relationship that possibly warrants further research.

4.1. Practical implications

The themes of the studies reviewed in this analysis highlighted many of the gaps in patient care that affect those with hearing loss. Recognizing the multifaceted challenges faced by patients with hearing loss is necessary in adopting a comprehensive approach to the care they receive. A major theme highlighted in this review was the importance of utilizing mixed education methods, including online platforms and social media to aid in bridging gaps in health literacy and ensuring accessible information reaches diverse populations. [86] Additionally, it is crucial to acknowledge the unique needs and experiences of females

with hearing loss, as gender is known to influence health outcomes. [87] Furthermore, addressing the neglect of sexual health issues and reproductive care in this population is essential for providing holistic and inclusive healthcare services to those with hearing loss. [88] Tackling physical barriers to care such as lack of transportation and rural location of patients are crucial for improving access to care via social determinants of health. [89,90] Mental health must also be highlighted and prioritized in care plans, given its impact on overall well-being. [90] Addressing financial obstacles, including insurance coverage and the costs of necessary technology, will promote equitable access to essential resources. [16] Hence, the use of a screening tool for a comprehensive approach to identify social determinants of health (SDoH) encompassing the socio-economic, physical, and mental barriers experienced by individuals with hearing loss would be of high importance in clinical settings. [95].

The **PhenX Toolkit**, developed by the National Institute of Minority Health and Disparities (NIMHD), is recommended to measure SDoH as it ensures that community-specific factors are captured and addressed and that data collection is standardized and robust. This in turn contributes to the creation of scalable and sustainable behavioral health and health literacy solutions to U.S. individuals with hearing loss. [95] Understanding the correlation between health literacy and variable disease states in patients with hearing loss will allow for tailored interventions designed by public health professionals and social workers to enhance patient outcomes in a more inclusive society that takes into consideration the barriers experienced by this population group. [71] By integrating these lessons into healthcare practices, providers can work towards more inclusive, accessible, and effective care for individuals with hearing loss, ultimately promoting their overall health and well-being.

4.2. Limitations

To our knowledge, this scoping review is one of the first to explore the different types of health disparities encountered by U.S. adults with hearing loss when seeking specialized care and to examine the role of health literacy in exacerbating such healthcare disparities in this population. However, study limitations need to be considered. First, although the authors carried out a comprehensive search of three databases, this scoping review did not encompass a search of gray literature or tracing of reference lists in included studies. Second, it is possible that an inadvertent omission of articles referring to health disparities and health literacy barriers in individuals with hearing loss might have taken place due to the evolving terminology of health disparities, health inequities, social determinants of health, and health literacy. The emergence of new technical terms related to the broad domain of health disparities in this specific population group might have led to the exclusion of potential studies. The impact of this limitation was mitigated by the involvement of a senior librarian whose expertise in the development of a well-refined search strategy based on the PRISMA guidelines for scoping reviews. Future reviews should include mesh terms relevant to specific health literacy frameworks that have been

Table 3
Main Themes from Lessons Learned Identified Across Included Studies.

Lessons Learned	Main Themes from Lessons Learned
Given potential gaps in health literacy, a logical next step might be mixed-methods interventional studies, using social media to enhance frequency of screening and self-assessment of risk factors (Argenyi et al., 2019)	Importance of using mixed education methods, particularly those online and via social media to decrease gaps in health literacy
Brief and well-focused videos with signers from similar backgrounds would have positive impact on capturing attention and reinforcing knowledge (Kushalnagar et al., 2015)	
Implementing interactive health literacy activities through the social media that is accessible in ASL to increase Health awareness and self-advocating health care techniques (Kushalnagar et al., 2017)	Importance of acknowledging the role of female gender in health outcomes for patients with hearing loss
Strategies that target and develop the internet and online platforms are important for deaf individuals to increase patient engagement, health promotion, early detection screening, early intervention, and management of health conditions (Ryan et al., 2018)	
Conscious effort should be made to recognize and acknowledge that female patients with HL may communicate differently from men (Cortina et al., 2023)	Need to address lack of transportation as a barrier to care in patients with hearing loss
Importance of protective association of HA with each condition is more common among females and minorities (Mahmoudi et al., 2019)	
Provide free transport to and from study locations (Garofalo et al., 2021)	Need to address rural location as a social determinant of health in patients with hearing loss
Transportation was frequently reported as a barrier to appointment attendance (Davis et al., 2022)	
Audiologists could provide their patients with options for social gatherings in their community and, if needed, options for means of transportation to events (Hay-McCutcheon et al., 2018)	Importance of acknowledging the gap in addressing sexual health issues and reproductive care in patients with hearing loss
More audiological resources needed in rural communities (Chan et al., 2017)	
Must consider that older adults living in rural areas with hearing loss may require additional attention to improve their social connections and help to prevent physical and emotional decline (Hay-McCutcheon et al., 2018)	
Through partnerships with hearing professionals and primary care professionals in rural settings it might be possible to both increase access to hearing healthcare and improve public awareness of the physical and emotional health consequences of hearing loss Hay-McCutcheon et al., 2021)	
Delay in timing of access to hearing healthcare in rural recipients (Hixon et al., 2016)	
Deaf women were less likely to adhere to Pap screening (Kushalnagar et al., 2019)	
There is a need for systematic examination of the pregnancy experiences, complications, costs, quality of care, and outcomes of women with hearing loss (Mitra et al., 2016)	
There must be further awareness among obstetric and primary care providers and the American College of Obstetricians and Gynecologists on DHH women's elevated risk for adverse pregnancy and	

Table 3 (continued)

Lessons Learned	Main Themes from Lessons Learned
neonatal outcomes (Mitra et al., 2021)	Understanding of the correlation of health literacy on variable disease states in patients with hearing loss
There is limited availability of sexual health information in ASL. Further public announcements and outreach programs need to ensure their messages are available in ASL through the use of video-based blogs (vlogs) and ASL-fluent community educators (Heiman et al., 2015)	
Although people who are deaf demonstrate knowledge of COVID-19 symptoms comparable to that of their peers who are hearing, people who are deaf reported challenges in obtaining and understanding COVID-19 information (Panko et al., 2021)	Need to address mental health in patients with hearing loss
Improved health literacy among higher educated Deaf individuals may play a significant role in cardiovascular protection (McKee et al., 2014)	
Healthcare providers should be aware of and address signs of depression in individuals with hearing loss (Scinicariello et al., 2019)	Need to address financial barriers with insurance and costs of technology for hearing impaired patients.
HAs may delay diagnosis of depression and anxiety among individuals with HL (Mahmoudi et al., 2019)	
Sustainable policy response is needed to address the prohibitive cost of hearing assistive technology (Ingram et al., 2016)	
Lack of coverage by health insurance remains a barrier to accessing assistive hearing technology (James et al., 2022)	
Need to determine if increased coverage for hearing healthcare and/or use of hearing aids results in cost savings for Medicare and other insurers in potentially avoidable healthcare use and improved quality of life (Simpson et al., 2018)	
Interventions focused on reducing financial barriers to obtaining hearing aids may improve access (Tran et al., 2020)	

used to address health disparities experienced by underserved and vulnerable communities. Third, this review only included articles published from 2010–2023, and no formal assessment of the quality of included studies and adopted measurement tools was carried out since it was beyond the scope of this paper. This, however, might inform systematic reviews on this topic. Finally, there still remains a gap in the application of health literacy frameworks to assess the extent of health disparities affecting care received by individuals with hearing loss. Moreover, the application and integration of strategies to address social determinants of health of this population when developing and adopting strategies to increase access to care is still limited in scope. Future studies are recommended to evaluate relevant theoretical frameworks and evidence-based implementation strategies to inform successful community-based interventions and achieve desired behavioral and health outcomes.

5. Conclusion

This scoping review highlights health disparities and health literacy challenges encountered by adults with hearing loss when seeking specialized care. Lessons learned about increasing equitable access to affordable and quality care for this population can inform future public health and health literacy interventions in underserved communities affected by high rates of hearing loss and limited access to needed healthcare services.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.pec.2024.108549](https://doi.org/10.1016/j.pec.2024.108549).

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