

# Continuum of Care for Older Adults With Concurrent Hearing and Vision Impairment: A Systematic Review

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## Abstract

**Background and Objectives:** A global report estimates up to 2% of the world population experience concurrent hearing and vision impairment (dual sensory impairment [DSI]). Older adults with DSI are often frequent users of health care, yet the evidence is limited to inform care delivery for this population. This systematic review aimed to synthesize evidence on tools and strategies for screening, assessment, and interventions that promote a continuum of care for older adults with DSI.

**Research Design and Methods:** The review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews. Electronic databases (CINAHL, Embase, MEDLINE, PsycINFO, Cochrane Library, Global Health, and Web of Science) and clinical trial registries (ISRCTN Registry, WHO ICTRP, and ClinicalTrials.gov) were searched. The quality appraisal was performed using the Mixed Methods Appraisal Tool.

**Results:** Of 4,775 identified references, 28 records were selected. The review identified 7 tools and 7 strategies for DSI-specific screening, assessments, and/or interventions. Some of the most promising tools were the interRAI Community Health Assessment with deafblind supplement, adapted Montreal Cognitive Assessment, and the Severe Dual Sensory Loss screening tool. Useful strategies included the use of alternative forms of communication, assistive devices or technology, education and training for service providers, and training of older adults on the use and maintenance of assistive aids/technology. However, quality appraisal indicated a need for more robust evidence to inform clinical practice.

**Discussion and Implications:** Reviewed evidence pinpointed the need for training for health care providers on DSI-specific challenges and supports and the use of integrated multidisciplinary care for older adults. Future studies need to explore the development and evaluation of tools and interventions to improve the continuum of care for this group.

**Systematic Review Registration:** PROSPERO registration # CRD42020180545

**Keywords:** access, health care, rehabilitation, sensory loss, strategies, tools

**Translational Significance:** Older adults living with dual sensory impairment (DSI; i.e., combined hearing and vision impairment) are a highly vulnerable population to fragmented care due to systemic barriers to accessing health care. This systematic review explores tools and strategies of screening, assessment, and interventions to provide optimal care to older adults with DSI. Seven tools and seven strategies were found that could improve the continuum of care for this group. A moderate level of evidence was found. Understanding the current state of available sets of tools and strategies for care for older adults with DSI is paramount to promote their healthy aging.

Age-related hearing or/and vision impairment are experienced by a large subset of older adults (Wahl et al., 2013), with a considerable proportion experiencing combined hearing and vision impairment, also known as dual sensory impairment (DSI; Wittich et al., 2013). Using the World Health Organization (WHO) criteria, hearing impairment refers to a loss of hearing greater than 25 decibels in the better-hearing ear, and vision impairment refers to visual acuity worse

than 0.3 logMAR (i.e., 20/40 or 6/12; Mick et al., 2021; World Health Organization, 2021a, 2021b). DSI is defined as a condition in which an individual experiences any level of concurrent vision and hearing impairment, independent of severity, age, or order of onset (Ask Larsen & Damen, 2014; Dammeyer, 2015). The WHO definitions of hearing and vision impairment are behavioral, based on clinical measures of sensory impairment; however, the latter definition of DSI

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is functional, based on the subjective experience of sensory impairment. It is important to note that there is no widely accepted behavioral definition of DSI based on clinical measures, and the combination of both is often used (Ask Larsen & Damen, 2014; Wittich et al., 2016). However, the Nordic definition of DSI, based on the WHO International Classification of Functioning, Disability and Health, has been widely used to identify persons with DSI. As per the Nordic definition, DSI/deafblindness is a distinct disability arising from a combined vision and hearing impairment of such severity that it is hard for the impaired senses to compensate for each other (Centre for Welfare and Social Issues, 2016). For this review, DSI was defined using the Nordic definition of DSI.

Older adults with DSI face challenges in access to information, communication, mobility, and daily functioning (Jaiswal et al., 2018). DSI is more disabling than having a single sensory impairment alone, as the two senses complement one another, and compensation for a decline in one with the use of the other modality is not possible (Simcock & Wittich, 2019). A global report estimated up to 2% of the world population experience DSI, of which a majority belonged to older age groups (World Federation of the Deafblind [WFDDB], 2018).

The prevalence of DSI increases with advancing age and is projected to continue to rise over the next decade, particularly in high- and middle-income countries (Guthrie et al., 2016; Minhas et al., 2022). For older adults above 80 years, the prevalence of DSI was reported to be 11.3% in the United States (Swenor et al., 2013) and 26.8% in Australia (Schneider et al., 2011). Estimates of DSI prevalence are high as 37.6% among centenarians (Cimarolli & Jopp, 2014). With respect to older adults in home care and long-term care (LTC) across four countries (Belgium, Canada, Finland, and the United States), the prevalence of DSI ranged between 13.4% and 24.6% in home care, and between 9.7% and 33.9% in LTC residents (Guthrie et al., 2016).

Evidence highlights that DSI has a great impact on the health of older adults and can lead to poor health outcomes, such as cognitive decline (Guthrie et al., 2018), functional disability (Brennan et al., 2005; Cimarolli & Jopp, 2014), depression (Heine & Browning, 2014), social isolation (Schneider et al., 2011), poor self-rated health and quality of life (Guthrie et al., 2016), which, in turn, are associated with high health care utilization and mortality (Deardorff et al., 2019). Moreover, compared to those without sensory impairment, individuals with DSI are more likely to be affected by comorbidities, including stroke, arthritis, cardiovascular disease, and hypertension (Gopinath et al., 2013), and thus, they are more likely to be followed by multiple health care providers for concomitant issues (Deardorff et al., 2019). Many of the professionals involved in the care of DSI patients lack the training and expertise required to communicate effectively with patients and meet their health care needs (Guthrie et al., 2016). Consequently, the care for older adults with DSI carries the risk of being fragmented (Simcock & Wittich, 2019). The continuum of DSI care refers to screening, detection, assessment of vision and hearing and other comorbidities, diagnosis, and treatment interventions designed to optimize health and functioning in individuals with DSI. Understanding the current state of the continuum of care for older adults with DSI is paramount to promoting their healthy aging.

Older adults with DSI access health care in a range of settings, such as LTC, community care, home care, hospitals, private clinics, and rehabilitation agencies, and yet, they often

feel anxious when accessing care, owing to fears that communication difficulties will result in their health care needs being misunderstood (Simcock & Wittich, 2019). The situation becomes even more challenging when the professional care staff lacks a basic understanding of how to screen and assess the needs of individuals with DSI and provide with the appropriate intervention (Guthrie et al., 2016; Wittich et al., 2012). An individualized care plan following a proper screening and thorough assessment is of the utmost importance to ensure optimal quality health care for this older group (Guthrie et al., 2016). For this review, optimal health care is defined as “care that is specific to DSI and best meet health needs of older adults with DSI.” Outcome of optimal care to this specific older group could be achieved when health care providers use interventions (tools and strategies) that are DSI-specific and enhance the access and uptake of health care services by older adults with DSI.

To date, there is no comprehensive review focusing on the continuum of care for older adults with DSI. We have conducted a preliminary search in PROSPERO, the Cochrane Database of Systematic Reviews, and the JBI Database of Systematic Reviews to avoid any duplication of the work and found no current or ongoing systematic review on the topic. Therefore, this systematic review aimed to answer the following research question: What are the tools and strategies of screening, assessment, and interventions that were available and/or adapted to provide optimal health care to older adults with DSI?

## Method

A systematic review was conducted following the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines to summarize data from various designs (Moher et al., 2010). The review was performed following the methodological guidance for a quality systematic review, and included an a priori protocol, comprehensive and unbiased search strategy, use of PRISMA statement and procedures, quality appraisal of included studies, and future recommendations (Heyn et al., 2019). The research protocol was registered in the International Prospective Register of Systematic Reviews (PROSPERO, registration # CRD42020180545; see Table 1 for PICO [population, intervention, comparison, and outcome]). The detailed methodology can be found elsewhere (Jaiswal et al., 2020a, b).

## Search Strategy

The search strategy was developed with the assistance of a senior health science librarian (P. Dupont) from the Université

**Table 1.** PICO (Population, Intervention, Comparison, and Outcomes)

Criteria	Description
Population	Older adults with dual sensory impairment were defined as individuals aged 65 years and older with varying levels of both hearing and vision impairment
Intervention	Tools or strategies used by health care providers to enhance the access and uptake of health care services by older adults with dual sensory impairment
Comparison	None
Outcomes	Optimal health care services for older adults with dual sensory impairment

de Montréal, Canada. A comprehensive search of seven databases (Cochrane Database of Systematic Reviews [from inception], CINAHL [1937–] via EBSCOhost, MEDLINE [1946–], EMBASE [1974–] via Ovid, Global Health [1910–], APA PsycINFO [1806–], and Web of Science [1945–]) was carried out in August 2020 and last updated in December 2021 (see [Supplementary Material Section 1](#) for the search strategy as used in Ovid Medline). Additionally, three clinical trial registries such as [www.ClinicalTrials.gov](http://www.ClinicalTrials.gov), BioMed Central ISRCTN registry (<https://www.isrctn.com/>), and the International Clinical Trials Registry Platform (<http://www.who.int/trialssearch/>) were searched. There were no language and date restrictions. Reference lists from selected studies were also hand-searched.

### Study Selection

The reference software EndNote Versions X9 (Clarivate Analytics, Philadelphia, PA) was used to manage references and remove duplicates. Using PRISMA guidelines, a two-stage screening process was used by the research team to assess the relevance of studies—first, at the level of title and abstract screening, and second, at the level of full-text review using Covidence (Veritas Health Innovation, Melbourne, Australia). Consistent with the systematic review process, post hoc inclusion criteria (see [Table 2](#)) were used by the research team to assess the relevance of articles identified in the search process. Studies were included if (a) they are original research studies of any study design, including randomized controlled trials, observational, descriptive, or cohort studies, case-control studies, cross-sectional studies, qualitative studies, and mixed methods studies, (b) all or some participants are older adults (aged 65 years and older), and (c) participants had DSI (defined subjectively through self-report or objectively using standardized screening or assessment tests for hearing or vision impairment). Studies were excluded if (a) they were prevalence or incidence studies, (b) they included only children (0–18 years) or working-age adults (18–64 years) with DSI, or (c) they examined only impairments other than DSI. Conference publications, thesis/dissertations, books, or letters were not included.

Articles in a language other than English were translated using DeepL Translator, a language translation software ([www.DeepL.com](http://www.DeepL.com), Köln, Germany). A senior reviewer (W. Wittich) was consulted to resolve conflicts.

### Data Extraction and Quality Assessment

Two senior reviewers with a PhD training (A. Jaiswal and S. Gupta) independently appraised and scored the quality

of all selected studies using the Mixed Methods Appraisal Tool (MMAT). The MMAT is a critical appraisal tool designed for the appraisal stage of systematic reviews, that is, reviews that include qualitative, quantitative, and mixed methods studies (Hong et al., 2018). The MMAT includes two screening questions (for all types of studies) followed by five criteria questions for methodological quality; a total of 25 criteria on five categories of studies—qualitative research, randomized controlled trials, nonrandomized studies, quantitative descriptive studies, and mixed methods studies (Hong et al., 2018). For example, for quantitative studies, major criteria include sample representativeness, control of confounders, and risk of bias, and for qualitative studies, appropriateness of research question and coherence between qualitative data sources, collection, analysis, and interpretation. The authors of the MMAT discourage users from calculating an overall score from the ratings of each criterion and suggest providing a more detailed presentation of the ratings of each criterion to better inform the quality of the included studies (Hong et al., 2018; see [Supplementary Material Section 2](#) for the detailed presentation of quality appraisal of included 28 studies).

The MMAT was chosen because it is freely available, used in health science, can assess the methodological quality of various diverse study designs, and is the only tool that includes specific criteria for mixed methods studies (Hong et al., 2018). The data were extracted from each included study for the following descriptors: author(s), year of study, location of study, study design, study population, sample size, aim of article, methods, interventions, key outcome/strategies, and any other relevant information. Any differences that arise in judgment were resolved through a consensus discussion with a senior reviewer (W. Wittich).

### Data Synthesis

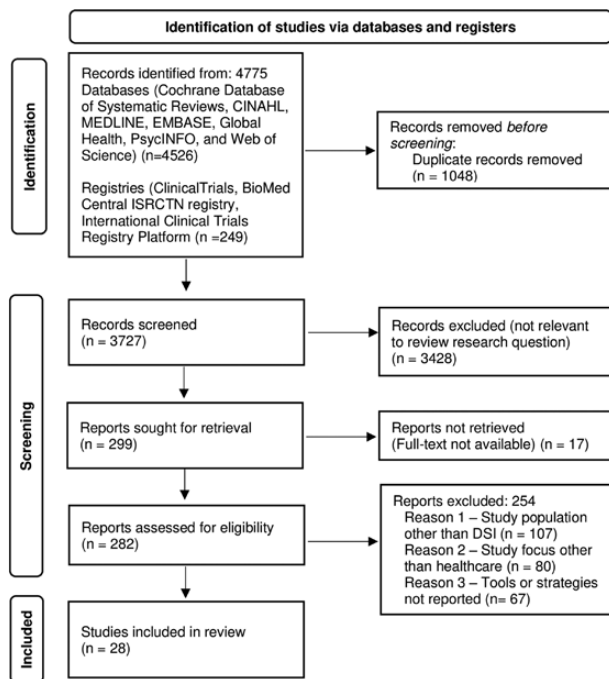
Based on the study design, our team had initially decided that data would be analyzed separately, using meta-analysis for quantitative data and thematic analysis for qualitative data. However, due to the heterogeneity across the studies, data summary measures such as odds ratios, linear regression coefficients, and correlation coefficients could not be computed. A meta-synthesis was created, combining qualitative and quantitative evidence. We also report data in the form of tables for study characteristics, participants’ details, and strategies/outcomes.

### Results

This systematic review initially identified 4,775 potential references. After excluding 1,048 duplicates, a two-stage screening process was conducted. At the abstract level screening stage, 3,428 records were excluded as either their study population did not include older adults with sensory impairment, or their study focus was not relevant to the research question. Another 271 records were excluded at the full-text screening due to the following reasons: the full-text record was not available ( $n = 17$ ); the study population included persons with hearing or vision impairment but not DSI ( $n = 107$ ); the study focus was on something other than health care ( $n = 80$ ); or no tools or strategies were reported ( $n = 67$ ). Details about the screening process are provided in [Figure 1](#): PRISMA 2020 flow chart (Page et al., 2021). Finally, 28 records were considered eligible.

**Table 2.** Inclusion and Exclusion Criteria

Inclusion criteria	Exclusion criteria
Original studies of any study designs, and all or some of the participants were older adults aged 65 and older, with dual sensory impairment, and identified through either self-reported or using standardized screening/assessments	Prevalence/incidence studies Study participants were exclusively children or working-age adults with dual sensory impairment, or if the study examined only impairments other than dual sensory impairment. Conference abstracts or proceedings, thesis/dissertations, books, or letters



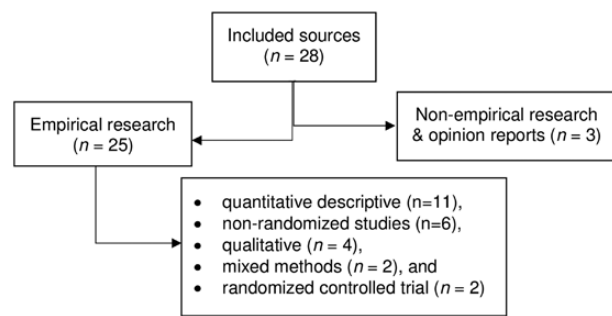
**Figure 1.** PRISMA 2020 flow diagram. DSI = dual sensory impairment. Source: Page et al. (2021).

## Study Characteristics

Of the 28 records included in the final review, the majority ( $n = 25$ ) were peer-reviewed empirical studies, while the remaining were nonempirical research and opinion reports ( $n = 3$ ). Their source type and methodology are displayed in Figure 2, and the study characteristics are shown in Table 3. The 25 empirical records covered a diverse range of study designs, including quantitative descriptive ( $n = 11$ ), nonrandomized ( $n = 6$ ), qualitative ( $n = 4$ ), mixed methods studies ( $n = 2$ ), as well as randomized controlled trials ( $n = 2$ ). The oldest included article was published in 1994, and the most recent in 2020. Most of the articles ( $n = 23$ ) were published between 2010 and 2020. With respect to geographical location, the studies were conducted in 15 different countries. Most studies were conducted in North America ( $n = 12$ ) and Europe ( $n = 11$ ). Other locations were Oceania ( $n = 4$ ), Asia ( $n = 1$ ), and South America ( $n = 1$ ). Four studies were conducted in multiple countries. Of 25 empirical studies, 21 included older adults with sensory impairments, three studies included older adults with dementia with DSI, and five studies were conducted with health care professionals working with older adults with DSI. One study was conducted with older Veterans with DSI (Dullard & Saunders, 2016). With regards to study setting, most studies were conducted with community-dwelling older adults while a few ( $n = 3$ ) in other residential settings such as LTC homes (Flynn et al., 2002; Haque et al., 2012; Roets-Merken et al., 2018).

## Quality Appraisal Using MMAT

All 11 quantitative descriptive studies had a relevant sampling strategy, appropriate measurement instruments, and suitable statistical analysis. However, using MMAT quality criteria 4.2, only 1 out of 11 studies had a representative sample from the target population. Most of the quantitative descriptive studies ( $n = 9$ ) had complete outcome data and bore a low



**Figure 2.** Types of sources.

risk of nonresponse bias (wherever applicable). Among six nonrandomized studies, all used appropriate measurements and administered the intervention as intended. However, all the nonrandomized studies recruited their sample from non-representative pools. Three out of six studies accounted for confounders, while the other three studies did not specify if any methods were adopted to control for confounding. All four qualitative studies met all quality criteria defined on MMAT, indicating that qualitative approaches were appropriate, and findings were adequately derived and interpreted to answer the research question. Similarly, two randomized controlled trials and two mixed method studies met all the quality criteria suggesting that findings from these studies were reliable (see Supplementary Material Section 2 for the quality appraisal).

## Overview of tools and strategies

**Tools.**—Nine studies focused on seven tools for health care assessments and/or interventions to improve health care for older adults with DSI (Arauz et al., 1997; Bruhn & Dammeyer, 2018; Dalby et al., 2009; Dupuis et al., 2015; Hovaldt et al., 2018; Roets-Merken et al., 2014; Takano et al., 2016; Urqueta Alfaro et al., 2019; Vreeken et al., 2020). Of all the tools reported, five were standardized clinical assessment instruments. The tools are listed here:

1. *interRAI Community Health Assessment (CHA) with deafblind supplement.* The interRAI instruments are standardized clinical instruments used for assessing the sensory profile, communication difficulties, cognition and behavioral patterns, psychosocial well-being, informal and formal support services, physical status, and medical diagnoses among older adults (<https://www.interrai.org/>). The CHA is one of the interRAI instruments developed to assess sensory impairment, health, and functioning of community-dwelling older adults, including those with single or DSI (Dalby et al., 2009). The interRAI CHA deafblind supplement, developed in 2009, is triggered based on two items (vision and hearing) in the overall CHA assessment and is uniquely used for individuals with any level of DSI. It has demonstrated acceptable reliability and validity (Dalby et al., 2009). A group of researchers further assessed the sensitivity and specificity of the interRAI CHA for detecting sensory impairments against performance-based measures of hearing (pure-tone audiogram) and vision (distance acuity). The instrument was found to have a high specificity (96.2%) and sensitivity (96.9%) for identifying DSI (Urqueta Alfaro et al., 2019).

**Table 3.** Study Characteristics (*n* = 28)

Study; location	Aim of the study	Sample size, participants	Study design and data collection	Study outcomes/findings
Alhusein et al. (2018); Scotland	Explore pharmaceutical care needs of, and service provision to, older people with SI (VI, HI, DSI) on prescribed polypharmacy (≥4 medicines)	23 older adults and 30 community pharmacy personnel for interviews 171 community pharmacists for survey	Mixed method study; qualitative interviews Subsequent national cross-sectional survey	Helpful strategies are to disclose their impairment to pharmacy personnel (and other health care providers), and provision of large written font on labels and braille instructions on boxes. Community pharmacy personnel require training to deliver person-centered pharmaceutical care for older people with SI, particularly regarding communication.
Alhusein et al. (2019); Scotland	Explore community pharmacy personnel's experiences providing pharmaceutical care for older people with SI	17 community pharmacists and 13 other pharmacy personnel	Qualitative study Semistructured telephone interviews	A need to train pharmacy personnel to recognize SI; understand disability etiquette and communication skills in interacting with older people with SI; use sign language and/or sensory aids, such as hearing loops.
Arauz et al. (1997); Argentina	Assess rehabilitation outcomes after multichannel cochlear implantation in older adult with DSI	A 69-year-old man blind since the age of 25 and deaf since the age of 51	Case study A battery of tests was performed at 2, 4, and 6 months after the implantation	Successive fittings of the speech processor of cochlear implant helped participant achieve better identification of acoustical message and improved communication.
Bernardini and Davis (2014); United States	Evaluate efficiency and effectiveness of a training conducted using audio, visual, and animated instruction	40 patients, including those with SI	Quantitative descriptive Pre- and post-training evaluations using questionnaires	The use of automated instruction with audio, video, and animation embedded in the cycler, combined with a standardized training script, appears to be effective in promoting learning for peritoneal dialysis.
Bruhn and Dammeyer (2018); Denmark	Develop and evaluate a TTB for cognitive assessment in individuals with DSL	60 older adults with DSL with dementia, and without dementia or DSL (controls)	Quantitative descriptive TTB and MMSE	A high correlation was found between MMSE and tactile-based battery assessment for cognitive decline among older adults with DSL.
Dalby et al. (2009); Canada	Develop and pilot test standardized instruments—interRAI CHA and deafblind supplement	182 individuals with DSI from age 18 to 94 years	Quantitative descriptive Analytical cross-sectional; interRAI CHA and deafblind supplement	Deafblind supplement provides detailed information on each person, including his or her communication abilities, ability to interact with others, use of formal services, and level of SI based on standard operational measures.
Dullard and Saunders (2016); United States	Examine documentation of SI in EMRs of Veterans with DSI	20 people with DSI	Observational design Retrospective chart/clinical records review	Primary care providers documented DSI in 50% of EMRs. Audiologists documented VL in 50% of cases, whereas ophthalmologists or optometrists documented HL in 15% of cases.
Dupuis et al. (2015); Canada	Assess the impact of SI on performance of MoCA	301 older adults (mean age = 71 years)	Quantitative descriptive Audiometric testing, WIN test, MoCA, and assessment of visual acuity	Cognitive abilities may be underestimated if SI is not considered during MoCA administration and interpretation. More participants with normal sensory functioning passed MoCA compared to those with SI even after adjusting for auditory and visual factors, indicating a higher risk of CI in those with SI.
Flynn et al. (2002); New Zealand	Establish a screening program for older adults in residential care with communication difficulties	178 older residents	Quantitative descriptive; case history, hearing and vision assessment, hearing aid assessment, and sentence identification	Participants who owned hearing aids were unable to perform important routine maintenance such as changing the batteries (22.0%) or removing wax from around the tubing and casing (34.1%), which affected their social participation.

Table 3. Continued

Study; location	Aim of the study	Sample size, participants	Study design and data collection	Study outcomes/findings
Fraser et al. (2019); Canada	Explore experiences of professionals working with older adults with DSI to improve the rehabilitation process	13 professionals working with individuals with DSI	Qualitative study Interviews	A multidisciplinary team rehabilitation approach is needed to train and educate health care professionals about the needs of older adults with DSI
Hooper et al. (2019); Cyprus, France, United Kingdom	Assess feasibility, acceptability, and tolerability of a home-based sensory-based intervention	19 older adults with dementia along with VI and HI and their care partners	Nonrandomized controlled study Questionnaires and interviews	Home-based delivery was acceptable, convenient, and desirable. Sensory support therapist support was found helpful in encouraging the use of corrective devices and optimizing activity engagement.
Hovaldt et al. (2018); Denmark	Investigate construct validity and reliability of Major Depression Inventory among older adults with DSL	207 people $\geq 50$ years of age with functional DSL	Quantitative descriptive; questionnaires	An eight-item version of the Major Depression Inventory is valid and reliable to be used to screen for depressive symptoms in older adults with DSL
Leroi et al. (2019a); Canada, Cyprus, France, Germany, Greece, United Kingdom	Explore gaps in assessment and service provision and potential solutions to provide services to older adults with DSI and CI	Hearing, vision, and dementia care professionals ( $n = 17$ for discussions; $n = 653$ for survey)	Mixed method study; group discussions and survey with an international group of interdisciplinary professionals	Lack of validated, adapted assessments tools and evidence-based interventions to account for concurrent deficits was identified as the main barrier. A “sensory-cognitive” team approach for patient care was recommended.
Leroi et al. (2019b); Cyprus, France, United Kingdom	Explore the impact of “sensory intervention” on dementia-related outcomes	19 dyads of older adults with dementia with acquired HI and/or VI and their care partners	Open-label field trial and nested case series; semistructured interviews, participant diaries, and logbooks.	Home-based intervention has a positive impact on outcomes, such as self-efficacy, quality of life, and neuropsychiatric symptoms, and improvement in functioning and social engagement. A randomized controlled trial was recommended.
Luey (1994); United States	Describe a social work coordinated project to provide integrated services for SI	31 older adults with DSI and nine caregivers	Qualitative study; interviews and questionnaires	Program improved professional understanding, interdisciplinary collaboration, and increased accessibility of client services.
McMahon et al. (2017); Australia	Evaluate benefits of an integrated service delivery model: Hearing Screening Education Model within a low-vision clinic	169 older adults ( $>55$ years of age) attending low-vision clinics	Quantitative descriptive; survey, follow-up interviews	All study participants viewed integration between vision and hearing services positively.
Roets-Merken et al. (2014); The Netherlands	Evaluate psychometric properties of Severe DSL screening tool	56 older adults receiving aged care, and 12 nurses and care assistants	Quantitative descriptive; questionnaires	Moderate to good sensitivity and specificity was found for the hearing and visual subscales. The internal consistency of the items and the interrater reliability of the tool were substantial. The tool was found valid, reliable, and easy-to-administer.
Roets-Merken et al. (2018); The Netherlands	Evaluate effectiveness of a nurse-supported self-management program to manage medical and rehabilitation aspects	258 older adults with DSI 30 LTCs	Randomized controlled trial Diaries, interviews, and questionnaire Linear mixed-model analysis for evaluating the effectiveness	The programme was effective in empowering older adults with DSI to address the domain of instrumental activities of daily living, but no differences were found in addressing sociocultural and leisure activities.
Schneider et al. (2014); Australia	Pilot a “Hearing Screening and Education Model” (HSEM) to promote hearing services among older adults attending low-vision clinics	300 older adults ( $>55$ years of age) attending low-vision clinics	Quantitative descriptive; questionnaire and follow-up interviews; the Hearing Handicap Inventory for the Elderly; International Outcome Inventory—Hearing Aids	With the HSEM intervention, 40% of participants with low vision (with unmet need for hearing services) undertook a full hearing assessment and many obtained hearing aids. Hearing- and vision-rehabilitation services need to better screen for, and take account of, DSI among their older clients.

**Table 3.** Continued

Study; location	Aim of the study	Sample size, participants	Study design and data collection	Study outcomes/findings
Smith et al. (2019); Scotland	Explore pharmaceutical care experiences and perspectives of older people with SI receiving polypharmacy	23 community-dwelling older adults with SI receiving polypharmacy	Qualitative study Semistructured telephone or face-to-face interviews	Helpful strategies were online ordering, home-delivery service, use of a large screen for reading online, personalized medication storing techniques, blister packs, revealing SI to the pharmacy, pharmacy notifying patients of medication changes, and family support.
St-Amour et al. (2019); Canada	Assess audibility of assistive technology devices for rehabilitation use	23 adults with DSI	Quantitative descriptive; Hearing Handicap Inventory for the Elderly; and MoCA	Audibility of low-vision assistive devices is compromised in older individuals with DSI and requires additional volume adjustment options.
Takano et al. (2016); Japan	Evaluate clinical outcomes of cochlear implantation in patients with severe to profound HL and VL	8 patients with severe SL who received a cochlear implant	Observational design: Retrospective chart review; clinical records, case history, hearing and vision assessments	Seven out of eight patients were able to hold conversations after cochlear implantation and had a significant impact on their quality of life.
Urqueta Alfaro et al. (2019); Canada	Assess sensitivity and specificity of interRAI CHA for detecting SL	200 older adults (>61 years) receiving sensory rehabilitation	Quantitative descriptive interRAI CHA MoCA	interRAI CHA detects VL only, HL only, and DSL with strong sensitivity and specificity. Instrument shows high accuracy even with the presence of CI.
Vreeken et al. (2020); Belgium, The Netherlands	Evaluate effectiveness of a new DSL protocol on well-being and communication of older adults with DSI and their partners	131 older adults with DSI and their 113 communication partners	Randomized controlled trial; standardized questionnaires Linear mixed-model analysis to evaluate the effectiveness	No significant improvements in communication and well-being were found in DSI participants. Further research is warranted to investigate how the protocol might be adapted.
Wittich et al. (2016); Canada	Assess performance and usability of assistive listening devices	60 older adults (age 60–100) with low vision only, DSI, and a control group	Quantitative descriptive; participants were asked to assemble a pocket talker and operate a talking clock and an amplified telephone	Instruction, as well as practice (simple repetition) for technology devices, use among older adults with DSI, had beneficial effects on performance success.
Echt and Saunders (2014) <sup>a</sup> ; United States	Discuss implications of DSI for patients and professionals and provide strategies to support communication	Opinion report; patients with DSI	NA	Physician awareness of alternative forms of communication, environmental modifications, caregiver engagement, and the use of assistive technology is important while managing older patients with DSI.
Erber and Scherer (1999) <sup>a</sup> ; Australia	Describe a teaching strategy to increase students' awareness of nature of SL and information about specialist therapies	Expert opinion	NA	Multimedia demonstrations simulating HL and VL from older patient's point of view were effective for engaging medical and nursing students to consider the variety of communicative problems which older people encounter.
Haque et al. (2012) <sup>a</sup> ; United States	Demonstrate screening for HI in an older adult resident with DSI and dementia	Opinion paper through a case report; one female patient with DSI living in LTC	Tuning forks to assess functional hearing	Hearing aid types and battery life are important considerations for persons with SI and CI. Hearing assessments with a tuning fork can be a reliable way to determine hearing status when SI is suspected.

Notes: CHA = interRAI Community Health Assessment; CI = cognitive impairment; DSI = dual sensory impairment; DSL = Dual Sensory Loss; EMRs = electronic medical records; HI = hearing impairment; HL = hearing loss; LTC = long-term care; MMSE = Mini-Mental State Examination; MoCA = Montreal Cognitive Assessment; NA = not applicable; SI = sensory impairment; SL = sensory loss; TTB = Tactile Test Battery; VI = vision impairment; VL = vision loss; WIN test = Words-in-Noise test.

<sup>a</sup>These last three studies are peer-reviewed and nonempirical.

2. *Major Depression Inventory (MDI) for assessment of depression.* One study assessed the validity and reliability of the MDI with 207 older individuals with acquired

DSI, using Rasch analysis (Hovaldt et al., 2018). The authors found that the eight-item version of the MDI had an acceptable construct validity and reliability (reliability

- score: 0.81) for screening for symptoms of depression among older adults with acquired DSI.
3. **Tactile Test Battery (TTB) for assessment of dementia.** A study by Bruhn and Dammeyer, (2018) developed and evaluated a TTB for cognitive assessment in (total sample = 60) individuals with DSI and dementia and compared it to the standardized Mini-Mental State Examination (MMSE). The findings suggested that the TTB is a valid and promising tool to assess dementia in older adults with DSI. A high correlation (Spearman's rho = 0.83,  $p < .001$ ,  $n = 40$ ) between MMSE scores and TTB summary Z-scores, and an acceptable sensitivity (86%) and specificity (89%) of the TTB were reported. However, the authors noted the need for more studies to determine if this tool is equally valid for individuals with DSI with various degrees and durations of sensory impairments.
  4. **Adapted Montreal Cognitive Assessment (MoCA) for assessment of cognitive functioning.** A study was conducted on the MoCA to develop a new proportional scoring system to exclude items likely to rely heavily on auditory and visual abilities, to make it suitable for persons with DSI (Dupuis et al., 2015). The authors adjusted the minimum scores needed to pass the test. Using this alternative scoring approach, the results illustrated improved test sensitivity for those with sensory impairments. The authors noted the importance of considering and/or assessing an individual's auditory and visual functioning during administration and interpretation of scores on cognitive screening measures, such as the MoCA, to prevent misdiagnosis or overdiagnosis of cognitive impairment (CI) among older adults with DSI (Dupuis et al., 2015).
  5. **Severe Dual Sensory Loss (SDSL) screening tool.** A group of researchers from the Netherlands developed a screening tool to help nurses and care assistants identify hearing, vision, and DSI in older adults in nursing homes (Roets-Merken et al., 2014). The SDSL screening tool was validated against criterion measurements, including pure-tone screening audiogram and low-vision screening. The study reported the Cronbach's alpha of 0.81 for hearing subscale and 0.84 for visual subscale, a sensitivity of 0.71, and a specificity of 0.72. The authors concluded that the SDSL is a reliable, valid, and easy-to-administer tool that can assist nurses and care assistants in recognizing DSI and in maximizing intervention planning and functional opportunities (Roets-Merken et al., 2014).
  6. **Dual Sensory Loss (DSL) protocol.** In a randomized controlled trial study in Netherlands and Belgium, a group of researchers investigated the effectiveness of a newly developed DSL protocol on the well-being and communication of 131 older adults with DSI and their communication partners (Vreeken et al., 2020). The protocol was delivered by occupational therapists (OTs) working in low-vision services and consisted of: (a) optimal use of hearing aids; (b) use of assistive devices and adaptations to the living environment; and (c) coping with DSI and use of effective communication strategies. Although no statistically significant effects of the protocol emerged (effect size standardized mean difference: 0.60), the researchers suggested further studies, adapting the protocol, providing a larger number of OT appointments, and involving social workers or other mental health professionals in the process (Vreeken et al., 2020).
  7. **Cochlear implantation.** Two studies supported cochlear implantation to improve functioning and rehabilitation care for older adults with DSI (Arauz et al., 1997; Takano et al., 2016). Using a case study of a 69-year man with acquired DSI, Arauz and colleagues (1997) reported that multichannel cochlear implantation improved the individual's communication and psychosocial well-being. In another study with eight patients with severe DSI, Takano and colleagues (2016) found seven patients had positive outcomes with improved communication and quality of life post cochlear implantation. The study concluded the need for educational programs for patients on the benefits of cochlear implantation.
- Strategies.*—Out of 28 included studies, 22 mentioned strategies to improve health care services for older adults with DSI. These approaches included: adapted communication strategies used by health care providers ( $n = 8$ ); education and training for service providers ( $n = 6$ ); integrated multidisciplinary health and rehabilitation care services ( $n = 5$ ); training for and use of assistive technology ( $n = 5$ ); screening and recording of vision and hearing abilities in older patients with other chronic conditions ( $n = 3$ ); home-based services ( $n = 2$ ); and a self-management program ( $n = 1$ ). Please note that these numbers do not sum to 22, as some studies discussed more than one strategy. These strategies are discussed in detail below.
1. **Adapted communication strategies.** Several studies ( $n = 8$ ) reported general as well as specific strategies to improve communication between health care providers and individuals with DSI (Alhusein et al., 2018, 2019; Arauz et al., 1997; Bernardini & Davis, 2014; Echt & Saunders, 2014; Erber & Scherer, 1999; Luey, 1994; Smith et al., 2019). General strategies included environmental modifications, using alternative forms of communication, and using assistive devices or technology. Environmental strategies to improve communication included the use of slow speech and short sentences, decrease in the distance between self and patient, elimination of reflective glare and visual distractions, reduction in noise in the examination room, and possibility for repetition and clarification, when necessary (Alhusein et al., 2018, 2019; Echt & Saunders, 2014; Erber & Scherer, 1999). An exploratory study conducted by Luey (1994) reported several strategies that improved the rehabilitation care of their clients with DSI. These included using magnifiers and lights while training clients with vision impairment on the use of hearing aids or other devices, putting bright colored or raised dots on hearing aid controls, offering the use of a hand-held amplifier while discussing adaptations to low vision, reducing background noise and visual distraction, considering hearing when discussing talking books, clocks, or calculators; considering vision when explaining hearing aid controls, tele-caption decoders, or text-based phone equipment (Luey, 1994). Some of these strategies were also noted by Echt and Saunders (2014).
- A group of authors published three studies on medication management challenges faced by older adults with DSI and pharmacy professionals in Scotland (Alhusein et al., 2018, 2019; Smith et al., 2019). The findings suggested several communication strategies, which participants found helpful. Some of these strategies were also



noted by [Echt and Saunders \(2014\)](#). To improve pharmaceutical care for this group, these strategies included providing information in accessible formats, such as the use of large-print leaflets for written information, minimizing noise during telephone consultations, speaking louder, clearly and slowly, and improving the readability of labels on medical products using large font and braille. Findings also suggested that disclosure of sensory impairment by patients or awareness of patient's sensory impairment by pharmacy personnel was very important to improve communication and to optimize the safety of medical regimens ([Alhusein et al., 2018, 2019](#)).

Under specific strategies, two studies reported the use of speech-tracking, a speech processor such as a retro-auricular microphone, braille, and computer-assisted programs for assessment and other clinical procedures ([Arauz et al., 1997; Bernardini & Davis, 2014](#)). For example, in a study that evaluated the effectiveness of a computer-guided training program (using automated instruction with animation, visual images, and voice cues) to train patients with sensory impairment for peritoneal dialysis, researchers found that all the participants were able to meet the training objectives ([Bernardini & Davis, 2014](#)).

2. **Education and training for service providers.** Several studies ( $n = 6$ ) supported the necessity of education and training for health care providers to identify and manage communication difficulties faced by older population with DSI ([Alhusein et al., 2018, 2019; Erber & Scherer, 1999; Flynn et al., 2002; Fraser et al., 2019; Leroi et al., 2019a](#)). In a multinational study by [Leroi and colleagues \(2019a\)](#), less than 25% of professionals who provide services to individuals with DSI and CI felt they had sufficient training to administer an alternative screening assessment tool for concurrent impairments. Furthermore, these professionals did not feel they had adequate knowledge of how to use the results of these additional tools and enough awareness of referral pathways for patients with DSI. They highlighted the pressing need for cross-discipline training and guidelines for physicians to improve assessments and care pathways ([Leroi et al., 2019a](#)).

A qualitative study in Canada found that health care professionals working with older adults with DSI needed to provide services that fall into their scope of practice but also to work as counselors, navigators, and trainers for their clients with DSI ([Fraser et al., 2019](#)). This study emphasized the need for education, training, and support for health care professionals for these additional roles outside of their specific training. [Erber and colleagues \(1999\)](#) suggested strategies to train medical and nursing students and professionals about sensory loss and communicative outcomes. The authors found that multimedia demonstrations that simulate sensory impairment in older adults were an effective method to engage trainees to consider the variety of communication problems encountered by older adults with DSI. The authors recommended the education of professionals on various communication strategies to assist with the assessment and rehabilitation of older adults with DSI ([Erber & Scherer, 1999](#)).

Similarly, a study in New Zealand suggested communication skills training for residential care workers ([Flynn et al., 2002](#)). The authors found that functional assessments of vision and hearing difficulties provided a simple assessment of the required level of assistance for each resident in care homes. Studies focusing on community pharmacy personnel also identified the need for education and training on how to ensure safety and improve communication and how to provide more information about the assistive devices available to support older adults with DSI ([Alhusein et al., 2018, 2019](#)).

3. **Integrated multidisciplinary health and rehabilitation care services.** Five studies suggested integrated multidisciplinary care services to cater to the needs of older adults with DSI ([Fraser et al., 2019; Luey, 1994; McMahon et al., 2017; Schneider et al., 2014](#)). A study by [Leroi and colleagues \(2019a\)](#) with 670 health professionals and experts across six countries exploring gaps and solutions in assessment and service provision to clients with age-related DSI and CI. Participants indicated that hearing and vision specialists must undertake brief, adapted cognitive screening as part of their sensory-based functional assessments and memory specialists doing brief hearing and vision assessments, using a common "sensory-cognitive" team approach for patient care. Another study concluded that a multidisciplinary team would serve best to fulfill the needs of older adults with DSI ([Fraser et al., 2019](#)).

Two studies conducted in Australia assessed a Hearing Screening and Education Model (HSEM) of an intervention within a low-vision clinic that aimed to facilitate access to hearing services for older patients with low vision ([McMahon et al., 2017; Schneider et al., 2014](#)). The HSEM consisted of: (a) standard pure-tone audiometry; (b) discussion of implications of DSI; and (c) provision of information on hearing services and referral. Following the intervention, 40% of participants with low vision followed the recommendations to seek help for hearing loss ([Schneider et al., 2014](#)). They completed a full hearing assessment, obtained hearing aids or other devices, and got their previous aids adjusted. In another study on HSEM in 2017, the participants valued the opportunity to have hearing and vision assessment available in the same clinic ([McMahon et al., 2017](#)). The authors concluded a need to develop and evaluate integrated models of health care to provide tailored, multidisciplinary services to older adults with DSI ([McMahon et al., 2017; Schneider et al., 2014](#)).

Another study reported on a coordinated hearing and vision service delivery program for older clients with DSI, led by a social worker ([Luey, 1994](#)). The program included: (a) structured training programs for the staff of a hearing and a vision service provider agency, (b) the provision of low-vision equipment (such as magnifiers, large printing devices, illuminating lights) to an audiology service agency, and assistive listening equipment (radio-based devices) to a vision service agency, and (c) the coordination of services, individual counseling, and group support by a social worker. The program's salient feature was that the staff of hearing service provider trained the staff of vision service provider about hearing loss, techniques to communicate, and use of assistive devices. Similarly, the staff of vision service provider trained the staff of hearing service provider on vision loss

in older adults and the range of available equipment and resources. Overall, the program had a moderate satisfaction rate (54%) among clients and emphasized the need for having a social work specialist on interdisciplinary teams to address the psychosocial needs of older clients and coordination of services (Luey, 1994).

4. **Training on the use and maintenance of assistive aids/technology.** Four studies highlighted the importance of training older adults with DSI on the proper use and maintenance of assistive devices to improve their communication with health care professionals (Flynn et al., 2002; Haque et al., 2012; St-Amour et al., 2019; Wittich et al., 2016). For example, Flynn and colleagues (2002) reported that older adults who owned hearing aids were unable to perform important routine maintenance such as changing the batteries (22%) or removing wax around the tubes and case (34.1%), which, in turn, affected their functioning and quality of life. Some of these participants did not use their hearing aids because of difficulty with insertion and adjusting the controls. Similar challenges were reported by Haque and colleagues (2012) in their case report. A quantitative study assessed the effectiveness of assistive listening devices (including a pocket talker, a talking clock, and an amplified telephone) for older adults with DSI to improve health monitoring and other rehabilitation interventions (Wittich et al., 2016). The authors found that minimal interventions, such as simple instructions and repetitions, can facilitate the use of assistive listening devices by older adults with DSI, which can further help in health care interactions, communicating health information and implementing other rehabilitation interventions. Several studies also suggested improving the design of assistive devices, which consider the complexity of multiple concurrent impairments, minimize the visibility and dexterity needs, and reduce task complexity (St-Amour et al., 2019; Wittich et al., 2016).
5. **Screening and recording for vision and hearing in older patients with other chronic conditions.** Three studies suggested the use of sensory assessments to uncover problems that may not be identified during usual systematic clinical evaluations (Dullard & Saunders, 2016; Dupuis et al., 2015; Leroi et al., 2019a). One study found that hearing, vision, and cognition experts agreed that a lack of adapted instruments for screening of sensory impairments among older adults led to fragmented care and indicated the need for such tools and assessments (Leroi et al., 2019a). Similarly, a study mentioned that not taking individuals' sensory abilities into account often leads to misdiagnosis of other impairments, which can, in turn, have serious consequences for those individuals (Dupuis et al., 2015). The authors suggested incorporating hearing and vision screening during the examination of other conditions, such as CI, and adapting the screening processes that heavily rely on vision and hearing. Using case studies, another study emphasized the importance of documentation of sensory impairments in the electronic medical records of patients so that the documentation can be used while planning interventions, referrals, and coordinating services for these clients (Dullard & Saunders, 2016).
6. **Home-based sensory intervention services by a sensory support therapist.** Two studies from the SENSE-Cog Field Trial group tested the feasibility and effect of a home-

based sensory intervention program among 19 older adults with dementia and sensory loss and their 19 care partners (Hooper et al., 2019; Leroi et al., 2019b). The intervention consisted of hearing and vision assessment, fitting of corrective devices (glasses, hearing aids), and home-based support from a sensory support therapist for device adherence and maintenance, communication training, referral to support services, and environmental modification. The authors concluded that the home-based program was feasible, acceptable, convenient, and desirable for older clients (Hooper et al., 2019; Leroi et al., 2019b). These clients reported that the assistance from a sensory support therapist was "extremely helpful" in encouraging the introduction of the corrective devices and optimizing activity engagement (Hooper et al., 2019). The qualitative data supported the effectiveness of the intervention with respect to more social engagement, improved functioning and communication, and less dependence on care partners (Leroi et al., 2019b). Both studies warranted a randomized controlled trial to test intervention effectiveness.

7. **Self-management programs.** Using a cluster randomized controlled trial, one study evaluated the effectiveness of a nurse-supported self-management program for older adults living in LTC homes (Roets-Merken et al., 2018). Trained nurses offered self-management interventions in the everyday environment of LTC homes, the problems were identified by the older adults themselves, and solutions were explored within that same everyday environment. The authors reported that the program showed beneficial effects in addressing problems in instrumental activities of daily living among older adults with DSI. The effect size of 4.3 was reported as the mean difference between the intervention and control group from baseline.

## Discussion

This systematic review aimed to appraise and synthesize the evidence on tools and strategies for screening, assessment, and interventions that promote optimal health care for older adults with DSI. Our review identified nine studies focused on seven tools and 22 studies reporting on seven specific strategies for screening, assessments, and/or interventions to improve health care for older adults with DSI (see Table 4 for tools and strategies identified for screening, assessment, and interventions, and Table 5 for a summary of tools and strategies). Of 28 included studies, please note that some studies discussed tools as well as strategies. Quality appraisal of the included studies indicated a moderate level of evidence to inform clinical practice. While only two studies were randomized controlled trials, most quantitative studies were descriptive. Most studies came from high-income countries, pinpointing the need for DSI-related health care research in low- and middle-income countries (LMICs) to fill this evidence gap, as highlighted in the WFDB Global report (2018).

Our review is a first attempt to synthesize the evidence on this topic to directly inform clinical practice, examining scientific articles from seven research databases and three clinical trial registries since their inception. Even though the number of older adults with DSI is projected to increase with age worldwide (Minhas et al., 2022), the most intriguing finding

**Table 4.** Tools and Strategies

	Screening and assessment	Intervention
Tools	<ul style="list-style-type: none"> <li>Severe Dual Sensory Loss Screening tool (Roets-Merken et al., 2014)</li> <li>Major Depression Inventory (Hovaldt et al., 2018)</li> <li>interRAI Community Health Assessment with deafblind supplement (Dalby et al., 2009; Urqueta Alfaro et al., 2019)</li> <li>Adapted Montreal Cognitive Assessment (Dupuis et al., 2015)</li> <li>Tactile Test Battery (Bruhn &amp; Dammeyer, 2018)</li> </ul>	<ul style="list-style-type: none"> <li>Dual sensory loss protocol (Vreeken et al., 2020)</li> <li>Cochlear implantation (Arauz et al., 1997; Takano et al., 2016)</li> </ul>
Strategies	<ul style="list-style-type: none"> <li>Screening and recording for vision and hearing in older patients with comorbidities (Dullard &amp; Saunders, 2016; Dupuis et al., 2015; Leroi et al., 2019)</li> <li>Education and training for health care providers to identify communication difficulties due to dual sensory impairment (DSI; Alhusein et al., 2018, 2019; Erber &amp; Scherer, 1999; Flynn et al., 2002; Fraser et al., 2019; Leroi et al., 2019a)</li> </ul>	<ul style="list-style-type: none"> <li>Adapted communication strategies (Alhusein et al., 2018, 2019; Arauz et al., 1997; Bernardini &amp; Davis, 2014; Echt &amp; Saunders, 2014; Erber and Scherer, 1999; Luey, 1994; Smith et al., 2019)</li> <li>Home-based sensory intervention services (Hooper et al., 2019; Leroi et al., 2019b)</li> <li>Integrated multidisciplinary health care (Flynn et al., 2002; Fraser et al., 2019; Luey, 1994; McMahon et al., 2017; Schneider et al., 2014)</li> <li>Nurse-supported self-management programs (Roets-Merken et al., 2018)</li> <li>Training on the use of assistive technology for older adults (Flynn et al., 2002; Haque et al., 2012; St-Amour et al., 2019; Wittich et al., 2016)</li> <li>Education and training for health care providers to manage communication difficulties due to DSI (Alhusein et al., 2018, 2019; Erber and Scherer, 1999; Flynn et al., 2002; Fraser et al., 2019; Leroi et al., 2019a)</li> </ul>

was that there are only a few tools and strategies that have been developed, tested, or used to ensure that older adults with DSI receive proper screening, diagnosis, clinical or lab assessments, and interventions. Another important point to consider is whether these existing tools and strategies are even known among clinical care providers. Reviewed evidence pinpointed the dire need for education and training for health care professionals on DSI-specific challenges and supports and the use of integrated multidisciplinary health and rehabilitation care services for older adults. There is also a key consideration for continual adaptation of a model of care services as the needs of older adults with DSI change with age and may require transitions from one care setting to another (e.g., home care, hospital, LTC, or rehabilitation care; Guthrie et al., 2016; Simcock & Wittich, 2019).

Patient-centered optimal care, which places patients and their needs at the forefront of their health care, is dependent on communication and the ability to navigate and interact with the clinical environment independently, which may not be entirely possible in the case of those with DSI (Reed et al., 2020). Effective communication between health care professionals and care recipients is key to successful clinical care process, and related outcomes (Brennan et al., 2005). Our review reported specific strategies that could improve health care-related communication, such as environmental modifications, using alternative forms of communication, and assistive technology. There is a dire need to have policies or protocols to guide and train professionals to work with, or simply to communicate with individuals with DSI in health care organizations (Simcock & Wittich, 2019). Professionals working in geriatric care, whether in community, clinical, home care, or residential settings, need an awareness of the needs, preferences, and diverse communication modes and possibilities

used by older adults with DSI. This becomes even more important knowing that older adults with DSI perceive twice as much discrimination in their daily life as those without DSI, mostly due to the communication barrier (Shakarchi et al., 2020), and often rely on companions to accompany them during medical visits to facilitate communication (Reed et al., 2020). With the coronavirus disease 2019 pandemic, emerging evidence highlights that the restrictions on accompanying visitors and the use of personal protective equipment, such as masks, posed an additional barrier to health care communication and access to care for this group that needs to be further explored in future studies (Jaiswal et al., 2021a, 2022; Wittich et al., 2021).

One of the most intriguing findings, however, was the dearth of research on older veterans with DSI ( $n = 1$ ) and those in residential settings such as LTC/nursing homes ( $n = 3$ ). Even though the prevalence of DSI has been reported to be higher among older adults in LTC facilities (Guthrie et al., 2016), only two studies primarily focused on LTC residents. The use of screening tools for early identification of DSI among LTC residents is recommended for efficient referral, timely diagnosis, and management of the condition by staff (Andrusjak et al., 2020). Future research should investigate tools or approaches in the care settings, including in palliative or end-of-life care, where older adults with DSI are often high users (Heine & Browning, 2015).

Further, our review indicated that there is limited evidence on how to provide care to older adults with DSI with comorbidities, such as CI or depression. Our review suggested the development and use of new or adapted instruments for screening of sensory impairments among older adults, such as the TTB tool and the adapted MoCA tool. Incorporating hearing and vision screening during the examination of other

**Table 5.** Summary of Tools and Strategies

	Summary
<b>Tools</b>	
interRAI Community Health Assessment (CHA) with deafblind supplement	The interRAI CHA deafblind supplement is based on two items (vision and hearing) in the overall CHA assessment and is uniquely used for individuals with any level of dual sensory impairment (DSI). It assesses sensory impairment, health, and functioning of community-dwelling older adults, including those with single or DSI; it is found to have a high specificity (96.2%) and sensitivity (96.9%) for identifying DSI (Urqueta Alfaro et al., 2019)
Major Depression Inventory (MDI)	The MDI is a screening tool based on the International Classification of Diseases 10th Revision (ICD-10) diagnostic criteria for moderate to severe depression. It has acceptable construct validity and reliability for screening for depression among older adults with acquired DSI (Hovaldt et al., 2018)
Tactile Test Battery (TTB)	The TTB is a valid tool to assess dementia in older adults with DSI, although there is a need for more studies to determine if this tool is equally valid for individuals with DSI with various degrees and durations of sensory impairments (Bruhn et al., 2018)
Adapted Montreal Cognitive Assessment (MoCA)	The MoCA is a tool to measure cognitive abilities including attention, memory, language, and visuospatial functions. Adapted MoCA is a new proportional scoring system to exclude items likely to rely heavily on auditory and visual abilities, to make it suitable for persons with DSI (Dupuis et al., 2015)
Severe Dual Sensory Loss (SDSL) screening tool	The SDSL screening tool is a tool for nurses and care assistants to identify DSI and can be used separately or in addition to diagnostic tools or treatment programs for cognitive impairment or depression. It is a reliable, valid, and easy-to-administer tool that can assist nurses and care assistants in recognizing DSI and in maximizing intervention planning and functional opportunities (Roets-Merken et al., 2014)
Dual Sensory Loss (DSL) protocol	The DSL protocol consisted of a handbook to increase communication ability and well-being among persons with DSL. The DSL protocol was used to assess well-being and communication of 131 older adults with DSI and their communication partners; however, further studies and protocol adaptation is needed (Vreeken et al., 2020)
Cochlear implantation	Cochlear implantation is surgical implantation of neuroprosthesis for the auditory rehabilitation of qualified patients with severe to profound sensorineural hearing loss. It was found to improve functioning and rehabilitation care for older adults with DSI (Arauz et al., 1997; Takano et al., 2016)
<b>Strategies</b>	
Adapted communication strategies	Strategies include environmental modifications, using alternative forms of communication, and using assistive devices or technology (Alhusein et al., 2018, 2019; Arauz et al., 1997; Bernardini & Davis, 2014; Echt & Saunders, 2014; Erber & Scherer, 1999; Luey, 1994; Smith et al., 2019)
Education and training for service providers	Education of professionals on various communication strategies to assist with the assessment and rehabilitation of older adults with DSI (Alhusein et al., 2018, 2019; Erber & Scherer, 1999; Flynn et al., 2002; Fraser et al., 2019; Leroi et al., 2019a)
Integrated multidisciplinary health and rehabilitation care services	Integrated multidisciplinary health and rehabilitation care services includes training of vision service providers by hearing service providers about hearing loss, techniques to communicate, and use of assistive devices. Similarly, the vision service providers train hearing service provider on vision loss in older adults and the range of available equipment and resources (Fraser et al., 2019; Leroi et al., 2019a; Luey, 1994; McMahon et al., 2017; Schneider et al., 2014)
Training on the use and maintenance of assistive aids/technology	Training on assistive technology includes strategies on the use and maintenance of assistive aids/technology, such as simple instructions and repetitions to facilitate the use of assistive listening devices by older adults with DSI (Flynn et al., 2002; Haque et al., 2012; St-Amour et al., 2019; Wittich et al., 2016)
Screening and recording for vision and hearing in older patients with other chronic conditions	Strategy includes incorporating hearing and vision screening during the examination of other chronic health conditions, such as cognitive impairment, and adapting the screening processes that heavily rely on vision and hearing (Dullard & Saunders, 2016; Dupuis et al., 2015; Leroi et al., 2019a)
Home-based sensory intervention services by a sensory support therapist	Home-based sensory intervention services include hearing and vision assessment, fitting of corrective devices (glasses, hearing aids), and home-based support from a sensory support therapist for device adherence and maintenance, communication training, referral to support services, and environmental modification (Hooper et al., 2019; Leroi et al., 2019b)
Self-management program	A nurse-supported self-management program for older adults living in long-term care homes to improve their social participation (Roets-Merken et al., 2018)

conditions, such as CI, and adapting the tool or screening processes that heavily rely on vision and hearing is critical (Dupuis et al., 2015; Leroi et al., 2019a). Wittich and colleagues (2018) recommended nurses to use sensory screening methods that are flexible enough to accommodate for a range of mild to severe CIs among LTC residents. Researchers should leverage this emerging opportunity to generate evidence on the nexus of DSI and CI to inform the continuum of

care for older adults with combined DSI and CI (Jaiswal et al., 2021b; Liu et al., 2022).

Although DSI has a detrimental impact on the mental health of older adults, we found only one study on screening for, or managing of, mental health concerns (depression in this case) among older adults with DSI (Hovaldt et al., 2018). Given that DSI is a risk factor for mental health conditions among older adults, future research is warranted for better

screening, assessment, and management of these concerns among older adults with DSI, especially considering the barriers to access mental health care worldwide for this aging population. Moreover, future research should consider the intersectionality of the age of older adults with DSI, with other factors such as race, gender, indigeneity, ethnicity, language, and immigration status.

### Limitations

Our study has several limitations to consider. First, most included studies are limited by small sample sizes. This could be attributed to the fact that older adults with DSI are underrepresented in research because of methodological and ethical concerns, which may have affected the number of studies undertaken or published (Paramasivam et al., 2021). Second, there might be a potential publication bias because there were a few studies where the research team used a similar recruitment or data source. Third, there could be instances where studies with unsuccessful interventions were less likely to be published, and hence, this review did not capture them. Lastly, one main limitation is related to the generalizability of the review for the older population with DSI in LMICs, as most included studies were from high-income countries.

### Conclusion

Age-related hearing and vision impairment is a serious public health issue that will affect the lives of millions of people worldwide. This systematic review focused on appraising the scientific literature on tools and strategies to provide optimal care to older adults with DSI. Despite having a comprehensive search in the databases since their inception (dated 1806 onwards), the review identified a limited number of studies. The tools and strategies identified were not comprehensive and did not tackle every aspect of health care for older adults with DSI. Quality appraisal indicated a moderate level of evidence on the effectiveness of these tools/strategies. Reviewed evidence also indicated the knowledge gap between the training needs and training provision on DSI-specific care for health care providers. Future studies are warranted for the development and evaluation of tools and interventions that accommodate for sensory loss and are effective in improving health care access and experiences for this group.

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### Conflict of Interest

The authors have no conflicts of interest to declare.

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## Supplementary Material

Supplementary data are available at *Innovation in Aging* online.

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