

SYSTEMATIC REVIEW

Open Access



Association of hearing loss with cognitive function and mental health in Africa: A systematic review

Abdulazeez Ahmed¹, Fatimah Tsiga-Ahmed^{2*}, Nafisatu Bello-Muhammad³, Abdulrazaq Ajiya³, Mustapha Gudaji⁴ and Denes Stefler⁵

Abstract

Objective To summarize the evidence for the associations between hearing loss and mental health and cognitive function in Africa.

Methods This systematic review was prepared following the PRISMA guidelines. Cohort, case–control and cross-sectional studies were considered for inclusion if they reported the prevalence of any mental health conditions or levels of cognitive functioning among persons with hearing loss/deafness in comparison to those without hearing loss. No age restriction was applied. Articles not published in English or not from the African subcontinent were excluded. The initial search yielded a total of 2,822 articles from electronic databases. After title, abstract and full-text screening, seven articles were found to be eligible, with a total of 2,761 participants across Africa.

Results Five studies reported that hearing difficulties were significantly associated with an increased prevalence of poor mental health. Two studies reported on cognition, one on higher odds (2.22; 95%CI) of developing cognitive decline among persons with hearing difficulties than among those with normal hearing. The majority of studies were conducted among special populations (i.e., retirement homes and special schools), with most participants being female.

Conclusion This study revealed an increased risk of mental health disorders and/or cognitive decline for people with hearing impairment in African populations. However, the number of relevant studies is small, and more research is needed to provide evidence for public health interventions across the continent.

Trial registration PROSPERO—CRD42024520957.

Keywords Hearing loss, Cognitive decline, Mental health, Africa, Systematic review

*Correspondence:

Fatimah Tsiga-Ahmed
fitsiga.cmed@buk.edu.ng

Full list of author information is available at the end of the article



© The Author(s) 2025. **Open Access** This article is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License, which permits any non-commercial use, sharing, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if you modified the licensed material. You do not have permission under this licence to share adapted material derived from this article or parts of it. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by-nc-nd/4.0/>.

Background

The World Health Organization (WHO) estimates that by 2050, more than 700 million people—or 1 in 10 people—will have disabling hearing loss, which currently affects over 5% of the world's population (432 million adults and 34 million children) [1]. Most people with disabling hearing loss—nearly 80% of them—live in low- and middle-income countries (LMICs) [1]. According to the WHO, sub-Saharan Africa is thought to have a much higher prevalence of hearing loss than developed nations. In sub-Saharan Africa, the prevalence of hearing loss in people under the age of 15 years is 15.7%, whereas it is 4.9% in developed countries [1, 2].

Research indicates that globally, individuals with hearing loss are more likely to experience behavioural, mental, neurodevelopmental, and social issues compared to their peers without hearing loss, with prevalence rates in Africa ranging from 19 to 77% [3–6]. Hearing loss can worsen existing mental health problems and is associated with higher rates of conditions such as depression and anxiety [6–9]. Other studies report higher depression rates and scores among people with hearing loss [7].

Hearing loss in childhood can increase the risk of mental health issues [10], with multiple episodes potentially leading to behavioural and learning difficulties later in life [10]. However, the severity of hearing loss doesn't necessarily correlate with mental health issues [6, 11]. Adults with hearing impairment are more likely to experience depression, with women being more affected [12]. Addressing hearing impairment is therefore considered essential for mental health.

Hearing loss presents significant health challenges in low- and middle-income countries (LMICs), particularly in Africa, where access to ear and hearing care services, as well as mental health services, is limited due to competing health priorities and insufficient funding [13–16]. Mental healthcare in sub-Saharan Africa is often ineffective, insufficient, and inequitable [16], and mental health remains underprioritized despite the high prevalence of mental illnesses [15, 16].

A significant and growing body of literature links hearing loss to cognitive function. Research also shows that individuals with moderate to severe hearing loss who lack access to amplification (assistive listening devices) struggle with conversations, particularly in noisy environments or social settings [17]. This difficulty can lead to social isolation, which may contribute to cognitive decline [17]. A distinct clinical condition that impacts hearing capacity and mental health has been connected to deficiencies in speech perception in noisy environments, Auditory Processing Disorder (APD) and this has been linked to a higher risk of dementia [18].

In the Health ABC Study conducted in the US, which oversampled African-Americans and included a cohort of 3,075 men and women aged 70 to 79, researchers found that moderate age-related hearing loss was associated with accelerated cognitive decline in older adults [19]. Similarly, the English Longitudinal Study on Aging, which involved 7,865 subjects, found that self-reported hearing loss increased the risk ratio for dementia over ten years by 1.4 times for moderate hearing loss and 1.6 times for severe hearing loss compared to those without hearing loss [20].

A systematic review and meta-analysis of 40 studies globally found a small but significant association between age-related hearing loss and cognitive function across all domains based on the pooled adjusted effect sizes using random-effects models [21]. This study reported a statistically significant correlation between dementia and age-related hearing loss (OR, 2.42; 95% CI, 1.24–4.72) as well as cognitive impairment (OR, 2.00; 95% CI, 1.39–2.89). The researchers concluded that age-related hearing loss is a modifiable risk factor and potential biomarker for dementia, cognitive decline, and cognitive impairment [21, 22]. Oxidative stress, known to cause hearing loss [23, 24], is also a common feature of several neurodegenerative disorders such as Alzheimer's Disease [25]. Interestingly a few years ago, following a cross-sectional study of 100 subjects aged 80 to 99 years, the researchers reported that wearing hearing aids was associated with better cognitive function, contributing to evidence that hearing aids may slow the progression of cognitive decline [26].

Understanding the links among hearing loss, cognitive function, and mental health, and summarizing the evidence could significantly impact public health in Africa and globally. Therefore, the research question, "What is the association of hearing loss with cognitive function and mental health in Africa?" seeks to address this gap.

Methods

Protocol

This systematic review was conducted and reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement [27]. This systematic review protocol was registered with the International Prospective Register of Systematic Reviews (PROSPERO) under CRD42024520957.

Eligibility criteria

Outcomes definition

Hearing loss outcome studies reporting hearing threshold of 20 dB or more in both ears (can affect one ear or both ears) and leads to difficulty in hearing conversational

speech or loud sounds [1], – were considered to have hearing loss via Audiometry; or self-reported hearing losses.

Cognitive impairment Studies looking at any type of decline or function which were measured using standardised or validated means were considered.

Mental illness any type of study reporting use of validated measures was also considered i.e., behaviour disorders—oppositional defiant disorder, conduct disorder, etc.; Mood disorders—bipolar disorder, hypomania, depressive disorders, disruptive mood dysregulation disorder; as well as neuropsychiatric diseases/stress related disorders- anxiety disorders, schizophrenia, psychosis, etc.

Inclusion criteria

Studies examining the relationship between hearing loss and cognitive function and/or mental health issues in comparison to those without hearing loss; cohort, case–control, and cross-sectional studies among people with hearing impairment, loss, or deafness; research conducted in Africa and published in English that took into account various techniques for evaluating exposure and results. Studies that use self-reported measures or clinical assessments to illustrate different types of hearing loss (conductive, sensorineural, mixed, mild, moderate, severe, or profound); studies that show different types of cognitive impairment or function measured using standardized or validated means. As well as behavioural disorders (such as conduct disorder), mood disorders (such as bipolar disorder, depressive disorders), and neuropsychiatric diseases (such as anxiety disorders, schizophrenia) measured via validated means.

Exclusion criteria

Systematic reviews, randomized controlled trials, and studies where the full text was not available.

Sources and data search strategy

We searched Medline, PsycINFO, Cochrane Library, and EMBASE databases from their inception dates to Dec. 30, 2023 with no limit placed on the date of publication. The search strategy for identifying relevant studies involved keywords for four main terms: Africa, hearing loss, cognitive function, and mental health. These keywords were developed using MeSH terms and based on existing studies on similar topics. Boolean operators and truncation were applied to construct and combine searches for these key concepts across various databases. Additionally, systematic reviews and study protocols identified during the search were reviewed for eligible studies. Reference lists

of selected articles were also examined for further relevant studies. The screening process used medical subject headings (MeSH) and keywords in titles and abstracts, combining terms related to hearing loss (e.g., hearing loss, hearing disorders, deafness) with terms related to mental health (e.g., mental illness, cognitive decline) and specifying the African context (e.g., Africa, South Africa, sub-Saharan Africa).

Studies were initially selected for screening via medical subject headings (MeSH) terms and keywords in the titles and abstracts: (hearing loss OR hearing disorders OR hearing impairment OR deafness OR hard of hearing OR persons with hearing impairment) AND (mental illness OR mental health OR mental ill-health OR behavioural health OR psychiatric illness) OR (cognition OR cognitive decline OR social cognitive OR cognition assessment) AND (Africa OR south Africa OR Africa south of the Sahara OR Africa, central OR Africa, southern OR Africa, northern OR Africa, eastern OR Africa, western).

Study selection and data collection process

Stage 1—Duplicate Removal: All studies identified during the search were imported into EndNote version X9 to remove duplicates and facilitate title and abstract screening. After deduplication, records were transferred to Rayyan [28], a web-based tool for systematic review article screening.

Stage 2—Title and Abstract Screening: The remaining records were screened based on titles and abstracts to determine their relevance to the research question.

Stage 3—Full-Text Screening: Full-text articles were retrieved for studies that passed the title and abstract screening. If full texts were not available, library staff were consulted. No authors were contacted for additional access during this review.

Stage 4—Data Extraction: Data was extracted from the selected studies. Two reviewers (Ahmed A & Tsiga-AF) independently conducted the screening and data extraction. Discrepancies between reviewers were resolved through discussions with a third reviewer (Denes S). The methodological quality of the included studies was assessed independently by three researchers (Ajiya A, Bello-M N & Gudaji M). This process is illustrated in Fig. 1 (flow chart).

Assessing the quality of evidence

The quality of each selected study was evaluated using the GRADE categories, which classify evidence as high, moderate, low, or very low [29]. Observational studies begin with a “low” rating by default. Each outcome was assessed individually, with adjustments made to either

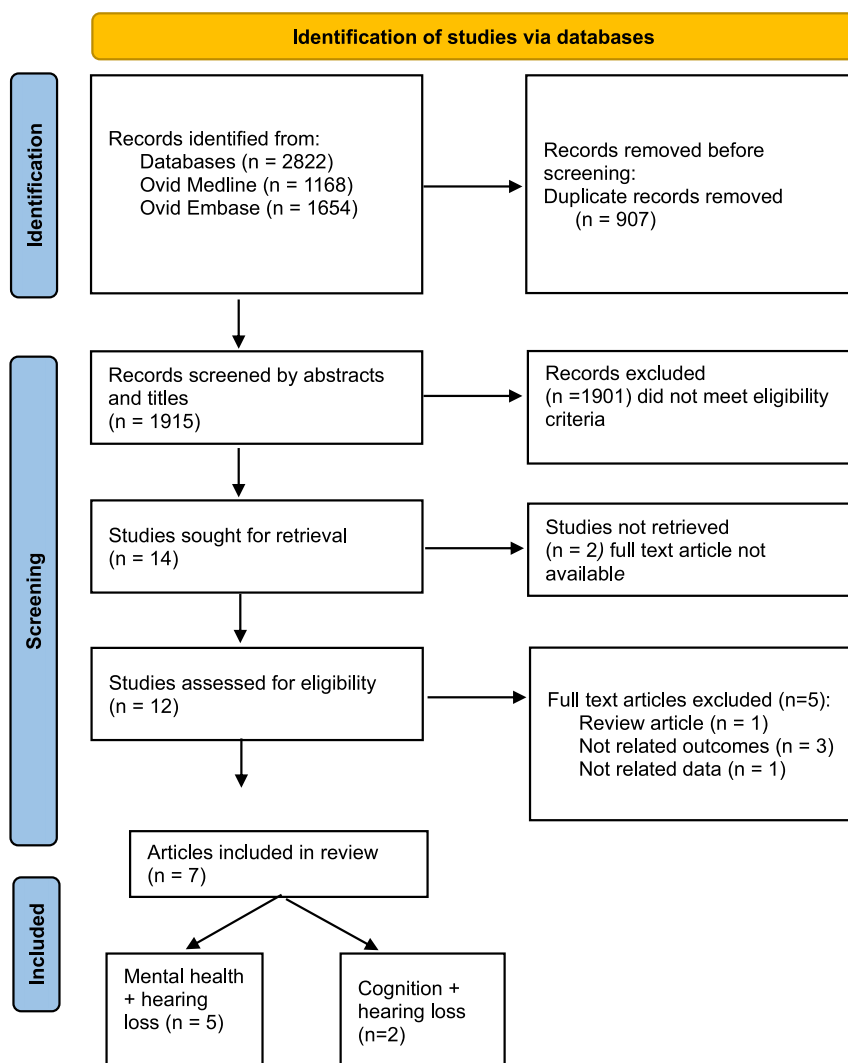


Fig. 1 PRISMA flow chart of search results

upgrade or downgrade the certainty of the evidence based on the following factors:

- Risk of Bias/Study Limitations: Evaluates potential biases and methodological limitations in the studies.
- Precision of Effect Estimates: Considers the accuracy and reliability of the effect sizes reported.
- Consistency of Study Results: Assesses the uniformity of findings across studies.
- Directness of Evidence: Examines how directly the evidence addresses the research question.
- Publication or Reporting Biases: Looks at potential biases in the reporting of results.

Despite any reasons for downgrading the evidence, it cannot fall below a "very low" rating [29]. None of the

studies were excluded based on the quality of evidence. The outcome of this exercise is illustrated in Tables 1 and 2.

Results

Description of included studies

A total of 2,822 studies were initially identified and screened for duplicates. Out of these, 907 duplicates were removed. The remaining 1,915 studies underwent title and abstract screening. Of these, 1,903 studies were excluded as they did not meet the criteria for title and abstract screening, leaving 12 studies that met the eligibility criteria for full-text retrieval.

Upon full-text screening, five studies were excluded: one was a review article, three had no relevant outcomes according to the inclusion criteria, and one lacked relevant data. This left seven studies eligible for the review.

Table 1 Key characteristics and findings of included studies

| Study author and design | Country | Sample size (HL/ Control) | Age/Population type | Hearing Loss Assessment | Outcome Assessment | Prevalence (HL/ Outcome) | Effect Estimates (OR, 95%CI) | Key Findings |
|--|--------------|---------------------------|------------------------------------|-------------------------|------------------------------|--------------------------|------------------------------|--|
| Govender et al., 2021 Cross-sectional | South Africa | 46/14 | Mean 79 yrs / Retirement home | Audiometry/ OAE | WHOQoL (Mental health) | 77% / 29% | Not reported | Hearing difficulties associated with increased rates of poor mental health |
| Wallace et al., 2020 Cross-sectional | Cameroon | 32/1,567 | Mean 44.5 yrs / General population | Self-reported | WG ES-F (Mental health) | Unclear / 6.5% | aOR 0.9 (0.2, 4.2) | No significant association between hearing loss and mental health outcomes |
| Adeniyi et al., 2019 Cross-sectional | Nigeria | 102/102 | Mean 15.2 yrs / Special school | Audiometry | SDQ (Mental health) | 88.2% / 65.5% | Not reported | Deaf children had higher rates of mental health problems than hearing counterparts |
| Dotchin et al., 2015 Cross-sectional | Tanzania | 224/72 | ≥ 70 yrs / Community dwellers | Self-reported | WHODAS (Cognition) | Unclear / 89.1% | OR 2.22 (1.03–4.79) | Significant association between hearing loss and cognitive decline |
| Mosaku et al., 2015 Cross-sectional | Nigeria | 52/52 | Mean 16 yrs / Special school | Not reported | ICD-10 (Mental health) | Unclear / 19.2% | Not reported | High prevalence of mental health problems among hearing-impaired adolescents |
| Obilade et al., 2015 Cross-sectional | Nigeria | 141/161 | 6–15 yrs / Special school | Not reported | Raven's Matrices (Cognition) | Unclear / Unclear | Not reported | No difference in cognitive functions between hearing-impaired and non-hearing-impaired |
| Gomaa et al., 2014 Cross-sectional | Egypt | 146/50 | 20–60 yrs / Hospital-based | Audiometry | DASS scale (Mental health) | Unclear / 4.3% | Not reported | Positive correlation between depression levels and duration of hearing loss |

HL hearing loss, aOR adjusted odds ratio, CI Confidence interval, OAE otoacoustic emission, WHOQoL World Health Organization Quality of Life disability questionnaire, SDQ Strengths and Difficulties questionnaire, DASS scale Depression, Anxiety and Stress scale, WHODAS World Health Organization Disability Assessment Schedule, WG ES-F Washington Group Extended Set-Functioning classification

Table 2 GRADE evidence profile: associations of hearing loss with cognitive function and mental health in Africa

| Study Design: Observational | Risk of bias (rating down score) | Inconsistency (rating down score) | Indirectness (rating down score) | Imprecision (rating down score) | Publication Bias (rating down score) | Quality of evidence (Overall score) ^a |
|--------------------------------|----------------------------------|-----------------------------------|--|---|--------------------------------------|--|
| Govender et al. 2021 | Risk of bias possible -1 | No serious Inconsistency 0 | Indirectness ^b Noted -1 | Imprecision ^c Noted -1 | Undetected 0 | Very low |
| Wallace et al 2020 | No serious risk of bias 0 | No serious Inconsistency 0 | No Indirectness 0 | No serious Imprecision 0 | Undetected 0 | Low |
| Adeniyi et al 2019 | No serious limitations 0 | No serious Inconsistency 0 | No Indirectness 0 | Imprecision ^c Noted -1 | Undetected 0 | Low |
| Dotchin et al 2015 | No serious limitations 0 | No serious Inconsistency 0 | Indirectness ^b Noted -1 | No serious imprecision 0 | Undetected 0 | Low |
| Mosaku et al 2015 | No serious risk of bias 0 | No serious Inconsistency 0 | No Indirectness 0 | Imprecision ^c Noted -1 | Undetected 0 | Low |
| Obilade et al. 2015 | No serious risk of bias 0 | No serious Inconsistency 0 | No Indirectness 0 | Imprecision ^c Noted -1 | Undetected 0 | Low |
| Gomaa et al 2014 | No serious risk of bias 0 | No serious Inconsistency 0 | No Indirectness 0 | Imprecision ^c Noted -1 | Undetected 0 | Low |

^a All studies were observational in design, therefore the quality rating started as “Low” [29]

^b Use of surrogate (WHOQOL) for mental ill health was considered indirectness

^c Studies that report wide confidence intervals or do not report confidence intervals (CIs) or using ‘p-values’ to estimate effects were documented as having “imprecision”

Hearing loss and mental health outcomes

Five studies examined hearing loss in relation to mental health outcomes [30–33].

Hearing loss and cognitive function

Two studies focused on hearing loss and cognitive function as the main outcomes [34, 35].

Studies that addressed the research question as a primary aim or part of secondary analysis were included. After retrieving and double-checking the full texts for accuracy, the findings were summarized in Table 1. Due to the heterogeneity of the included studies, meta-analysis was not feasible, and a narrative synthesis was conducted instead.

Study characteristics

All seven studies were cross-sectional studies that included a total of 2,761 participants from five different countries across Africa: Cameroon, Egypt, Nigeria, South Africa, and Tanzania. A total of 743 were hearing impaired, and 2,018 had normal hearing. The number of participants in each of the included studies varied considerably, ranging from 60–1599. Overall, all age categories were included in the studies; three studies (43%) included children and adolescents (6 to <18 years), and the remaining studies (57%) included adults (≥18 years)

(Table 1). The majority of the study settings ($n=4$) were special populations (retirement homes/special schools), one ($n=1$) was in a hospital, and two ($n=2$) were population-based. Most studies reported that more than 50% of participants were female. Only one study reported a male majority (53.2%). Furthermore, three (3) studies were conducted in Nigeria, one (1) in Egypt, one (1) in Tanzania, one (1) in South Africa and one (1) in Cameroon as part of 3 regional/district surveys (Nepal, India, Cameroon). Only two studies utilized random sampling for participant selection; however, in four studies, the sampling method was unclear, and one study utilized convenience sampling.

Description of the outcome measurement

Hearing loss assessments were performed via pure-tone audiometry and otoacoustic emission testing in three studies and self-reported in one study and one study through a validated questionnaire, whereas two studies did not describe how hearing loss was assessed (residents of special schools who were already deaf).

Two studies evaluated cognitive function via the World Health Organization Disability Assessment Schedule (WHODAS) [34] as well as the Standard Raven’s Progressive Matrices [35] (nonverbal test for assessing cognitive functioning) respectively.

Four (4) studies assessed different types of mental health problems (Anxiety, Depression, grief, anger, sadness and stress), each using a different scale. Gomaa et al. used the Depression, Anxiety and Stress Scale (DASS) [31], ICD-10 guidelines were used by Mosaku et al. to assess a host of psychopathologies (anxiety disorder, Attention deficit hyperactivity disorder (ADHD), behavioural disorders, Unspecified nonorganic psychosis, and recurrent depressive disorders [30], while the Cameroonian study used the Washington Group Extended Set-Functioning' (WG ES-F) scale [36], and in South Africa the World Health Organization Quality of Life (WHO-QoL) disability questionnaire was utilized, all of these studies broadly assessed anxiety and depression.

The seventh study used the Strengths and Difficulties questionnaire (SDQ) to assess behavioural problems generally amongst children. There were a lot of variability between studies in their covariates, although two (2) studies adjusted for covariates. The importance of covariates such as age, sex, mobility, use of hearing aids, have been mentioned in all identified studies, however, only two of them [32, 34] provided multivariable adjusted effect estimates (ORs) where the confounding effect of these covariates were appropriately taken into account. Table 1.

Quality of studies and risk of bias

All included studies were initially graded as "Low" quality according to GRADE criteria [29].

One study was rated as "Very Low" quality. The remaining six studies were rated as "Low" quality [30–35].

Contributing factors to quality ratings included, very low-quality study (primarily due to indirectness, risk of bias/study limitations, and imprecision); and low-quality studies (could not be upgraded or downgraded further. However, there were no serious risk of bias, inconsistency, imprecision, or detected publication bias.

Outcomes of individual studies

Mental health

Three studies found a significant association between hearing difficulties and poor mental health (Table 1), particularly in special populations such as retirement homes and special schools [30, 33][12, 34, 38]. Reasons included, poor language development, poor socio-economic status of guardians (in special schools) [30], undiagnosed hearing impairment, and poor continuity of care (in retirement homes) [32].

One Study reported an adjusted odds ratio (aOR) of 0.9 for developing mental health problems, which was not statistically significant (95% CI: 0.2 to 4.2) [32].

One Study suggested that hearing loss alone may not be the dominant factor in mental ill-health. It highlighted

the importance of considering tinnitus and the correlation between depression level and duration of hearing loss [31].

Cognitive function

Dotchin et al. (2015): Found a significant association with cognitive decline, reporting an adjusted odds ratio of 2.22 (95% CI: 1.03 to 4.79) for individuals with hearing difficulties compared to the normal hearing group [34].

Obilade et al. (2015): Reported no overall difference in cognitive function between hearing-impaired and non-hearing-impaired children. However, primary four pupils in the hearing-impaired school had significantly higher mean scores (5.95 points) higher than their peers from normal hearing schools ($P < 0.05$) [35].

Discussion

Evidence on the association between hearing loss, cognitive function and mental health disorders from the African continent were limited, with only seven studies included in the review. Majority of the studies were conducted amongst special populations (retirement homes/special schools). The included studies were generally of low quality and heterogeneous in terms of how hearing loss, cognitive function and mental health disorders were measured, thus making it difficult to compare results across studies. Due to the lack of effect estimates, the strength of the association across studies and/or regions could not be determined.

There are aetiological differences regarding hearing loss between children and adults. For instance, the majority of hearing losses in adults are caused by noise exposure and age-related hearing loss (presbycusis). While meningitis, hyperbilirubinemia, birth asphyxia, chronic suppurative otitis media, Otitis Media with Effusion, and certain genetic disorders are among the more diverse causes of hearing loss in children. Certain aetiologies, like ototoxicity, trauma, neoplasia, congenital, and/or hereditary conditions, also affect both age groups which can impact treatment and rehabilitation. To make matters worse, the consequences can be severe when the loss coincides with a co-morbidity, such as mental illness and/or cognitive decline. This could make participation and activity restrictions even more severe. Only two of the three child-focused studies in this review provided percentages on the cause of hearing loss, and these were also inconsistent. However, congenital, trauma, infections (fever, measles, jaundice at birth), and unknown were the aetiologies noted. In contrast to a study under review, whose authors reported 76.9% [30], although they had a small sample size, some studies in Europe reported far much less; 31% and 13.9%, respectively, representing unknown causes of hearing loss [37, 38]. It is evident, nevertheless,

that the aetiologies presented by the selected studies for this review were comparable to those found in other researches on hearing loss in children. On the other hand, the adult studies that were selected were also conducted in retirement homes or among older populations, and there was no documentation of the causes of hearing loss even though, they are adjudged to have age-related hearing loss.

Three out of five studies on mental health issues provided evidence that the prevalence of mental health disorders is higher among people with hearing loss compared to those without hearing loss. Several studies have reported increased vulnerability of children with hearing loss to a range of mental disorders, such as depression and less consistently, anxiety [39–42]. Some included studies particularly those involving children in special schools, supported these findings [30, 43].

Four of the five studies reviewed measured anxiety and depression in relation to hearing loss [30–32]. Despite limited studies from Africa, findings align with evidence from developed countries indicating that hearing loss may be associated with the risk of mental health disorders. In the US, Lawrence et al. (2021) found a small association between hearing loss and depression (1.47 times greater odds in older adults) [44], while Contrera et al. (2017) highlighted the increased risk of emotional and social loneliness in older adults with hearing loss, which is linked to depressive symptoms [45]. The Health ABC Study, which included 3075 men and women aged 70 to 79, showed that those with hearing impairments developed more depressive symptoms over five years [46]. West (2017) suggested that inadequate social support could explain the link between hearing loss and depression in older adults [47].

Gender differences were not prominent in the studies reviewed, though most subjects were female (50–79%). The NHANES study found a link between moderate hearing loss and depression in women aged 52 to 69 [48]. However, some studies found conflicting evidence on the link between hearing loss and depression, suggesting behavioural mechanisms like social withdrawal could lead to depression [49]. Children with congenital hearing loss are at higher risk of developing psychopathologies, as noted in a study of hearing-impaired children at a special school for the deaf, which found issues like ADHD and non-organic psychosis [11].

Regarding anxiety, studies from high-income countries such as the US, Taiwan, and Norway found a positive association with hearing loss [45], though some studies found inverse or no significant associations [9], suggesting self-reported measures of hearing loss may lack accuracy [50, 51].

Of the two studies on cognitive function reviewed, one found a significant association between hearing loss and cognitive decline, consistent with findings from high-income countries across the lifespan [52–55]. However, one of the included studies reported no difference in cognitive function between hearing-impaired and non-hearing-impaired individuals [35], a finding not corroborated by other studies perhaps due to publication bias or small sample size ($n = 302$). Three of the reviewed studies reported on the use of hearing aids; one study reported 0% hearing aid users with only less than 8% of participants who could benefit from its use but probably had no access [30], another reported less than 3% of their participants were users of hearing aids [33]. While the third study was unclear regarding the percentage of users, reports therein however reveal a better quality of life for users [56]. A growing body of evidence suggests hearing aids may improve depressive symptoms in older adults with hearing loss [8]. Further, preliminary evidence suggests that the use of communication strategies and assistive listening devices for cognitive screening and mental health rehabilitation hold promise for improvement among older adults [8, 57, 58].

Similarly, Auditory processing disorder (APD) was not reported in all studies under review. Understandably, for the special school for children (Adeniyi et al.) since there were already deaf, whereas APD is particularly indicated in people with normal pure tone audiometry results and those with mild hearing loss [59]. Only two other studies utilized audiometry for hearing assessment, a hospital-based study and retirement home, but none reported any APD findings.

Limitations of the study

Included studies were published in English, potentially biasing results towards English-speaking countries. Some of the selected studies relied on self-reported measures for hearing outcomes, introducing measurement bias and potential confounding factors. Even with adjustments, residual confounding may still be unavoidable. Apart from the heterogeneity of measurements of hearing loss, we also acknowledge that not all types of hearing loss may have been represented across all the studies reviewed. Five studies did not conduct a regression analysis, making it difficult to summarize the relationship between the variables across the studies.

The review included data from few studies and countries, and many of the samples were recruited from very specific institutions (i.e. care homes, special schools), thus reducing the external validity of the findings across the African continent.

Finally, the low quality of the seven studies included in the review is a significant limitation (Table 2). Cross

sectional studies are particularly susceptible to biases and confounding factors, and they lack the ability to establish robust causal inferences due to issues with temporality.

Future directions

To provide more substantial evidence on whether hearing aids improve depressive symptoms among different age groups with hearing loss, and to explore the relationship between hearing loss, cognitive decline, and depression, robust longitudinal follow-up studies are needed in Africa. Additionally, longitudinal studies with pragmatic follow-up, cohort, or case–control studies are necessary to identify individuals with progressive or de novo hearing loss and to pool data for meta-analysis. Despite resource constraints, well-designed cross-sectional studies are also needed to evaluate this public health issue.

Conclusion

This systematic review aimed to summarize the evidence on the association between hearing loss, mental health conditions, and cognitive decline in Africa. It found some evidence linking mental health conditions and cognitive decline to hearing impairment throughout the life course. However, the retrieved studies were of low quality, which is a considerable limitation of the available evidence making it difficult to assess the strength of these associations. Despite these limitations, the findings underscore the importance of early detection, provision of care, and improved access to services, particularly for the aging population. As Africa's population grows and life expectancy increases, it is crucial to develop or revise geriatric policies to incorporate hearing health and mental health into managed care and universal health coverage frameworks.

Acknowledgements

Not applicable.

Authors' contributions

A.A. conceptualized the study and led the writing. A.A. & T.A.F. led the review search and extraction process and substantially contributed to writing the manuscript. A.A. and T.A.F. conducted the search and extraction. D.S. also substantially contributed to reviewing and writing the manuscript. A.J. A, B-M.N. & G.M. contributed substantially to the revision process and editing. All authors reviewed the manuscript.

Funding

Not applicable.

Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

¹Departments of Otolaryngology, Bayero University & Aminu Kano Teaching Hospital, Kano, Nigeria. ²Department of Community Medicine & Public Health, Bayero University & Aminu Kano Teaching Hospital, Kano, Nigeria. ³Department of Otolaryngology, Bayero University & Aminu Kano Teaching Hospital, Kano, Nigeria. ⁴Department of Psychiatry, Bayero University & Aminu Kano Teaching Hospital, Kano, Nigeria. ⁵Institute of Epidemiology and Health Care, University College London, London, UK.

Received: 13 August 2024 Accepted: 20 January 2025

Published online: 24 January 2025

References

- World Health Organization. Deafness and hearing loss Geneva: WHO; 2023 [Available from: <https://www.who.int/news-room/fact-sheets/detail/deafness-and-hearing-loss>].
- Mulwafu W, Kuper H, Ensink RJ. Prevalence and causes of hearing impairment in Africa. *Tropical Med Int Health*. 2016;21(2):158–65.
- Hogan A, Shipley M, Strazdins L, Purcell A, Baker E. Communication and behavioural disorders among children with hearing loss increases risk of mental health disorders. *Aust N Z J Public Health*. 2011;35(4):377–83.
- Fiorillo CE, Rashidi V, Westgate PM, et al. Assessment of behavioral problems in children with hearing loss. *Otol Neurotol*. 2017;38:1456–62.
- Huber M, Kipman U. The mental health of deaf adolescents with cochlear implants compared to their hearing peers. *Int J Audiol*. 2011;50:146–54.
- Theunissen SCPM, Rieffe C, Kouwenberg M, et al. Behavioral problems in school-aged hearing-impaired children: the influence of sociodemographic, linguistic, and medical factors. *Eur Child Adolesc Psychiatry*. 2014;23:187–96.
- Cetin B, Uguz F, Erdem M, Yildirim A. Relationship between quality of life, anxiety and depression in unilateral hearing loss. *J Int Adv Otol*. 2010;6:252–7.
- Cosh S, Helmer C, Delcourt C, Robins TG, Tully PJ. Depression in elderly patients with hearing loss: current perspectives. *Clin Interv Aging*. 2019;14:1471–80.
- Cosh S, Carriere I, Daien V, Amieva H, Tzourio C, Delcourt C, et al. The relationship between hearing loss in older adults and depression over 12 years: Findings from the Three-City prospective cohort study. *Int J Geriatr Psychiatry*. 2018;33(12):1654–61.
- Nielsen J, Obel C, Homøe P, Kørvel-Hanquist A, Dammeyer J. Associations between otitis media and child behavioural and learning difficulties: Results from a Danish cohort. *Int J Pediatr Otorhinolaryngol*. 2016;84:12–20.
- Böttcher L, Dammeyer J. Disability as a risk factor? Development of psychopathology in children with disabilities. *Res Dev Disabil*. 2013;34(10):3607–17.
- Li CM, Zhang X, Hoffman HJ, Cotch MF, Themann CL, Wilson MR. Hearing impairment associated with depression in US adults, National Health and Nutrition Examination Survey 2005–2010. *JAMA Otolaryngol Head Neck Surg*. 2014;140(4):293–302.
- Waterworth CJ, Marella M, O'Donovan J, Bright T, Dowell R, Bhutta MF. Barriers to access to ear and hearing care services in low- and middle- income countries: A scoping review. *Glob Public Health*. 2022;17(12):3869–93.
- O'Donovan J, Namanda AS, Hamala R, Winters N, Bhutta MF. Exploring perceptions, barriers, and enablers for delivery of primary ear and hearing care by community health workers: a photovoice study in Mukono District, Uganda. *International Journal for Equity in Health*. 2020;19(1):62.
- Saade S, Lamarche AP, Khalaf T, Makke S, Legg A. What barriers could impede access to mental health services for children and adolescents in Africa? A scoping review. *BMC Health Serv Res*. 2023;23(1):348.
- Aguwa C, Carrasco T, Odongo N, Riblet N. Barriers to Treatment as a Hindrance to Health and Wellbeing of Individuals with Mental Illnesses in Africa: a Systematic Review. *Int J Ment Health Addict*. 2022:1–17.
- Shankar A, Hamer M, McMunn A, Steptoe A. Social isolation and loneliness: relationships with cognitive function during 4 years of

- follow-up in the English Longitudinal Study of Ageing. *Psychosom Med*. 2013;75(2):161–70.
18. Stevenson JS, Clifton L, Kuźma E, Littlejohns TJ. Speech-in-noise hearing impairment is associated with an increased risk of incident dementia in 82,039 UK Biobank participants. *Alzheimers Dement*. 2022;18(3):445–56.
 19. Lin FR, Yaffe K, Xia J, Xue QL, Harris TB, Purchase-Helzner E, et al. Hearing loss and cognitive decline in older adults. *JAMA Intern Med*. 2013;173(4):293–9.
 20. Davies HR, Cadar D, Herbert A, Orrell M, Steptoe A. Hearing Impairment and Incident Dementia: Findings from the English Longitudinal Study of Ageing. *J Am Geriatr Soc*. 2017;65(9):2074–81.
 21. Shin H-Y, Hwang H-J. Mental Health of the People with Hearing Impairment in Korea: A Population-Based Cross-Sectional Study. *Korean J Fam Med*. 2017;38(2):57–63.
 22. Loughrey DG, Kelly ME, Kelley GA, Brennan S, Lawlor BA. Association of Age-Related Hearing Loss With Cognitive Function, Cognitive Impairment, and Dementia: A Systematic Review and Meta-analysis. *JAMA Otolaryngol Head Neck Surg*. 2018;144(2):115–26.
 23. Henderson D, Bielefeld EC, Harris KC, Hu BH. The role of oxidative stress in noise-induced hearing loss. *Ear Hear*. 2006;27(1):1–19.
 24. Fetoni AR, Paciello F, Rolesi R, Paludetti G, Troiani D. Targeting dysregulation of redox homeostasis in noise-induced hearing loss: Oxidative stress and ROS signaling. *Free Radic Biol Med*. 2019;135:46–59.
 25. Niedzielska E, Smaga I, Gawlik M, Moniczewski A, Stankowicz P, Pera J, et al. Oxidative Stress in Neurodegenerative Diseases. *Mol Neurobiol*. 2016;53(6):4094–125.
 26. Qian ZJ, Wattamwar K, Caruana FF, Otter J, Leskowitz MJ, Siedlecki B, et al. Hearing Aid Use is Associated with Better Mini-Mental State Exam Performance. *Am J Geriatr Psychiatry*. 2016;24(9):694–702.
 27. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *Syst Rev*. 2021;10(1):89.
 28. Mourad O, Hossam H, Zbys F, Ahmed E. Rayyan — a web and mobile app for systematic reviews. *Syst Rev*. 2016;5:210.
 29. Guyatt G, Oxman AD, Akl EA, Kunz R, Vist G, Brozek J, et al. GRADE guidelines: 1. Introduction—GRADE evidence profiles and summary of findings tables. *Journal of Clinical Epidemiology*. 2011;64(4):383–94.
 30. Mosaku K, Akinpelu V, Ogunniyi G. Psychopathology among a sample of hearing impaired adolescents. *Asian J Psychiatr*. 2015;18:53–6.
 31. Gomaa MA, Elmagd MH, Elbadry MM, Kader RM. Depression, Anxiety and Stress Scale in patients with tinnitus and hearing loss. *Eur Arch Otorhinolaryngol*. 2014;271(8):2177–84.
 32. Wallace S, Mactaggart I, Banks LM, Polack S, Kuper H. Association of anxiety and depression with physical and sensory functional difficulties in adults in five population-based surveys in low and middle-income countries. *PLoS ONE*. 2020;15(6 June) (no pagination).
 33. Adeniyi Y, Omigbodun O, Adeosun A. Comparative Study of Prevalence and Correlates of Mental Health Problems in Deaf and Hearing Adolescents in a Semi-Inclusive Setting in Ibadan, Southwest Nigeria. *American Journal of Psychiatry and Neuroscience*. 2019;7(1):1.
 34. Dotchin CL, Paddick SM, Gray WK, Kisoli A, Orega G, Longdon AR, et al. The association between disability and cognitive impairment in an elderly Tanzanian population. *Trends in Anaesthesia and Critical Care*. 2015;5(1):57–64.
 35. Obilade TT. A comparative study of the cognitive function of the hearing-impaired and non-hearing impaired in two primary schools in Lagos State. *Nigeria International Archives of Medicine*. 2015;8:1–18.
 36. Wallace S, Mactaggart I, Banks LM, Polack S, Kuper H. Association of anxiety and depression with physical and sensory functional difficulties in adults in five population-based surveys in low and middle-income countries. *PLoS ONE*. 2020;15.
 37. Byckova J, Mikstiene V, Kiveryte S, Mickeviciene V, Gromova M, Cernyte G, et al. Etiological profile of hearing loss amongst Lithuanian pediatric cochlear implant users. *Int J Pediatr Otorhinolaryngol*. 2020;134: 110043.
 38. Friis IJ, Aaberg K, Edholm B. Causes of hearing loss and implantation age in a cohort of Danish pediatric cochlear implant recipients. *Int J Pediatr Otorhinolaryngol*. 2023;171: 111640.
 39. van Gent T, Goedhart AW, Hindley PA, Treffers PD. Prevalence and correlates of psychopathology in a sample of deaf adolescents. *J Child Psychol Psychiatry*. 2007;48(9):950–8.
 40. Kvam MH, Loeb M, Tambs K. Mental health in deaf adults: symptoms of anxiety and depression among hearing and deaf individuals. *J Deaf Stud Deaf Educ*. 2007;12(1):1–7.
 41. Fellingner J, Holzinger D, Beitel C, Laucht M, Goldberg DP. The impact of language skills on mental health in teenagers with hearing impairments. *Acta Psychiatr Scand*. 2009;120(2):153–9.
 42. Amini D, Afroz GA, Sharifi Daramadi P, Homan HA. Recognition of Disorders and Emotional Problems of Deaf Children Using House-Tree-Person and Draw-A-Person Tests in Comparison with Normal Children of Hamadan Province. *Avicenna Journal of Clinical Medicine*. 2013;20(1):49–58.
 43. Adeniyi YC, Adeniyi AF. Development of a community-based, one-stop service centre for children with developmental disorders: changing the narrative of developmental disorders in sub-Saharan Africa. *Pan Afr Med J*. 2020;36:164.
 44. Lawrence BJ, Alexander E, Jayakody DMP. Hearing Loss and Depression in Older Adults: A Small Association. *Am J Med*. 2021;134(1):e76–7.
 45. Contrera KJ, Betz J, Deal J, Choi JS, Ayonayon HN, Harris T, et al. Association of Hearing Impairment and Anxiety in Older Adults. *J Aging Health*. 2017;29(1):172–84.
 46. Brewster KK, Ciarleglio A, Brown PJ, Chen C, Kim HO, Roose SP, et al. Age-Related Hearing Loss and Its Association with Depression in Later Life. *Am J Geriatr Psychiatry*. 2018;26(7):788–96.
 47. West JS. Hearing impairment, social support, and depressive symptoms among U.S. adults: A test of the stress process paradigm. *Social Science & Medicine* (1982). 2017;192:94–101.
 48. Scinicariello F, Przybyla J, Carroll Y, Eichwald J, Decker J, Breyse PN. Age and sex differences in hearing loss association with depressive symptoms: analyses of NHANES 2011–2012. *Psychol Med*. 2019;49(6):962–8.
 49. Rutherford BR, Brewster K, Golub JS, Kim AH, Roose SP. Sensation and Psychiatry: Linking Age-Related Hearing Loss to Late-Life Depression and Cognitive Decline. *Am J Psychiatry*. 2018;175(3):215–24.
 50. Tsimpida D, Kontopantelis E, Ashcroft D, Panagioti M. Comparison of Self-reported Measures of Hearing With an Objective Audiometric Measure in Adults in the English Longitudinal Study of Ageing. *JAMA Netw Open*. 2020;3(8): e2015009.
 51. Zelaya CE, Lucas JW, Hoffman HJ. Self-reported Hearing Trouble in Adults Aged 18 and Over: United States, 2014. *NCHS Data Brief*. 2015;214:1–8.
 52. Powell DS, Brenowitz WD, Yaffe K, Armstrong NM, Reed NS, Lin FR, et al. Examining the Combined Estimated Effects of Hearing Loss and Depressive Symptoms on Risk of Cognitive Decline and Incident Dementia. *J Gerontol B Psychol Sci Soc Sci*. 2022;77(5):839–49.
 53. Yamada Y, Denking MD, Onder G, Henrard JC, van der Roest HG, Finne-Soveri H, et al. Dual Sensory Impairment and Cognitive Decline: The Results From the Shelter Study. *J Gerontol A Biol Sci Med Sci*. 2016;71(1):117–23.
 54. Kim AS, Garcia Morales EE, Amjad H, Cotter VT, Lin FR, Lyketsos CG, et al. Association of Hearing Loss With Neuropsychiatric Symptoms in Older Adults With Cognitive Impairment. *Am J Geriatr Psychiatry*. 2021;29(6):544–53.
 55. Okely JA, Akeroyd MA, Deary IJ. Associations Between Hearing and Cognitive Abilities From Childhood to Middle Age: The National Child Development Study 1958. *Trends in Hearing*. 2021;25:23312165211053708.
 56. Govender SM, De Jongh M. Identifying hearing impairment and the associated impact on the quality of life among the elderly residing in retirement homes in Pretoria, South Africa. *South African Journal of Communication Disorders - die Suid-Afrikaanse Tydskrif vir Kommunikasieafwykings*. 2021;68(1):e1–9.
 57. Gaeta L, Azzarello J, Baldwin J, Ciro C, Hudson MA, Johnson CE, et al. The Impact of Amplification on Cognitive Screening Test Scores. *J Gerontol Nurs*. 2022;48(7):31–7.
 58. Jafari Z, Kolb BE, Mohajerani MH. Age-related hearing loss and tinnitus, dementia risk, and auditory amplification outcomes. *Ageing Res Rev*. 2019;56: 100963.
 59. Chermak GD, Bamio D-E, Iliadou V, Musiek FE. Practical guidelines to minimize language and cognitive confounds in the diagnosis of CAPD: a brief tutorial. *Int J Audiol*. 2017;56(7):499–506.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.