

# Depression in elderly patients with hearing loss: current perspectives

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**Abstract:** Hearing loss (HL) is highly common in older adulthood, constituting the third most prevalent chronic health condition in this population. In addition to posing a substantial burden to disease and negatively impacting quality of life, an emerging literature highlights that HL is associated with unipolar depression including among older adults. This review outlines evidence examining the HL and depression relationship as well as clinical implications for assessment and treatment of comorbid depression and HL. Although prevalence estimates of comorbid depression in HL vary, as many as 1 in 5 experience clinically relevant depression symptoms. Both cross-sectional and longitudinal studies indicate that HL is related to increased unipolar depression symptoms, although the strength of the association varies between studies. A range of methodological variations, such as inclusion age, severity of HL and assessment of depression, likely underpin this heterogeneity. Overall, however, the evidence clearly points to an association of HL with clinically relevant depression symptoms. The association with the diagnosis of major depression disorder remains less clear and under-researched. HL is also associated with a range of other poor mental health outcomes in older adults, including anxiety and suicidal ideation, and predicts poorer cognitive functioning. Accordingly, assessment and treatment of comorbid depression in HL is pertinent to promote mental well-being among older adults. Currently, evidence regarding best practice for treating depression in HL remains scant. Preliminary evidence indicates that audiological rehabilitation, including use of hearing aids, as well as community-based hearing interventions can also improve mental health. Psychological intervention that enhances communication skills and addresses coping strategies might also be beneficial for this population. Additionally, evidence suggests that online interventions are feasible and may circumvent communication difficulties in therapy associated with HL. Due to poor help-seeking among this population, an enhanced focus on specific and targeted assessment and treatment is likely necessary to ensure reduced mental health burden among older adults with HL.

**Keywords:** sensory loss, hearing impairment, mental wellbeing, treatment, intervention, aging

Hearing loss (HL) is common in older adulthood with as many as one-third of adults aged over 65 reporting HL.<sup>1</sup> Prevalence of HL continues to increase with age and constitutes the third most prevalent chronic health condition in older adulthood.<sup>2</sup> Age-related HL typically results from pathologic changes associated with aging, with loss of hair cells at the basilar membrane resulting in loss of high-frequency hearing.<sup>3</sup> HL in older adults results in increased disability,<sup>4</sup> risk of incident morbidity,<sup>5</sup> frailty and poorer self-rated health.<sup>6</sup> Consequently, HL among older adults poses a substantial burden to disease.<sup>7,8</sup> HL also confers poorer psychosocial outcomes, including lower levels of happiness and self-efficacy,<sup>9,10</sup>

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impaired relationship functioning and poorer emotional vitality<sup>9</sup> and is related to poor psychological well-being, including presence of comorbid unipolar depression. Consequently, HL in older adults significantly impinges upon quality of life.<sup>11,12</sup>

## HL and depression

Within the older adult population with HL, prevalence estimates of comorbid unipolar depression remain varied, but suggest that up to 1 in 5 older adults with HL report a clinically relevant level of depression symptoms that would necessitate treatment,<sup>13</sup> and a further 22% experience the onset of incident depression symptoms over time.<sup>14</sup> An emerging body of research further indicates that HL increases the risk of experiencing depression. In a recent meta-analysis of 35 studies (N=147,148), HL increased odds of depression including over time.<sup>15</sup> However, the certainty of evidence was deemed low, due to few studies adjusting for covariates. Furthermore, a high degree of heterogeneity regarding the strength of the association was observed and not all studies have corroborated the HL–depression association, suggesting that there may be further nuances to this relationship.

A cross-sectional association between HL and depression among older adults has been consistently observed.<sup>13,16</sup> Longitudinal studies remain less clear, however, with some mixed findings. HL was shown to be associated with an increased incidence of depression over 12 years, relative to matched controls, in a recent Taiwanese study.<sup>17</sup> Likewise, elevated depression symptoms have also been observed over time in those with HL.<sup>18,19</sup> Conversely, a Norwegian study highlighted a cross-sectional relationship, yet this was no longer significant at 6-year follow-up.<sup>20</sup> Similarly, several Dutch studies have failed to find evidence of a longitudinal relationship between HL and depression.<sup>21–23</sup>

Differences in study methodology may contribute to the variation in findings. For instance, a relationship between HL and depression was demonstrated in adults of all ages,<sup>24,25</sup> yet the strength of association reduces into older age.<sup>17</sup> Relatedly, a recent study of the oldest old showed no relationship between HL and depression.<sup>26</sup> In the extant literature, varied inclusion ages (ranging from 50 and up) were used and this variation likely influences the observed results.

## Hearing assessment in the literature

Further methodological variations likely to impact on findings include the assessment of HL, with some studies

indicating differential results depending on whether HL is self-reported or measured.<sup>16</sup> It should be noted that in Lawrence et al<sup>15</sup> meta-analysis, sensitivity analyses indicated no difference in depression outcome for self-reported or measured HL. However, while both self-report and measured HL might be associated with depression, patterns of association can vary depending on assessment method.<sup>25</sup> Mixed HL thresholds have also been used in the literature. While depression symptoms were observed both in mild and in severe self-reported HL,<sup>14</sup> several large-scale studies have indicated that severity of HL is associated with increased depression risk,<sup>27,28</sup> indicating a graded relationship between HL and depression. Accordingly, strengths of relationships and risk estimates of comorbid HL and depression can vary based on HL assessment methods.

## Depression assessment in the literature

Assessment of depression varies substantially between studies and different depression measures have been shown to yield different findings. For example, a higher prevalence of comorbid depression was observed when depression was assessed using the Centre for Epidemiology Studies Depression-10 Scale compared with the Mental Health Index.<sup>13</sup> Accordingly, mixed results may partly reflect variations in depression assessment.

Additional differences include analysis of depression either as a continuous variable representing symptom severity or as a categorical variable, dichotomizing depression into the presence or absence of clinically relevant symptoms. Analysis of depression as a continuous variable has yielded mixed longitudinal findings.<sup>18–21</sup> Conversely, studies that have categorized depression have reported that HL predicts increased odds of elevated depression symptoms over time.<sup>6,14</sup> These collective findings may indicate that HL predicts the presence of clinically significant depression symptoms, yet may less directly impinge on symptom severity.

Furthermore, the majority of current research has focused on exploring depression symptoms, with diagnosis of major depression disorder (MDD) less common. A recent study assessed both diagnosis of MDD and elevated depression symptomatology<sup>14</sup> and found that HL was associated with increased odds of elevated depression symptoms both at baseline and over 12 years, but not with MDD over follow-up. Although there is some evidence of an association of HL with MDD in adults of all ages,<sup>17,29</sup> in older adults, HL appears to be related to the

presence of depression symptoms that may not meet the full diagnosis for MDD. Presence of subthreshold depression may reflect patterns of mental health in aging more broadly, with subthreshold mental disorders common in older adults.<sup>30</sup>

A recent trend in depression research has shifted away from classifying depression as a single construct and, rather, uses an approach focusing on dimensions of depression symptoms.<sup>31</sup> Early dimensional research has indicated that HL is also related to interpersonal problems at baseline (S Cosh, personal communication, May, 2019). HL is also associated with somatic symptoms, and this pattern parallels the tendency for older adults to report somatic depression symptoms more so than cognitive-affective symptoms. Different depression measures differentially assess different symptom types, which may further explain heterogeneity in HL–depression findings.

## Conclusions regarding the HL–depression relationship

While there remain some variations to date, taken together, the extant literature clearly points to an association of HL in older adults with the presence of depression symptoms both cross-sectionally and over time, and this is observed with both measured and self-reported HL. However, differences in study methods portend varied prevalence rates and strengths of association between HL and depression. Ongoing research would valuably explore measured HL along with a diagnosis of MDD and subthreshold depression symptoms in order to paint a clearer picture of comorbid depression prevalence in older adults with HL.

## Adjustment to depression in older adults with HL

Despite the growing body of evidence examining HL and depression, longer-term adjustment has been less commonly explored. A number of studies have shown that depression symptoms remain elevated over time.<sup>6,18,19</sup> Yet, several studies have shown only cross-sectional relationships with depression, indicating that symptoms may subside over time.<sup>20,32</sup> Arguably, older adults with HL might be able to adapt and modify communication styles, thereby mitigating potential isolation and loneliness outcomes which might contribute to depression symptoms. In the study by Chou,<sup>32</sup> only half of the sample with sensory loss and depression continued to report persistent depression after 2 years. However, such studies have not assessed

depression treatment as a covariate for change in symptoms. Currently, it remains unclear if or when adjustment occurs for older adults with HL. Further assessment of symptom trajectories over the longer term is needed to gain a greater understanding about possible adjustment.

## Possible mechanisms of the HL–depression relationship

A range of possible mechanisms for depression in HL have been proposed, although ongoing research remains needed to paint a clearer picture and resolve equivocal findings. A reduction in activities of daily living observed in older adults with HL,<sup>33</sup> partly due to impairments in communication, is a suggested contributing factor for poorer mental health outcomes.<sup>32</sup> However, recent results showed that adjustment for functional ability did not attenuate HL–depression associations.<sup>6,14</sup> Further possibilities include the low levels of help-seeking commonly observed in the population with HL,<sup>34</sup> which might further contribute to or exacerbate depression symptoms. Additionally, engagement in mentally stimulating activities was shown to attenuate HL's association with depression,<sup>19</sup> suggesting that disengagement in activities post-HL may contribute to depression.

A well-researched mechanism pertains to communication difficulties, stemming from HL, which may pose challenges to social and relationship functioning.<sup>19,35</sup> Relationship difficulties have been observed in HL. For example, a recent study reported that adults who were deaf were notably more likely to have conflict in key relationships, compared with those without HL.<sup>36</sup> In support of this proposed mechanism, intervention studies to improve communication strategies have resulted in decreased anxiety and depression symptoms in adults with HL.<sup>37</sup>

Additional consequences of communication barriers, such as loneliness and social isolation, have further been suggested to contribute to depression onset, with lack of social support a known predictor of depression.<sup>38</sup> Loneliness and social isolation among older adults with HL have been well documented.<sup>23,39</sup> These may partly be due to difficulty following a conversation, leading to increased feelings of isolation.<sup>40</sup> Furthermore, with a lack of social support, it has been argued that HL can then develop into a chronic stressor, thereby leading to or exacerbating depression symptoms.<sup>41</sup> It has been observed that the association between HL and depression is attenuated when adjusted for social engagement.<sup>19</sup> However,

adjustment for social activities and number of friends did not attenuate the HL–depression relationship in another study,<sup>20</sup> although assessment of social isolation was limited. However, adjustment to communication limitations might mitigate isolation as a pathway to depression. Currently, the extent to which isolation and loneliness contribute to depression onset remains unclear, and this may be subject to notable variation between individuals.

Although less explored, biological explanations may further explain the comorbidity of depression and HL. Shared biological disease processes have been purported to explain comorbid depression and physical health conditions when somatic symptoms of depression are dominant.<sup>42</sup> Given the stronger association of HL to somatic symptoms (S Cosh, personal communication, May, 2019), a shared biological process may be a plausible explanation; however, dedicated research is needed to evidence this.

Recently, patterns of diminished prefrontal cortex activity have been observed in neuroimaging studies of older adults with HL and with depression, suggesting a possible shared neuropathological pathway.<sup>43</sup> Moreover, reduced activity in the limbic system – responsible for both emotion and behavior – has been observed in those with HL. In particular, diminished limbic and auditory activity has been observed in response to emotional and auditory stimuli.<sup>43</sup> These findings point to the possibility that neurological change or degeneration might explain both HL and depression. While these findings are highly promising, further evidence is needed to further understand the neuropathology of depression in HL.

## HL and suicide risk

HL may also increase suicide risk, although research remains in the nascent stages. As many as 10% of older adults with HL reported suicidal ideation in a French study, and this prevalence was higher in those with severe HL and those with comorbid vision and HL.<sup>44</sup> Increased risk for suicidal ideation continued to be observed over 5 years for both mild and severe HL. Notably, these results remained significant after adjustment for depression symptoms, indicating that suicide ideation may be experienced regardless of depression severity. The reasons for increased suicidality in this population are not currently clear, although an increased perception of the self as a burden<sup>45</sup> and loneliness<sup>46</sup> are associated with greater suicidal ideation in the elderly and may be particularly prominent in this population.<sup>47</sup> Whether HL increases suicide

risk or likelihood of attempts, however, remains unclear and this area requires further examination.

## Dual sensory loss (DSL)

The population of older adults with HL are vulnerable to even poorer mental health outcomes in the event of the onset of a secondary sensory loss. A number of longitudinal studies have suggested that those with DSL – vision loss and HL – experience a greater severity of their depression symptoms than observed in single sensory losses,<sup>20,35</sup> including in the oldest old.<sup>26</sup> As many as one in four adults over 70 have vision loss,<sup>48</sup> thus, a sizeable proportion of older adults are susceptible to dual losses and the resultant worsening in depression symptom severity. Given that depression severity impinges on the quality of life and treatment outcome,<sup>30</sup> DSL is a necessary consideration when assessing and treating older adults.

## HL and other mental health outcomes

While the majority of the literature has focused on depression, an increased prevalence of a range of psychiatric disorders is associated with HL.<sup>40</sup> Most notably, an emerging literature indicates that HL is also associated with anxiety cross-sectionally.<sup>20,49,50</sup> Given the high rates of comorbid depression and anxiety and that older adults with comorbid depression and anxiety typically have poorer outcomes,<sup>51</sup> comorbid psychiatric conditions are necessary to consider when working with this population. Additionally, increased anxiety, especially in relation to social settings and interactions, might result in the avoidance of feared social and interpersonal situations, which might worsen social isolation and potentiate poorer depression outcome.

Anxiety disorder–specific studies remain rare, although HL was not shown to be associated with diagnosis of Generalized Anxiety Disorder.<sup>50</sup> However, agoraphobia and social phobia are more prevalent among older adults with vision loss,<sup>52</sup> and similar patterns of association might be noted in HL due to communication barriers impinging on social functioning. Further anxiety disorder–specific research would allow for a clearer understanding of the mental health needs of older adults with HL.

It should also be noted that some evidence points toward a prospective association of anxiety with HL. Having a lifetime history of Generalized Anxiety Disorder predicted slightly greater odds of HL onset<sup>50</sup>

and higher rates of past anxiety were reported by adults with sensorineural HL compared with those with no HL.<sup>53</sup> Further evidence is needed to confirm this relationship and to better understand the possible underlying mechanisms. It also remains unclear whether HL onset increases risk of experiencing anxiety, especially in those without a history of anxiety, or whether the observed cross-sectional associations between HL and anxiety are a reflection of pre-existing anxiety that predated the HL onset.

There is also strong emerging evidence that HL is related to poor cognitive outcomes. HL is associated with impaired cognitive function, including poorer episodic memory,<sup>54</sup> accelerated cognitive decline<sup>55</sup> and also incident dementia.<sup>56,57</sup> The extent to which depression and HL may interact to increase the risk for dementia onset is not clear and has not yet been thoroughly examined. However, extant research indicates that comorbid depression and HL may heighten the risk of incident dementia. Such risk may be explained by shared neurobiological patterns, such as impairment of the central auditory function<sup>43</sup> or reduced speech perception resulting in reduced brain volume for auditory and cognitive processing.<sup>58</sup> Likewise, impairments in social communication from HL and social withdrawal as part of depression might further amplify the role of social isolation in dementia onset.

### Clinical implications: assessment

A renewed focus on assessment and identification of both HL and depression among healthcare professionals is needed. Primary care physicians may be best placed to identify both HL and depression in the first instance,<sup>59</sup> although health professionals would benefit from an increased understanding of HL, depression, and their interrelationship, in order to aid identification.<sup>40</sup> Currently, screening of asymptomatic older adults for HL is not part of routine geriatric assessment guidelines.<sup>60</sup> Yet, given the low levels of awareness of many older adults regarding their own HL,<sup>61</sup> older adults may be less likely to seek help for HL symptoms, thus increased screening for HL in the older adult population may promote better hearing health, which may in turn also enhance psychosocial well-being.<sup>62</sup> The role of HL in accelerating cognitive decline further underscores the need for early identification and screening of possible hearing deficits.

Further awareness of the potential impact of HL on psychosocial functioning among health professionals may facilitate identification of depression symptoms for further assessment and/or treatment. Despite expressing a desire for mental health treatment, a lack of referrals has been reported

by those with severe HL,<sup>63</sup> suggesting an increased need for assessment and referral in this population. To achieve this, further training for audiologists to understand and identify psychosocial difficulties associated with HL, as well as increased confidence in discussing mental health with patients, would be valuable.<sup>64</sup> Further, when referred for comprehensive mental health assessment, depression assessment should be sensitive to subthreshold depression symptoms, commonly observed in HL, given the continued distress levels and deleterious outcomes observed.<sup>65</sup> Additionally, many commonly used depression screening tools do not assess suicide risk. Given that HL confers increased odds for experiencing suicidal ideation,<sup>44</sup> consideration and assessment of suicide risk may also be beneficial. Upskilling of non-mental health professionals may be needed to facilitate observation of risk and appropriate referral.

### Clinical implications: intervention

To date, there is a minimal examination of best practice for the treatment of comorbid depression and HL, especially within the older adult population. A dual approach of managing HL in addition to psychotherapeutic interventions is likely the best approach.<sup>40</sup> However, ongoing research to guide clinical intervention in this area is needed.

### Treatment of HL

Audiological rehabilitation including use of hearing aids (which amplify weak sounds) are common treatments for HL. Auditory rehabilitation, training and use of hearing aids have shown to improve hearing, including the cortical and subcortical processing of speech, and associated cognitive function.<sup>66,67</sup> Relatedly, use of hearing aids and auditory rehabilitation has been reported to mitigate depression symptoms.<sup>68-70</sup> A recent study showed that a 6-month auditory training program and 3 months of hearing aid use conferred a moderate to large effect on depression symptom reduction.<sup>70</sup> Further, an intervention study documented improved depression and psychosocial well-being within 3 months of hearing aid use.<sup>71</sup> However, findings regarding hearing aids are mixed, and in a recent meta-analysis, hearing aid use showed no effect on depression outcome,<sup>15</sup> although the authors suggested caution in the interpretation of this finding. Indeed, much of the literature conflates hearing aid ownership with hearing aid use and this lack of distinction may contribute to equivocal findings. It has been widely observed that many owners do not actively use their aids.<sup>72</sup> Additionally, not all users manage their aids or use

appropriate and up-to-date corrections. This may, in part, be due to financial reasons,<sup>73</sup> reluctance to seek help from health care providers<sup>74</sup> and anxiety, which impairs HL management.<sup>75</sup> Certainly, studies that monitor hearing aid use tend to produce the most promising results for hearing aids in reducing associated depression.

Cochlear implants are another HL intervention that may have subsequent benefit for mental well-being, although evidence for this also remains mixed. While cochlear implants have been shown to increase health-related quality of life, reduction in anxiety and depression symptoms was not observed 12 months postsurgery.<sup>76</sup> Conversely, an observational study was indicative of improvement in depression symptoms over 12 months following cochlear implant,<sup>77</sup> with improvements in anxiety and quality of life in addition to depression also observed.<sup>69</sup> The longer-term benefit of cochlear implants requires ongoing assessment in older adults but may be a fruitful means of intervention.

## Community-based interventions

More recently, community-based interventions to promote hearing health have been piloted. These interventions typically aim to overcome the financial burden associated with hearing aids and other HL treatments. The HEARS study, a recent pilot of a community-based program, showed promising results for depression symptoms.<sup>78</sup> In further support of such interventions, a recently piloted community-based intervention of health education, socialization and group auditory rehabilitation showed improvements in social and emotional loneliness and hearing-related quality of life.<sup>79</sup> These types of interventions might assist in overcoming barriers to auditory rehabilitation, such as cost. Subsequent randomized controlled trials (RCTs) to ascertain efficacy and cost-effectiveness will be valuable for guiding future intervention and clinical practice.

## Psychotherapeutic interventions

Psychotherapeutic interventions for mood are also needed, including for subthreshold depression, and it has been argued that this is required early in HL rehabilitation.<sup>80</sup> Currently used psychotropic medications are not known to have ototoxic effects and thus do not appear to be contraindicated for comorbid depression.<sup>40</sup> However, there is a dearth of research that specifically examines interventions for older adults with comorbid HL and depression, especially psychological intervention.

Communication barriers observed in HL likely have substantial implications for the conduct and effectiveness of traditional psychological “talk therapies”. The extent to which communication barriers impinge upon treatment has not been empirically explored, yet may provide invaluable information to guide subsequent intervention. However, one study examining the use of cognitive behavioral therapy (CBT) in adults of all ages with HL in the workforce has shown some preliminary support for CBT. Although depression symptoms remained unchanged, reductions in anxiety and use of avoidant communication were observed.<sup>81</sup> Ongoing study, especially in an older adult population, to corroborate such findings is needed.

Moreover, addressing communication barriers and modifying communication strategies might prove a beneficial first stage of psychological intervention, with such training shown to reduce psychological distress in older adults with HL.<sup>37</sup> Online and web-based interventions that bypass or limit direct conversation might also be of value for depression treatment in HL. A recent pilot of an 8-week online Acceptance and Commitment Therapy intervention showed promising results,<sup>82</sup> finding evidence of feasibility for an internet-based delivery in this population and improvement in symptoms. Thus, this approach may be of promise although ongoing large-scale RCTs are needed to better guide clinical practice.

Within the vision loss literature, acceptance of the loss has been shown to facilitate adjustment.<sup>83</sup> Promoting acceptance in HL might likewise be a fruitful focus of clinical intervention. Moreover, enhancing instrumental and social coping is associated with reduced depression in the vision loss population,<sup>83</sup> while ruminative and catastrophizing coping are associated with elevated depression and anxiety symptomatology in adults with HL.<sup>84</sup> Thus, intervention targeting upskilling of adaptive coping strategies, especially in order to facilitate coping with and accepting the loss, may also be a valuable guide in clinical approaches to working with an HL population.

Furthermore, depression treatment efficacy can be improved by tailoring interventions specifically to the presenting depression symptom dimensions.<sup>85</sup> Accordingly, a targeted focus on somatic symptoms of depression might be particularly indicated for older adults with HL. This may be especially critical given that somatic symptoms have been reported to portend an increased risk of suicidal ideation<sup>86</sup> in a population already likely to be at elevated suicide risk.<sup>44</sup>

## Help-seeking and engagement with health care

Help-seeking among those with HL is typically low.<sup>34,87</sup> Consequently, direct and targeted intervention may be necessary to engage those with HL and depression in the requisite treatment and interventions. Motivational interviewing post-HL screen is being trialed in response to low uptake of audiological rehabilitation.<sup>87</sup> Such an approach might also yield beneficial outcomes for engaging older adults with comorbid depression into mental health treatment; however, this remains to be empirically tested.

## Summary and conclusion

HL increases the likelihood of experiencing clinically relevant depression symptoms in the older adult population both cross-sectionally and over time, although the impact on symptom severity and MDD is less clear. Heterogeneity in the strengths of association and prevalence rates of comorbid HL and depression have been reported to date, likely due to variations in study methodology, such as inclusion age and depression assessment. Moreover, specific subgroups, including those with severe HL, DSL and younger adults are more susceptible to poorer mental health outcomes over time. Possible shared aging and neuropathological pathways might explain the association between HL and depression, alongside psychosocial factors such as isolation and loneliness. However, mechanisms of the HL–depression relationship remain under-researched and increased understanding is needed.

Increased awareness of HL as well as its psychosocial implications among healthcare professionals may aid identification of HL and depression, thereby facilitating timely intervention. To date, limited evidence regarding intervention for this group exists. This is an important area requiring future examination and trials in order to guide practice. Audiological rehabilitation and corrective devices (e.g. hearing aid, cochlear implant), alongside novel treatments still being developed, may be beneficial for both hearing and depression, where adherence is strong. Community-based interventions show early promise, although ongoing examination is needed to establish effectiveness for both hearing and mental health. Given the communication barriers observed in HL, communication skills training or internet-based psychological therapies may be useful modes of intervention, although further evidence is needed. Ongoing dimensional research might also guide psychological intervention. How to best promote help-seeking or tailor interventions to increase uptake requires

ongoing consideration in order to facilitate appropriate support for this population. Given that HL poses a substantial risk to psychosocial health and well-being of older adults, assessment and focused intervention is needed in this population to improve quality of life and reduce mental health burden.

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