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Depressive and Anxiety Symptoms in Older Adults with Auditory, Vision, and Dual Sensory Impairment

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Abstract

Objectives: To examine the association of auditory, vision, and dual sensory impairment with late-life depressive and anxiety symptoms.

Methods: Our study included 7,507 older adults from the National Health and Aging Trends Study, a nationally representative sample of United States Medicare beneficiaries. Auditory and vision impairment were determined by self-report, and depressive and anxiety symptoms were evaluated by the PHQ-2 and GAD-2, respectively.

Results: Auditory, vision, and dual impairment were associated with an increased risk of depressive and anxiety symptoms in multivariable analyses accounting for sociodemographics, medical comorbidity, and functional impairment. Auditory, vision, and dual impairment were also associated with an increased risk for depressive and anxiety symptoms that persist or were of new onset after one year.

Discussion: Screening older adults with sensory impairments for depression and anxiety, and screening those with late-life depression and anxiety for sensory impairments, may identify treatment opportunities to optimize health and well-being.

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Keywords

Epidemiology; sensory impairment; vision impairment; hearing impairment; aging; national survey

OBJECTIVE

Hearing and vision impairment are common in later life. In Western older populations, hearing impairment is one of the most prevalent chronic conditions (Cruickshanks et al., 2010). In the United States, nearly 30 million adults aged 60 years and older have some degree of bilateral hearing impairment (Goman & Lin, 2016). The prevalence of hearing loss doubles with every decade of life and, by the age of 70, two thirds of older adults are hearing impaired (Lin, Niparko, & Ferrucci, 2011). Hearing impairment has been associated with increased loneliness (Sung, Li, Blake, Betz, & Lin, 2016), depression (Garnefski & Kraaij, 2012; Huang, Dong, Lu, Yue, & Liu, 2010; C.-M. Li et al., 2014; Monzani, Galeazzi, Genovese, Marrara, & Martini, 2008; Shin & Hwang, 2017), anxiety (Garnefski & Kraaij, 2012; Monzani et al., 2008), mental distress (Kobayashi, Tamiya, Moriyama, & Nishi, 2015; Sano, Okamoto, Ohhashi, Iwasaki, & Ogawa, 2013), increased suicide risk (Kim, Kwak, & Kim, 2015; Shin & Hwang, 2017), reduced quality of life (Dalton et al., 2003; Sano et al., 2013), physical disability (Chen, Genther, Betz, & Lin, 2014), incident dementia (Golub et al., 2017; F. R. Lin et al., 2011), increased mortality (Genther et al., 2015), and less engagement in relationships and social activities (Sano et al., 2013).

In the United States, an estimated 6.4 million people have uncorrectable vision impairment (National Academies of Sciences, 2016). Correctable (but uncorrected) vision loss affects an additional 8.2 to 15.9 million (National Academies of Sciences, 2016). Vision impairment increases dramatically with age: blindness is present in 0.10% of the United States population aged 18 to 39 years old and 2.41% of those aged 65 years and older (Wittenborn & Rein, 2013), with exponential increases to 7% of the population over 80 years of age. Vision impairment (excluding blindness) increases from 1.1% at ages 65–69 to 16.7% at age 80 years and older (Congdon et al., 2004). Older adults with vision loss experience higher rates of chronic health conditions (J. E. Crews, Jones, & Kim, 2006), disability (Wittenborn & Rein, 2013), falls (Ivers, Cumming, Mitchell, & Attebo, 1998), and nursing home admissions (Braunseis, Deutsch, Frese, & Sandholzer, 2012). Additionally, vision loss compromises older adults' quality of life by reducing their capacity to engage in "valued activities" (e.g., reading, driving, watching television, managing finances, interacting with others) (Berman & Brodaty, 2006; Heyl, Wahl, & Mollenkopf, 2005) and is associated with depression (Carrière et al., 2013; Eramudugolla, Wood, & Anstey, 2013), anxiety symptoms (Li et al., 2011), suicide (Kim et al., 2015; Lam, Christ, Lee, Zheng, & Arheart, 2008), and poor self-perceived health (Sei Harada et al., 2008). Older adults with age-related macular degeneration have a 33% prevalence rate for clinically significant depression symptoms (Rovner, Casten, & Tasman, 2002), which is nearly thrice the rate found with older adults more broadly (Steffens, Fisher, Langa, Potter, & Plassman, 2009). The prevalence of anxiety disorders is 7.5% amongst visually impaired older adults (compared to only 3.2% of those with normal vision) (van der Aa, Comijs, Penninx, van Rens, & van Nispen, 2015). Not all

studies, however, demonstrate higher anxiety levels among those with vision impairment (Dawson, Mallen, Gouldstone, Yarham, & Mansell, 2014).

Dual-sensory impairment (DSI) is defined as the concurrent loss of vision and hearing (Diehl, 1998). In a large United States epidemiologic study, approximately 1 in 5 adults aged 70 years and older had some degree of self-reported dual auditory and vision sensory impairments (Brennan, Su, & Horowitz, 2006). Because of the aging population, the number of older adults with DSI is expected to increase (Schneider et al., 2012; Schneider et al., 2011). The association of DSI with mental health symptoms has been examined infrequently, however. DSI is associated with poorer self-rated health (John E Crews & Campbell, 2004), worse health-related quality of life (Chia et al., 2007; Khil, Wellmann, & Berger, 2015), suicide risk (Kim et al., 2015), and less interaction with social networks (Gopinath et al., 2011). In one study, DSI was linked with a threefold increase in the likelihood of having depression as well as reduced functional capacity (Sei Harada et al., 2008). While DSI has been associated with depression (Capella-McDonnall, 2005; Guthrie, Thériault, & Davidson, 2016; Kim et al., 2015), its association with anxiety has been largely unexamined (Heine & Browning, 2014).

There are likely multiple ways that sensory impairment contributes to the development of depression and anxiety. For example, poor psychosocial health outcomes associated with sensory impairment may result from problems in effectively adapting and/or active coping with the sensory loss and its impacts on social life and daily life activities (Andersson, Melin, Lindberg, & Scott, 1996). In particular, impaired communication resulting from sensory impairment may limit participation in social activities, decrease satisfaction in fulfilling social roles, and increase difficulty in maintaining social networks (Broese van Groenou, Hoogendijk, & van Tilburg, 2013; Kramer, Kapteyn, Kuik, & Deeg, 2002). In turn, disability and less engagement in social activities and social networks may worsen psychological health (Vink, Aartsen, & Schoevers, 2008).

Research examining sensory impairment and its association with mental health frequently has one or more of the following limitations: does not include anxiety (C. M. Li et al., 2014), is not nationally representative (Contrera et al., 2016), include study designs without randomization or does not include a control group without sensory impairment (Rovner et al., 2002), and/or is based on cross-sectional data (van der Aa et al., 2015). Our study builds on prior work because it: 1) uses contemporary data of a nationally representative sample of older adults in the United States, 2) examines auditory impairment, vision impairment, and DSI, and 3) characterizes the association of visual impairment, auditory impairment, and DSI with depressive and anxiety symptoms cross-sectionally and at follow-up. We hypothesized that: 1) compared to older adults without impairment, those with auditory, vision, and DSI will have higher levels of clinically significant depressive and anxiety symptoms, and 2) the association of auditory and/or vision impairment with depressive and anxiety symptoms will persist even after accounting for sociodemographic variables, medical comorbidity, and functional impairment.

METHODS

Participants

The National Health and Aging Trends Study (NHATS) has been examining a nationally representative cohort of Medicare beneficiaries aged 65 years and older since 2011 (Kasper & Freedman, 2017). The NHATS in-person interview occurs annually and is administered in English and Spanish; large print cards are used to help older adults answer the interview questions ("National Health & Aging Trends Study," 2017). NHATS used a stratified three-stage sample design to follow a nationally representative cohort of people aged 65 years and older who were enrolled in Medicare. The study oversampled non-Hispanic black older adults to assure adequate representations of this subgroup, and older aged individuals to account for increased mortality rates (Montaquila, Freedman, Edwards, & Kasper, 2012). People younger than 65 years, who lived outside of the contiguous United States, or who had state or county codes that were invalid/unidentified (about 0.01% of records) were excluded For the baseline interview in 2011, NHATS had a response rate of 70.9% (unweighted); among the baseline interview participants, the one-year follow-up interview had a response rate of 86.1% (unweighted) (Kasper & Freedman, 2017). The Johns Hopkins Bloomberg School of Public Health Institutional Review Board approved NHATS. Our sample consists of the 7,507 NHATS participants who had information on auditory or vision impairment at the initial interview. Among these 7,507 participants, 547 proxy interviewees were questioned when the sampled NHATS older adults could not respond in person to the interview questions (e.g., due to a physical or cognitive impairment) (Kasper & Freedman, 2017).

Auditory and Vision Impairment

We determined the presence of auditory and visual impairment by selecting a survey question for each from among several choices available in the NHATS questionnaire; these questions were selected prior to conducting the analyses (we examined other auditory and visual impairment questions in sensitivity analyses). For auditory impairment, we selected an item that asked whether the participant (even if a hearing aid was used) was able to "hear well enough to carry on a conversation in a room with a radio or TV playing." For vision impairment, we selected an item that asked whether the participant (even if glasses or contacts were used) was able to "see well enough to read newspaper print" ("National Health & Aging Trends Study," 2017). We categorized participants into four groups based on these two items at baseline: 1) auditory impairment only, 2) vision impairment only, 3) dual sensory impairment (DSI), and 4) no auditory or visual impairment.

Depressive and Anxiety Symptoms

The two-item Patient Health Questionnaire (PHQ-2), a validated depression screening instrument that measures depressed mood and anhedonia in the prior two weeks (Kroenke, Spitzer, & Williams, 2003), evaluated depressive symptoms. It is scored from 0 to 6 with scores of 3 or higher indicating the presence of clinically significant depressive symptoms. The PHQ-2's sensitivity and specificity for major depressive disorder are 83% and 90%, respectively (Kroenke et al., 2003). The two-item Generalized Anxiety Disorder (GAD-2) scale, a validated anxiety screening instrument that measures anxiety in the prior two weeks

(Kroenke, Spitzer, Williams, Monahan, & Lowe, 2007), evaluated anxiety symptoms. Analogous to the PHQ-2, it is scored from 0 to 6 with scores of 3 or higher indicating the presence of clinically significant anxiety symptoms. Its sensitivity and specificity for detecting an anxiety disorder (including generalized anxiety, panic, social anxiety, and posttraumatic stress disorders) are 65% and 88%, respectively (Kroenke et al., 2007). NHATS slightly modified the PHQ-2 and GAD-2 to examine the prior month period to correspond with NHATS measures for functioning (Kasper & Freedman, 2017).

Covariates

In determining which covariates to include in our analyses, we selected variables that may be relevant to the etiology of sensory impairment (e.g., age, medical comorbidity) and consequences of sensory impairment (e.g., ADL impairment, isolation) that were associated with late-life depression or anxiety in previous studies (Schneider et al., 2011; Vink et al., 2008). The following variables were included: age (65–74, 75–84, and 85+), gender, marital status (married or living with partner, separated or divorced, or widowed or never married), race and ethnicity (White, non-Hispanic; Black, non-Hispanic; Hispanic; Other which includes American Indian, Asian, Native Hawaiian, Pacific Islander, and other), education (did not finish high school, high school degree or equivalent, some college or vocational training, college degree), number of close social contacts (0 to 5), number of medical conditions (grouped by quartile with higher quartiles indicating the presence of more medical comorbidity), activities of daily living impairments (ADLs; present or absent), and instrumental activities of daily living impairment (IADLs; present or absent). ADL impairment was determined by this stem question: “The next few questions are about your ability to do everyday activities without help. By help, I mean either the help of another person, including the people who live with you, or the help of special equipment. Do you have any problem with…” Items included eating, getting in or out of bed, getting in or out of chairs, walking around inside, going outside, dressing, bathing, and getting to the bathroom or using the toilet. IADL impairment was determined by this stem question: “Are you able to…” Items included meal preparation, laundry, light housework, grocery shopping, manage money, take medicine, and make telephone calls (“National Health & Aging Trends Study,” 2017). Number of close social contacts was determined by this question: “Looking back over the last year, who are the people you talked with most often about important things?” (Kasper & Freedman, 2017; “National Health & Aging Trends Study,” 2017).

Statistical Analyses

We used bivariate statistics and the Rao-Scott F adjusted chi-square statistic (a statistic that is recommended for use in complex survey data because it yields a more conservative interpretation than the Wald chi-square) (National Center for Health Statistics, 2014) to examine depressive and anxiety symptoms (at baseline and one-year follow-up), sociodemographics, medical comorbidity, and functional impairment differences across the four sensory impairment groups (auditory impairment, vision impairment, DSI, and no auditory or vison impairment). We also conducted a series of unadjusted and adjusted logistic regression analyses with the presence of clinically significant depressive or anxiety symptoms serving as the two dichotomous outcome variables. The primary independent variable was auditory and/or vision impairment groupings (no, auditory, vision, and dual

sensory impairment). Age group, gender, marital status, race and ethnicity, educational attainment, medical conditions, ADL impairment, and IADL impairment were included in the adjusted models. Covariates were included as dummy variables. Reference groups were no auditory or vision impairment, 65–74 years old, male gender, married or living with a partner, white non-Hispanic, college degree, 0–25 percentile for medical conditions, ADL impairment not present, and IADL impairment not present. We did not include the number of close social contacts in the adjusted analyses because this was not associated with auditory and/or vision impairment in the bivariate analyses and because 547 participants did not have this information (NHATS did not ask social network information of proxy respondents) (Kasper & Freedman, 2017). Per NHATS technical guidance (Kasper & Freedman, 2017), we applied the Round 1 analytic weights for our analyses and relied on SAS survey procedures (version 9.4, SAS Institute, Inc., Cary, NC) to calculate population-weighted adjusted estimates that account for sampling design and nonresponse. We applied the "not missing completely at random" (i.e., nomcar) option in SAS's survey procedures to account for the variability of participants with missing data.

RESULTS

Sample

In the baseline NHATS interview, 7,507 older adults had information on auditory and/or vision impairment, for which there were 547 proxy completed interviews (5.6% of total sample). The not mutually exclusive reasons for proxy interviews included dementia (N=269), illness (N=150), speech impairment (N=35), hearing impairment (N=69), language barrier (N=57), participant unavailability (N=18), and/or other reasons (N=46). Of the 7,507 older adults, 12.0%, 3.1%, and 1.3% reported auditory impairment, vision impairment, or DSI, respectively.

Characteristics by Auditory and/or Vision Impairment Grouping

Clinically significant depressive and anxiety symptoms were more common in those with auditory (21.1% depression and 22.0% anxiety, respectively), vision (28.4% and 23.0%), and DSI (46.2% and 36.7%) than in older adults with no auditory or vision impairment (12.6% and 10.3%). Older adults with auditory and/or vision impairment tended to be older, be widowed or never married, have less formal education, have higher levels of medical comorbidity, and have ADL and IADL impairment; Hispanic race and ethnicity was associated with visual impairment and DSI (Table 1). Proxy informants were more common for older adults with auditory and/or vision impairment. There were no differences, however, across impairment groupings in the number of close social contacts.

Logistic Regression Analyses

In the unadjusted logistic regression analyses, auditory impairment, vision impairment, and DSI were associated with an increased risk of having clinically significant depressive and anxiety symptoms in the last month (compared to those without impairment). The odds ratio was highest for the DSI grouping (OR=5.99 for depression and OR=5.07 for anxiety). Except for depression in those reporting vision impairment, the 95% confidence interval for the DSI grouping's odds ratio did not cross the 95% confidence intervals of the odds ratios

for the auditory or vision impairment groups (Table 2). The association of auditory impairment, vision impairment, and DSI remained significant, with increased odds of clinically significant depressive and anxiety symptoms in the logistic regression analyses that adjusted for age, gender, marital status, race and ethnicity, educational status, medical comorbidity, ADL impairments, and IADL impairments (Table 2).

Depression and Anxiety at Follow-up

Among older adults with clinically significant depressive or anxiety symptoms at baseline, those with auditory and/or vision impairment were more likely to have persistent depressive and anxiety symptoms at the one-year follow-up interview (e.g., among those with clinically significant depressive symptoms at baseline, depressive symptoms persisted for 32.5% in the no impairment group at one-year compared to 60.1% in the DSI group). Among those without clinically significant depressive or anxiety symptoms at baseline, older adults with auditory and/or vision impairment were more likely than those without impairment to have new onset depressive and anxiety symptoms at the one-year follow-up interview (e.g., among those without clinically significant depressive symptoms at baseline, depressive symptoms occurred for 8.3% in the no impairment group at one-year compared to 18.1% in the DSI group) (Table 3).

Sensitivity Analyses

We conducted sensitivity analyses for which the number of close social contacts was added to the adjusted logistic regression analyses and which excluded participants whose information was collected via a proxy informant. These adjusted logistic regression analyses were congruent with our prior findings. Sensory impairment was associated with clinically significant depressive symptoms: auditory impairment OR=1.43 (95% CI: 1.08–1.89), vision impairment OR=1.57 (95% CI: 1.04–2.37), and DSI OR=2.68 (95% CI: 1.45–4.96). Sensory impairment was also associated with clinically significant anxiety symptoms: auditory impairment OR=1.90 (95% CI: 1.47–2.49), vision impairment OR=1.50 (95% CI: 0.99–2.28), and DSI OR=2.40 (95% CI: 1.27–4.53). When excluding proxy informants and not including the number of close social contacts, the OR estimates for sensory impairment's association with clinically significant depressive and anxiety symptoms was largely unchanged from the analyses that included the number of close social contacts: 1) depressive symptoms: auditory impairment OR=1.43 (95% CI: 1.09–1.89), vision impairment OR=1.57 (95% CI: 1.04–2.38), and DSI OR=2.67 (95% CI: 1.45–4.91), and 2) anxiety symptoms: auditory impairment OR=1.91 (95% CI: 1.48–2.46), vision impairment OR=1.53 (95% CI: 1.00–2.32), and DSI OR=2.39 (95% CI: 1.28–4.49).

We also performed sensitivity analyses that examined whether a participant was able to "hear well enough to use the telephone" (even if the participant uses a hearing aid) or whether a participant was able to "see well enough to recognize someone across the street" (even if glasses or contacts were used) ("National Health & Aging Trends Study," 2017). Using these definitions to determine the presence of auditory or vision impairment yielded findings largely consistent with the prior analyses: 1) auditory impairment was associated with depressive and anxiety symptoms in the unadjusted logistic regression (OR=2.65, 95% CI: 1.98–3.57; OR=2.50, 95% CI: 1.80–3.47) and the adjusted logistic regression analyses

(OR=1.56, 95% CI: 1.09–2.25; OR=1.44, 95% CI: 0.96–2.14), and 2) vision impairment likewise was associated with depressive and anxiety symptoms in the unadjusted (OR=2.92, 95% CI: 2.38–3.57; OR=2.76, 95% CI: 2.17–3.51) and the adjusted logistic regression analyses (OR=1.46, 95% CI: 1.13–1.89; OR=1.32, 95% CI: 1.00–1.75).

DISCUSSION

Our analyses of the association of auditory, vision, and DSI with clinically significant depressive and anxiety symptoms in a nationally representative sample of Medicare beneficiaries aged 65 years and older yielded findings congruent with our hypotheses. Consistent with prior literature (Casten & Rovner, 2013; Casten, Rovner, & Tasman, 2004; Contrera et al., 2016; Heine & Browning, 2014; Jones, Rovner, Crews, & Danielson, 2009; C. M. Li et al., 2014; Rovner et al., 2002; van der Aa et al., 2015), older adults with auditory impairment, vision impairment, and DSI were approximately 1.7 to 3.7 and 2.1 to 3.6 times more likely to have clinically significant depressive and anxiety symptoms, respectively. Those with DSI had the highest prevalence of depressive and anxiety symptoms. Additionally, even after accounting for sociodemographics, medical comorbidity, and functional impairment, the association with sensory impairment and depressive and anxiety symptoms persisted.

Also consistent with prior studies (J. E. Crews et al., 2006; Goman & Lin, 2016; Wittenborn & Rein, 2013), in bivariate analyses auditory and/or vision impairment were associated with older age, increased medical comorbidity, and increased ADL and IADL impairment. As a person’s sensorium can have a critical role in daily functioning, the association of ADL and IADL impairment with sensory impairment was anticipated yet still striking in that only 12.9% and 18.9% of the older adults without auditory or vision impairment reported ADL and IADL limitations compared to 64.2% and 70.6% of the DSI group, respectively. On the other hand, that 35.8% and 29.4% of older adults with DSI had no ADL or IADL impairment respectively is encouraging and indirect evidence that late-life sensory impairment does not necessarily equate to functional impairment. In bivariate analyses, non-Hispanic Black and Hispanic demographic characteristics were associated with vision impairment; Hispanic ethnicity also was associated with DSI. Whereas African American race has been associated with vision impairment (National Academies of Sciences, 2016), Hispanic and non-Hispanic white demographic characteristics previously have been associated with auditory impairment (Goman & Lin, 2016).

We anticipated that older adults with auditory and/or vision impairment would report having fewer people they could talk with about important things (i.e., “close social contacts”) because sensory impairment can result in social isolation and disengagement in pleasurable activities (Berman & Brodaty, 2006; Casten & Rovner, 2013; Heyl et al., 2005). In our analyses, however, auditory and/or vision impairment were not associated with fewer close social contacts (across all sensory impairment groups, 1 and 2 close contacts were the most commonly reported). Speculatively, it is possible that sensory impairment may have more of an impact on casual acquaintances, which may be important to older adults’ well-being, as weak social ties are important for connection, access to information, and sense of self in the context of society (Granovetter, 1983).

Our study is consistent with others showing an association between sensory impairment and depression and anxiety (Casten & Rovner, 2013; Heine & Browning, 2014; C. M. Li et al., 2014; van der Aa et al., 2015). In our multivariable analyses that adjusted for sociodemographics, medical comorbidity, and functional impairment, auditory, vision, and dual sensory impairment were associated with an increased risk of late-life depression and anxiety (odds ratios for the presence of clinically significant depressive and anxiety symptoms ranged from 1.36 to 2.70 and 1.51 to 2.24, respectively). Of note, compared to the unadjusted regression models, the OR point estimates were considerably lower in the adjusted models (e.g., for anxiety symptoms the DSI group had an OR of 5.07 in the unadjusted and 2.24 in the adjusted models). This suggests that some of sensory impairment's association with depressive and anxiety symptoms may be attenuated or even mediated by sensory impairment's relationship to the other variables included in the model (e.g., sensory impairment is associated with increased medical comorbidity and functional impairment that in turn are associated with depression and anxiety). There was no hierarchy of risk evident based on the full regression models as the odds ratios' 95% confidence intervals overlapped. Older adults with sensory (especially vision) impairment are at increased risk of reduced functional activity (e.g., mobility, managing finances) (Brennan et al., 2006; S. Harada et al., 2008). Our regression models included ADL and IADL impairments, however, which suggests that auditory and/or visual impairments' association with depressive and anxiety symptoms is not limited solely to sensory impairment's effect on daily functioning.

We also examined whether the presence of auditory or vision impairment may affect the persistence and incidence of clinically significant depression and anxiety. For older adults with no sensory impairment, about 3 in 10 had depressive or anxiety symptoms persist at the one-year follow-up interview compared to 6 in 10 (for depression) and 4 in 10 (for anxiety) in older adults with DSI. Furthermore, older adults with DSI were 2–3 times more likely to develop clinically significant depressive (18.1%) or anxiety (19.1%) symptoms at follow-up than those without impairment (8.3% and 6.4%, respectively). Consideration of whether older adults have an intact sensorium could therefore provide meaningful information in guiding efforts to prevent and/or treat late-life depression and anxiety.

Understanding the causal pathways and mechanisms as well as the expression of anxiety, depression, and other mental health experiences of older adults with sensory impairment(s) helps us identify clinical targets and strategies for intervention. One such pathway we described previously is that sensory impairment can lead to less social engagement and increased disability, which in turn could contribute to late-life depression and anxiety. To promote mental wellbeing to help older adults cope with sensory impairment, treatment can focus on socially engaging and mentally stimulating activities, daily functioning, use of sensory aids, sense of control, social and environmental support, and changes in expectations (Kiely, Anstey, & Luszcz, 2013). Additionally, teaching effective problem-solving and future planning strategies has been used successfully with visually impaired older adults (Rovner et al., 2014; Sorensen et al., 2015) and could be adapted to the DSI population. It is important for medical professionals to conduct ongoing assessment and consultation for older adults with sensory impairment(s) around communication, emotional wellbeing, suicide risk, support for activities of daily living, social engagement (networks and activities),

community resources (e.g., vocational rehabilitation to support workplace accommodations), and assistive devices (e.g., hearing aids, specialized household safety alarm systems). If clinicians have the necessary supports in place for psychiatric diagnosis, treatment, and follow-up of patients, we recommend that clinicians screen older adults with sensory impairment for late-life depression and anxiety.

Our study has several strengths. First, our analyses include a large longitudinal dataset that consists of a nationally representative sample of Medicare beneficiaries aged 65 years and older in the United States. Second, the NHATS dataset contains information on sociodemographics, medical and functional status, and sensory impairment that are not typically present in large administrative databases. Third, our study examines the association of auditory, vision, and DSI with both depressive and anxiety symptoms. Fourth, our study characterized the association of baseline sensory impairment with the trajectory of depressive and anxiety symptoms at one-year follow-up. Taken together, these strengths facilitate an in-depth examination of the role that auditory and/or vision impairment play with regard to an older adult's mental health.

Our study has several limitations. First, depression and anxiety were assessed with brief screening questionnaires rather than with a gold standard diagnostic psychiatry interview such as the Structured Clinical Interview for DSM Disorders (First, Spitzer, Gibbon, & Williams, 2002), and the 12-month and lifetime prevalence of depression and anxiety were not examined. The PHQ-2 and GAD-2 also examine a one-month reference time period in the NHATS dataset, while they were initially validated to examine a two-week timeframe. Given that the one-month timeframe is a more rigorous standard, it is possible that these modified measures have a decreased sensitivity and increased specificity compared to the two-week timeframe. Second, our study relied heavily on self-report data in assessing auditory and vision impairment, which may have resulted in some misclassification bias. The effect of possible sensory impairment misclassification is uncertain (e.g., non-directional misclassification could bias findings toward the null whereas directional misclassification's effect can be variable) (Rothman, Greenland, & Lash, 2008). Third, auditory and vision impairment were categorized as binary variables rather than as ordinal or continuous measures, which would have allowed for a "dose-response" examination of their association with depressive and anxiety symptoms (we considered examining those who reported being "deaf" or "blind," but there were only 20 and 46 participants for whom "deaf" and "blind" were endorsed, respectively). Fourth, sensory impairment may change with time, and our analyses examined self-reported sensory impairment at baseline.

Conclusions

Utilizing NHATS, a nationally representative dataset of United States Medicare beneficiaries, we were able to examine the association of auditory, vision, and DSI with clinically significant late-life depression and anxiety symptoms. Our findings suggest that, even after accounting for sociodemographics, medical conditions, and functional impairment, sensory impairment remains associated with an increased risk of late-life depression and anxiety. Furthermore, older adults with sensory impairment may be at an increased risk for developing levels of clinically significant depressive or anxiety symptoms

and for having these symptoms persist over one year of follow-up. There is some evidence suggesting that correcting sensory deficits via hearing aids (Mener, Betz, Genther, Chen, & Lin, 2013) or corrective lenses (Owsley et al., 2007) may alleviate depressive symptoms in older adults. Our findings suggest that clinicians working with older adults should consider screening for auditory and vision sensory impairments with their older adult patients with depression and/or anxiety. Likewise, clinicians should consider depression and anxiety screening with their older adult patients with auditory and/or vision impairments. Finally, although our analyses did not show a relationship between the number of close social connections with sensory impairment, future research efforts could examine whether sensory impairment affects weak social ties.

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Table 1.

Baseline characteristics by auditory and vision impairment groupings.

Baseline Characteristics	Auditory and Vision Impairment Status												F Value	p value[a]
	No Impairment, N=6112			Auditory Impairment Only, N=961			Vision Impairment Only, N=309			Dual Sensory Impairment, N=125				
	N	%	SE	N	%	SE	N	%	SE	N	%	SE		
Depression Screen Positive, Yes [b]	840	12.6	0.6	211	21.1	1.7	82	28.4	3.0	52	46.2	5.9	47.0	<0.001
Anxiety Screen Positive, Yes [c]	671	10.3	0.4	217	22.0	1.5	63	23.0	2.6	42	36.7	3.7	76.2	<0.001
Age at Baseline, Years													47.3	<0.001
65–74	2638	56.5	0.7	239	37.6	1.8	76	35.4	2.6	21	27.6	5.6		
75–84	2435	32.9	0.5	381	38.1	2.0	122	37.1	2.8	37	30.7	4.6		
85+	1039	10.6	0.4	341	24.3	1.5	111	27.5	2.7	67	41.7	4.3		
Gender, Female	3602	57.4	0.8	500	49.8	1.8	197	62.5	3.1	81	60.3	4.2	7.8	<0.001
Marital Status [d]													8.4	<0.001
Married or Living with Partner	3145	58.3	0.8	459	54.3	1.8	115	42.4	3.1	45	41.5	4.6		
Separated or Divorced	786	12.6	0.4	82	9.9	1.2	34	12.7	2.4	10	12.5	3.6		
Widowed or Never Married	2175	29.1	0.8	420	35.8	1.7	159	44.8	3.4	68	46.1	4.5		
Race and Ethnicity [e]													12.2	<0.001
White, non-Hispanic	4154	81.9	0.9	739	84.2	1.5	150	66.2	3.0	75	64.6	6.1		
Black, non-Hispanic	1398	8.5	0.4	112	4.3	0.5	112	16.1	1.9	18	6.4	1.7		
Hispanic	326	6.2	0.5	64	7.3	1.0	31	12.8	2.8	25	25.1	5.9		
Other	171	3.4	0.5	32	4.2	0.8	14	4.9	1.5	5	3.9	2.0		
Education [f]													16.0	<0.001
Did Not Finish High School	1482	19.5	0.8	331	30.4	1.7	137	34.8	3.2	65	54.6	5.9		
High School Degree or Equivalent	1679	27.5	0.8	264	28.9	1.5	71	26.9	3.1	25	21.0	4.1		
Some College or Vocational Training	1239	22.0	0.6	165	19.1	1.8	52	19.1	2.7	19	12.8	3.7		
College Degree	1647	31.0	1.2	183	21.6	1.7	44	19.2	2.9	12	11.6	3.4		
Close Social Contacts [g]													0.8	0.651
0	419	6.5	0.5	58	6.4	1.2	30	11.5	2.0	3	3.1	1.7		
1	2372	40.7	1.1	347	41.5	1.9	98	40.9	4.5	35	44.1	6.2		

Baseline Characteristics	Auditory and Vision Impairment Status												F Value	p value[a]
	No Impairment, N=6112			Auditory Impairment Only, N=961			Vision Impairment Only, N=309			Dual Sensory Impairment, N=125				
	N	%	SE	N	%	SE	N	%	SE	N	%	SE		
2	1433	23.9	0.7	223	24.7	1.7	54	23.7	3.5	22	29.5	5.8		
3	802	14.2	0.6	118	14.3	1.0	30	11.1	2.5	11	12.4	4.7		
4	422	8.3	0.5	51	6.6	0.9	12	6.7	2.0	5	7.0	3.2		
5	349	6.5	0.5	50	6.5	0.8	14	6.1	2.0	2	3.9	3.1		
Medical Conditions [h]													13.2	<0.001
0–25 Percentile	1671	30.9	0.7	185	21.5	1.6	59	19.2	2.8	14	13.9	3.7		
25–50 Percentile	1557	25.5	0.7	213	22.7	1.5	56	18.2	2.3	25	20.3	3.9		
50–75 Percentile	1380	21.4	0.6	201	21.2	1.6	85	28.0	2.5	33	23.0	4.2		
75–100 Percentile	1449	22.2	0.6	343	34.7	2.0	108	34.6	2.9	52	42.7	5.0		
ADL Impairments, Yes [i]	991	12.9	0.4	303	26.6	1.6	151	43.6	3.7	83	64.2	5.7	112.8	<0.001
IADL Impairments, Yes [j]	1398	18.9	0.6	386	35.5	1.7	188	56.2	3.4	94	70.6	5.9	105.3	<0.001
Proxy Interview, Yes	315	4.1	0.3	114	9.2	1.0	71	19.8	2.5	47	33.1	5.5	73.8	<0.001

Notes: SE: standard error

[a] p values determined by Rao-Scott F adjusted chi-square statistic.

There are missing data with the number of participants per auditory and vision impairment grouping (no impairment, auditory impairment, vision impairment, and auditory and vision impairment, respectively) equaling:

[b] 6073, 952, 306, 117;

[c] 6083, 956, 307, 121;

[d] 6106, 961, 308, 123;

[e] 6049, 947, 307, 123;

[f] 6047, 943, 304, 121;

[g] 5797, 847, 238, 78;

[h] 6057, 942, 308, 124;

[i] 5996, 940, 305, 121;

$^{j}_{5988, 938, 305, 121.}$

Table 2.

Logistic regression analyses of the association of auditory and vision impairment with depression and anxiety.

	Depression			Anxiety		
	N	Odds Ratio	95% Confidence Interval [a]	N	Odds Ratio	95% Confidence Interval [a]
Unadjusted Analyses [b]	7448			7467		
Auditory Impairment Only		1.86	1.52–2.29		2.47	2.02–3.01
Vision Impairment Only		2.76	2.04–3.73		2.61	1.97–3.46
Dual Sensory Impairment		5.99	3.71–9.69		5.07	3.68–6.97
Adjusted Analyses [b, c]	7192			7213		
Auditory Impairment Only		1.36	1.07–1.74		1.86	1.47–2.35
Vision Impairment Only		1.52	1.04–2.21		1.51	1.04–2.20
Dual Sensory Impairment		2.70	1.72–4.25		2.24	1.46–3.42

[a] Intervals based on 95% Wald confidence limits.

[b] Comparison group is no auditory or vision impairment.

[c] Analyses adjusted for age, gender, marital status, race and ethnicity, educational status, medical conditions, ADL impairments, and IADL impairments.

Table 3.

Depression and anxiety symptoms at the one-year follow-up interview across auditory and vision impairment groupings.

	Auditory and Vision Baseline Impairment Status												F Value	p value[a]
	No Impairment			Auditory Impairment Only			Vision Impairment Only			Dual Sensory Impairment				
	N	%	SE	N	%	SE	N	%	SE	N	%	SE		
Depression Screen, Positive at Baseline													4.8	0.003
Persists at Follow-up	209	32.5	2.8	64	38.4	4.1	23	49.7	8.4	21	60.1	7.6		
Resolves at Follow-up	430	67.5	2.8	89	61.6	4.1	27	50.3	8.4	12	39.9	7.6		
Depression Screen, Negative at Baseline													9.1	<0.001
New Onset at Follow-up	401	8.3	0.6	83	12.1	1.6	33	19.9	3.7	8	18.1	6.7		
Negative at Follow-up	3819	91.7	0.6	494	87.9	1.6	130	80.1	3.7	37	81.9	6.7		
Anxiety Screen, Positive at Baseline													2.7	0.050
Persists at Follow-up	171	35.6	2.5	77	47.8	3.6	22	47.8	9.8	14	42.5	9.6		
Resolves at Follow-up	330	64.4	2.5	79	52.2	3.6	18	52.2	9.8	14	57.5	9.6		
Anxiety Screen, Negative at Baseline													8.5	<0.001
New Onset at Follow-up	322	6.4	0.4	73	11.5	1.5	19	10.8	2.9	12	19.1	6.6		
Negative at Follow-up	4060	93.6	0.4	506	88.5	1.5	153	89.2	2.9	38	80.9	6.6		

Notes: SE: standard error

[a] p values determined by Rao-Scott F adjusted chi-square statistic.