THE GERONTOLOGICAL SOCIETY OF AMERICA®

Journals of Gerontology: Social Sciences
cite as: *J Gerontol B Psychol Sci Soc Sci*, 2021, Vol. 76, No. 1, 195–200
doi:10.1093/geronb/gbz094
Advance Access publication 30 July, 2019

OXFORD

Research Report

Functional Hearing Loss and Social Engagement Among Medicare Beneficiaries

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Received: March 6, 2019; Editorial Decision Date: July 16, 2019

Decision Editor: Deborah Carr, PhD

Abstract

Objectives: Hearing loss is common in older adults and limits communication. We investigated the independent association between functional hearing loss and social engagement in a nationally representative sample of older adults.
Methods: Using data from the 2015 Medicare Current Beneficiaries Survey, we modeled the cross-sectional association between self-reported hearing ability and limitation in social activity over the past month using multivariable logistic regression.
Results: The majority of the study population was female (54.8%) and non-Hispanic white (74.3%). Participants (40.4%) reported "a little trouble" hearing and 7.4% reported "a lot of trouble" hearing. Those who reported any trouble hearing had higher odds of limited social engagement in the past month. After adjustment for demographic, clinical, and functional covariates, those who reported "a lot of trouble" hearing had 37% higher odds of limited social activity in the past month compared to those with normal hearing.
Discussion: These results suggest that hearing loss may be an important risk factor for limited social engagement and downstream negative health consequences, independent of other disability and health conditions.

Keywords: Epidemiology, Functional health status, Social networks

Hearing loss is highly prevalent among older adults and increases with age such that approximately 4 in 10 adults aged 60–69 years and 7 in 10 adults aged 70–79 years have hearing loss (Goman & Lin, 2016). A growing body of evidence has linked age-related hearing loss to adverse health outcomes including cognitive decline (Lin et al., 2013) and depression (Deal et al., 2018). Lack of social engagement has been suggested as a potential mechanism for these relationships (Rutherford, Brewster, Golub, Kim, & Roose, 2017).

Lack of social engagement is characterized by limited participation in social activities and infrequent social interactions (Cornwell & Waite, 2009). Limited social engagement in older adults is associated with increased risk of mortality (Gopinath, Rochtchina, Anstey, & Mitchell, 2013), cognitive decline (Bassuk, Glass, & Berkman, 1999), and dementia (Wang, Karp, Winblad, & Fratiglioni, 2002).

Limitations in communication due to hearing loss can lead to embarrassment and avoidance of social situations (Heine & Browning, 2004) and may lead to decreased social

engagement. However, there is limited research examining the association between hearing loss and social engagement and the existing studies have had contradictory findings. Although some studies have found that hearing loss is associated with decreased social participation (Crews & Campbell, 2004), others have found no relationship between hearing loss and social participation (Yamada, Nishiwaki, Michikawa & Takebayashi, 2012) or have only found a relationship in women but not in men (Mick, Kawachi, & Lin, 2014). The aim of this study was to test the hypothesis that older adults with functional hearing loss would be less socially engaged, independent of demographics and functional status, in a nationally representative sample of Medicare beneficiaries.

Method

Study Cohort

We used cross-sectional data from the 2015 Medicare Current Beneficiaries Survey (MCBS), a nationally representative survey of older adults. The MCBS includes information on demographics, health status, and health care utilization and is described in detail elsewhere (Adler, 1994). Respondents or a proxy are interviewed using computer-assisted personal interviewing. In the 2015 cycle, 12,311 community-dwelling Medicare beneficiaries completed the interview. Among those interviewed, 1,009 responded by proxy and were included in this analysis. Data are publicly available and de-identified; thus, institutional review board approval was not required.

Limited Social Activities

The primary outcome was engagement in social activities over the past month. Participants were asked, "How much of the time during the past month has your health limited your social activities, like visiting with friends or close relatives?" with responses of "none of the time," "some of the time," "most of the time," or "all of the time." This variable was categorized as no limitations ("none of the time") and some or more limitation ("some of the time," "most of the time," and "all of the time") for analysis. Binary categorization was completed to improve spread and interpretation of data.

Functional Hearing Loss

Medicare beneficiaries with hearing loss were identified from self-report questions. Participants were asked, "Do you use a hearing aid?" "Yes" or "No." Following this, they were asked, "Which statement best describes your hearing [with a hearing aid]?"—"No trouble," "A little trouble," and "A lot of trouble." Self-perceived hearing status (with a hearing aid, if applicable) was our primary exposure of interest.

Covariates

Demographic characteristics included sex, race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, or other), age (categorized as <65, 65 to 74, 75 and older in MCBS), education (less than high school, high school or vocational, more than high school), annual household income (<$25,000 or ≥$25,000), and marital status (married or not currently married [divorced, widow, never]).

Self-report general health status compared to others the same age was categorized as excellent, very good, good, fair, or poor. Self-report functional limitation with instrumental activities of daily living (IADLs) and activities of daily living (ADLs) was categorized as no functional limitation, limitations in IADLs only, 1–2 ADLs, 3–4 ADLs, or limitations in 5–6 ADLs. History of depression and dementia were included as participant self-report of ever being told by a doctor that they had depression and ever being told that they had dementia or Alzheimer's.

Statistical Methods

Descriptive statistics were used to describe characteristics of the study population by hearing status. Multivariable logistic regression models were used to investigate the association of functional hearing status and any limitation in social activities over the past month. Subjects with missing data (298/12,311) were excluded from analyses. Sensitivity analysis using ordinal logistic regression (with proportional odds and partial proportional odds assumptions) and ordinary least squares linear regression was performed. Survey weights supplied by Centers for Medicare and Medicaid Services were applied to adjust for oversampling by race, older age, and disability status. All analyses were performed using Stata 15 (StataCorp, College Station, TX).

Results

The demographics and clinical characteristics of the study participants are presented in Table 1. The majority of participants were female (54.8%) and non-Hispanic white (74.3%). Participants (40.4%) reported little trouble hearing and 7.4% reported a lot of trouble hearing.

In unadjusted analysis, both "little trouble" and "a lot of trouble" hearing were associated with higher odds of limited social engagement (odds ratio [OR] = 1.33, 95% confidence interval [CI]: 1.18–1.50; OR = 2.60, 95% CI: 2.18–3.09, respectively). In fully adjusted analysis, "little trouble" hearing status was not significantly associated with limited social engagement (OR = 1.16, 95% CI: 0.99–1.35) whereas "a lot of trouble" hearing status remained significantly associated with limited social engagement (OR = 1.37, 95% CI: 1.09–1.73) (Table 2). Adding hearing aid use as a covariate to our model did not change effect estimates ("Little trouble hearing" OR = 1.16, 95% CI: 0.99–1.35; "A lot of trouble hearing" OR = 1.37, 95% CI: 1.08–1.73).

Because participants were asked how often their health limited their social activities, those who report no limitations may composed of those without any health problems and those with health problems that do not limit their social

Table 1. Baseline Characteristics of the Study Population

		Functional hearing status		
Variable	Total	No trouble hearing	Little trouble hearing	A lot of trouble hearing
Unweighted Sample (*N*)	12,013	6,263 (52.1%)	4,857 (40.4%)	893 (7.4%)
Weighted sample	51,224,762	27,623,082	20,260,894	3,340,786
Age				
64 and younger	16.14%	17.57%	14.29%	15.61%
65–74	49.60%	52.89%	47.22%	36.77%
75 and older	34.26%	29.55%	38.49%	47.62%
Female	54.76%	59.36%	50.16%	44.64%
Race/ethnicity				
Non-Hispanic white	74.28%	70.15%	79.19%	78.60%
Non-Hispanic black	9.58%	11.55%	7.65%	5.04%
Hispanic	9.27%	11.04%	7.17%	7.42%
Other	6.87%	7.26%	5.99%	8.94%
Education				
Less than high school	17.06%	17.26%	15.32%	25.92%
High school or vocational	35.45%	34.30%	36.56%	38.14%
More than high school	47.50%	48.44%	48.11%	35.94%
Income				
<$25,000	39.95%	41.41%	36.70%	47.65%
≥$25,000	60.05%	58.59%	63.30%	52.35%
Marital status				
Married	46.22%	47.53%	43.63%	51.15%
Widowed, divorced, never married	53.78%	52.47%	56.37%	48.85%
General health				
Excellent	16.96%	20.32%	13.88%	7.82%
Very good	28.51%	29.33%	28.55%	21.49%
Good	29.62%	28.50%	31.00%	30.54%
Fair	17.62%	15.98%	18.46%	26.09%
Poor	7.29%	5.86%	8.11%	14.07%
Functional limitations				
No functional limitations	53.27%	58.65%	50.32%	26.69%
IADLs only	11.85%	11.28%	11.93%	16.08%
1–2 ADLs	23.60%	21.37%	25.05%	33.24%
3–4 ADLs	7.76%	6.08%	8.64%	16.26%
5–6 ADLs	3.53%	2.62%	4.06%	7.74%
History of depression	28.89%	26.47%	30.95%	36.48%
History of dementia	4.11%	3.57%	4.03%	9.09%
Limited social engagement	30.18%	26.41%	32.39%	48.16%

Note: IADLs = instrumental activities of daily living; ADLs = activities of daily living.

activities. To address this, we conducted a sensitivity analysis excluding all participants who reported excellent health and found similar effect estimates for limited social activities (little trouble hearing OR = 1.15, 95% CI: 0.98–1.36; a lot of trouble hearing OR = 1.36, 95% CI: 1.07–1.73).

Given previous findings that the association between hearing loss and social engagement differed by gender (Micket al., 2014), we stratified by gender and found similar associations in men and women (Supplementary Table 1).

Sensitivity analysis using ordinal logistic regression revealed similar results. Compared to Medicare beneficiaries without hearing trouble, those who reported "little trouble" hearing had similar odds (OR = 1.07, 95% CI: 0.96–1.22) whereas those who reported "a lot of trouble" hearing had significantly higher odds (OR = 1.30, 95% CI: 1.04–1.63) of limited social engagement over the past month (Supplementary Table 2). Because the proportional odds assumption of ordinal logistic regression is often violated, we also performed generalized ordinal logistic regression with partial proportional odds assumption (Supplementary Table 3) and ordinary least squares regression (Supplementary Table 4) and found consistent results.

Discussion

In this nationally representative study of Medicare beneficiaries, functional hearing status is independently associated with limited social engagement in those with "a lot

Table 2. Odds of Limited Social Engagement by Self-reported Hearing Status

Variable	Adjusted[a] odds ratio (95% confidence interval)	*p* Value
Hearing status		
No trouble hearing	Ref	
Little trouble hearing	1.16 (0.99–1.35)	.070
A lot of trouble hearing	1.37 (1.09–1.73)	.009
Age (years)		
64 and younger	Ref	
65–74	0.43 (0.36–0.51)	<.001
75 and older	0.56 (0.47–0.67)	<.001
Sex		
Male	Ref	
Female	1.27 (1.10–1.46)	.001
Race/ethnicity		
Non-Hispanic white	Ref	
Non-Hispanic black	1.62 (1.33–1.96)	<.001
Hispanic	1.02 (0.83–1.25)	.843
Other	1.56 (1.17–2.08)	.003
Education		
Less than high school	Ref	
High school or vocational	1.06 (0.89–1.26)	.509
More than high school	0.96 (0.81–1.14)	.675
Income		
<$25,000	Ref	
≥$25,000	0.94 (0.81–1.10)	.451
Marital status		
Married	Ref	
Widowed, divorced, never married	0.96 (0.83–1.11)	.546
General health		
Excellent	Ref	
Very good	1.79 (1.41–2.27)	<.001
Good	3.42 (2.75–4.25)	<.001
Fair	7.09 (5.63–8.94)	<.001
Poor	12.14 (8.34–17.66)	<.001
Functional limitations		
No functional limitations	Ref	
IADLs only	2.99 (2.51–3.58)	<.001
1–2 ADLs	4.91 (4.19–5.77)	<.001
3–4 ADLs	13.70 (10.31–18.20)	<.001
5–6 ADLs	24.78 (16.89–36.35)	<.001
History of depression		
Never been diagnosed	Ref	
Diagnosed	1.63 (1.39–1.90)	<.001
History of dementia		
Never been diagnosed	Ref	
Diagnosed	1.43 (1.05–1.94)	.021

Note: IADLs = instrumental activities of daily living; ADLs = activities of daily living.
[a]Adjusted for age, sex, race/ethnicity, education, income, marital status, general health, functional limitations, history of depression, and history of dementia.

of trouble" hearing but not in those with "little trouble" hearing. Medicare beneficiaries with self-perceived "a lot of trouble" hearing have 37% increased odds of limited social activities in the past month compared to those with no perceived trouble hearing.

Epidemiologic exploration of the association between hearing loss and social engagement has revealed conflicting results, in part due to the varied definition of social engagement used in the literature. In one study of community-dwelling older adults, hearing loss was associated with decreased participation in social activities, such as phoning friends, attending church, and going to the movies (Crews & Campbell, 2004). However, another cross-sectional study found an association between social isolation (derived from marital status, number of friends, availability of emotional and financial support) and hearing loss only in 60- to 69-year-old women, but not in men or individuals older than 70 (Mick et al., 2014). Compared to men, women rely more on verbal communication to establish and maintain social connections (Maltz & Borker, 1982). Although we hypothesized gender differences in the association between hearing and social engagement based on previous studies, we found similar effect estimates in men and women. One explanation for our differing results might be that while other studies have used a composite measure of social isolation that included aspects of emotional support, we used a single question to assess limitation in social activities.

The relationship between hearing loss and decreased social engagement may be explained by hearing loss' negative influence on communication. Hearing loss increases cognitive load by requiring the brain to interpret degraded auditory signals (Pichora-Fuller, 2003) and could lead to increased fatigue from attempting to keep up with conversation. Further, older adults with hearing loss may feel embarrassment about their inability to hear, leading to social withdrawal (Heine & Browning, 2004). Inclusion of hearing aids in our model did not change the main effect. Hearing care is complex and other key variables, such as average daily hearing aid use and years of hearing aid use, would allow further study of whether hearing aid use effects the association between hearing loss and social limitations.

Our findings have important implications. Decreased social engagement in older adults is associated with depression (Oxman, Berkman, Kasl, Freeman, & Barrett, 1992) and cognitive decline (Bassuk et al., 1999; Kats et al., 2016). A recent study suggests that social isolation may be a mediator in the association between hearing loss and cognitive decline (Ray, Popli, & Fell, 2018), which is important considering that hearing loss has been identified as a modifiable risk factor for cognitive decline (Livingston et al., 2017). Although there are some effective interventions at the individual, group and services level to increase engagement among socially isolated older adults, there are few interventions for preventing social disengagement (Cotterell, Buffel, & Phillipson, 2018). Thus, identifying older adults with mild hearing loss might be important for preventing social disengagement and resulting negative health consequences.

Our study has limitations. Although the biological plausibility of limited social engagement leading to worse hearing

is low, our cross-sectional data cannot establish directionality of the observed association. Our primary exposure of interest was self-perceived hearing ability rather than objective, biologic hearing loss. However, previous studies have found single-question assessment of hearing to have high sensitivity and specificity for hearing loss measured by pure-tone audiometry (Sindhusake et al., 2001). Another limitation is that our outcome measure of social limitation was linked to perceived health status. To address this limitation we controlled for general health status in our statistical model and also conducted a sensitivity analysis excluding those with excellent health.

Conclusion

In this nationally representative cross-sectional study of Medicare beneficiaries, we found that persons with a lot of trouble hearing had 37% higher odds of limited social activity over the past month compared to those with normal hearing, independent of other risk factors. Future studies should use objective auditory measures and further examine the impact of hearing aid use on social engagement.

Supplementary Material

Supplementary data are available at *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences* online.

Funding

This work was supported in part by the Cochlear Center for Hearing and Public Health at Johns Hopkins University Bloomberg School of Public Health; the Eleanor Schwartz Charitable Foundation; and the National Institutes of Health (R33 DC015062 to F. R. Lin and KL2 TR001077 to N. S. Reed). Funders had no role in the design or execution of this study.

Author Contributions

A. Shukla conducted data analysis and drafted the manuscript. N. S. Reed planned the study, supervised the data analysis, and contributed to drafting the manuscript. T. K. M. Cudjoe supervised the data analysis and contributed to revising the article. F. R. Lin contributed to revising the article.

Conflict of Interest

F. R. Lin reports being a consultant to Cochlear, Amplifon, and Boehringer Ingelheim. N. S. Reed reports being an advisor to Clearwater Clinical. The other authors report no conflicts of interest.

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