Published in final edited form as:
J Am Geriatr Soc. 2014 June ; 62(6): 1186–1188. doi:10.1111/jgs.12860.

Association of Hearing Impairment and Frailty in Older Adults

Rebecca J. Kamil, B.S.[a], **Lingsheng Li, B.S., M.H.S.**[b], and **Frank R. Lin, M.D., Ph.D.**[c]

[a]Albert Einstein College of Medicine, Bronx, New York [b]University of Oklahoma College of Medicine, Oklahoma City, Oklahoma [c]Departments of Otolaryngology-Head and Neck Surgery, Geriatric Medicine, Mental Health, and Epidemiology, Johns Hopkins University, Baltimore, Maryland

TO THE EDITOR

Frailty is characterized by decreased physiologic reserve and an increased vulnerability to stressors and has been defined in epidemiologic studies as being present when three or more criteria are met: unintentional weight loss, slow walking speed, weakness, exhaustion, and low physical activity.(1) Frailty is independently associated with falls, disability, hospitalization, cognitive impairment, and death.(1, 2) Whether hearing impairment, which

Corresponding Author: Rebecca J. Kamil, Johns Hopkins Center on Aging and Health, 2024 E. Monument Street, Suite 2-700, Baltimore, MD 21205-2223, Telephone – (410) 614-0740, Fax – (410) 614-9444, rkamil1@jhmi.edu. Alternate Corresponding Author: flin1@jhmi.edu.

Conflict of Interest Checklist:

Elements of Financial/Personal Conflicts	Rebecca J. Kamil, B.S.		Lingsheng Li, B.S., M.H.S.		Dr. Frank R. Lin, M.D., Ph.D.	
	Yes	No	Yes	No	Yes	No
Employment or Affiliation		X		X		X
Grants/Funds		X		X	X	
Honoraria		X		X	X	
Speaker Forum		X		X		X
Consultant		X		X	X	
Stocks		X		X		X
Royalties		X		X		X
Expert Testimony		X		X		X
Board Member		X		X	X	
Patents		X		X		X
Personal Relationship		X		X	X	

*Authors can be listed by abbreviations of their names

Author Contributions:
Rebecca J. Kamil, B.S. – Active role in data analysis and interpretation, and preparation of manuscript.
Lingsheng Li, B.S., M.H.S. – Built and prepared NHANES dataset used in data analyses.
Dr. Frank R. Lin, M.D., Ph.D. – Leading role in study concept and design, analysis and interpretation of data and preparation of the manuscript.

is independently associated with physical and cognitive decline, is also associated with frailty is unknown. We conducted an exploratory cross-sectional study to investigate the association of self-reported hearing impairment and frailty.

METHODS

We analyzed data from 2,109 individuals 70 years and older in the 1999–2002 cycles of the National Health and Nutrition Examination Survey (NHANES), a nationally representative cross-sectional study that is representative of the non-institutionalized, civilian U.S. population.

Hearing impairment was measured by self–report and individuals were classified as having good/a little trouble hearing versus a lot of trouble hearing. We defined frailty per a previous study that investigated frailty in NHANES using the following criteria: 1) 5% or greater unintentional weight loss in the last year and/or BMI <18.5 kg/m^2; 2) 20-foot gait speed in the lowest gender-adjusted quintile; 3) self-reported weakness (“some/much difficulty” or “unable to do” in response to lifting or carrying an object as heavy as 10 pounds); 4) self-reported exhaustion (“some/much difficulty” or “unable to do” when “walking from 1 room to the other”); and 5) self-reported low physical activity (participant report of being less active compared to individuals of the same age).(3) Participants with 3 or more criteria were classified as frail, 1–2 criteria were pre-frail, and those with no criteria were not frail. Individuals were classified in analyses as being not frail versus pre-frail/frail. Gait speed was evaluated by trained technicians and participants completed a 20-foot walk at a usual pace.

Differences in demographic and general health characteristics according to hearing status were analyzed with chi-square. We examined the association between self-reported hearing impairment and frailty with step-wise logistic regression models adjusted for demographic factors, cardiovascular risk factors, health status, and hearing aid use. We explored for effect modification by gender in stratified analyses.

To account for the complex sampling design, we used sample weights according to National Center for Health Statistics guidelines. Analyses were performed with Stata (StataCorp, College Station, TX) and statistical significance was defined as two-sided $p<0.05$.

RESULTS

Demographic characteristics differed according to hearing status with individuals with greater hearing impairment more likely to be older, male, Caucasian, and frail. We analyzed the association between self-reported hearing impairment and frailty with stepwise logistic regression. In a fully-adjusted model, self-reported hearing impairment was associated with frailty (OR 1.68 [95% CI 1.00, 2.82]). When stratified by gender, hearing was significantly associated with frailty in women (OR 3.79 [95% CI 1.69, 8.51]) but not men (OR 0.85 [95% CI 0.44, 1.66]). Hearing aid use was not significantly associated with frailty in men (OR 0.82 [95% CI 0.50, 1.35]) or women (OR 0.44 [95% CI 0.14, 1.39]).

DISCUSSION

In this exploratory study, our results demonstrate that self-reported hearing impairment is independently associated with frailty in women ≥70 years. Potential explanations for this observed association include a shared neuropathologic etiology (e.g. microvascular disease, inflammation) contributing to both hearing impairment and frailty, effects of frailty on self-perceptions of hearing, or potential effects of hearing impairment on frailty through mediating pathways of cognitive load, social isolation, stress, or reduced awareness of the auditory environment affecting mobility.(4–6) In previous studies, hearing impairment has been independently associated with reduced gait speed, increased falls, hospitalizations and mortality that are potentially mediated through such pathways.(7–10) The basis for only observing an association of hearing impairment and frailty in women and not men is unclear but may be related to the greater risk of frailty in women.(1)

Key limitations of this exploratory analysis are that the underlying mechanistic pathways cannot be determined, hearing assessment was based on self-report, and the cross-sectional study design. Future research utilizing objective hearing measures and longitudinal assessment of physical functioning and frailty are warranted. In particular, given the high prevalence of untreated hearing impairment in older adults, investigating whether hearing rehabilitative treatments could potentially help reduce cognitive and physical functional decline is needed.

Acknowledgments

Funding: This work was supported by the National Institute of Deafness and Communication Disorders K23DC011279 Grant; Triological Society and American College of Surgeons Clinician Scientist Award; and Eleanor Schwartz Charitable Foundation.

For “yes”, provide a brief explanation: Dr. Lin receives grants from the NIDCD/NIH, American College of Surgeons/Triological Society, and Eleanor Schwartz Charitable Foundation to conduct research. He also serves as a consultant for Cochlear Americas, board member for Pfizer and Autifony, receives an honorarium for teaching and speaking from Amplifon, and has a non-financial relationship consisting of volunteer teaching and speaking with Med-El.

Sponsor’s Role: None.

References

1. Fried LP, Tangen CM, Walston J, et al. Frailty in older adults: Evidence for a phenotype. J Gerontol A Biol Sci Med Sci. 2001; 56:M146–56. [PubMed: 11253156]
2. Boyle PA, Buchman AS, Wilson RS, et al. Physical frailty is associated with incident mild cognitive impairment in community-based older persons. J Am Geriatr Soc. 2010; 58:248–255. [PubMed: 20070417]
3. Singh S, Bailey KR, Noheria A, et al. Frailty across the spectrum of ankle-brachial index. Angiology. 2012; 63:229–236. [PubMed: 21733950]
4. Dalton DS, Cruickshanks KJ, Klein BE, et al. The impact of hearing loss on quality of life in older adults. Gerontologist. 2003; 43:661–668. [PubMed: 14570962]
5. Lin FR, Ferrucci L, Metter EJ, et al. Hearing loss and cognition in the baltimore longitudinal study of aging. Neuropsychology. 2011; 25:763–770. [PubMed: 21728425]
6. Lin FR, Metter EJ, O’Brien RJ, et al. Hearing loss and incident dementia. Arch Neurol. 2011; 68:214–220. [PubMed: 21320988]

7. Li L, Simonsick EM, Ferrucci L, et al. Hearing loss and gait speed among older adults in the united states. Gait Posture. 2013; 38:25–29. [PubMed: 23177614]

8. Lin FR, Ferrucci L. Hearing loss and falls among older adults in the united states. Arch Intern Med. 2012; 172:369–371. [PubMed: 22371929]

9. Genther DJ, Frick KD, Chen D, et al. Association of hearing loss with hospitalization and burden of disease in older adults. JAMA. 2013; 309:2322–2324. [PubMed: 23757078]

10. Karpa MJ, Gopinath B, Beath K, et al. Associations between hearing impairment and mortality risk in older persons: The blue mountains hearing study. Ann Epidemiol. 2010; 20:452–459. [PubMed: 20470972]

Table 1

Stepwise Logistic Regression Models of the Association of Self-Reported Hearing Impairment and Frailty in Adults aged 70 and Older in NHANES 1999–2002

Self-reported hearing impairment was defined as good/little trouble hearing versus a lot of trouble hearing. Frailty was classified as being not frail versus pre-frail/frail.[a]

	All Participants		Men		Women	
	Odds Ratio of Frailty (95% CI)	p-value	Odds Ratio of Frailty (95% CI)	p-value	Odds Ratio of Frailty (95% CI)	p-value
Hearing loss alone	1.79 (1.29, 2.50)	.001	1.29 (0.83, 2.01)	.25	3.47 (1.97, 6.10)	<.001
Base model (Hearing loss + age)	1.52 (1.08, 2.14)	.02	1.20 (0.74, 1.93)	.45	2.74 (1.46, 5.12)	.003
Base model + demographic factors[b]	1.59 (1.12, 2.25)	.01	0.95 (0.55, 1.65)	.86	2.78 (1.56, 4.97)	.001
Base model + demographic factors + cardiovascular risk factors[c]	1.54 (1.05, 2.25)	.03	0.83 (0.47, 1.46)	.51	2.84 (1.55, 5.20)	.001
Base model + demographic factors + cardiovascular risk factors + hearing aid use	1.80 (1.08, 2.98)	.02	0.95 (0.50, 1.81)	.88	3.60 (1.74, 7.44)	.001
Base model + demographic factors + cardiovascular risk factors + hearing aid use + general health status	1.68 (1.00, 2.82)	.05	0.85 (0.44, 1.66)	.62	3.79 (1.69, 8.51)	.002

[a] Sampling weights were used in these calculations.

[b] Demographic factors include: gender, race, education, income, and body mass index (BMI). Note gender was removed from analyses stratified by gender.

[c] Cardiovascular risk factors include: smoking status, hypertension, stroke, and diabetes.