

Self-reported Hearing Loss Associated with Frailty among Afro-Caribbeans

MI Naharci¹, G Engstrom², C Keintz³, A Danesh³, R Tappen², JG Ouslander⁴

ABSTRACT

Objective: Data on ethnic differences in the relationship between hearing loss and frailty are sparse. We investigated the relationship between self-reported hearing loss and frailty in four ethnic groups.

Methods: This was a cross-sectional study of a community-dwelling sample of African American, Afro-Caribbean, Hispanic, and European American individuals aged 60 years or older ($n = 484$). Participants had to be able to ambulate independently or with the help of a device, and had an age- and education-adjusted Mini-Mental State Examination score of > 23 to be enrolled. Self-reported hearing loss was measured by a single question: 'Is your hearing excellent, very good, good, fair or poor?'. Answers of excellent, very good and good were considered as 'no hearing loss', and answers of fair and poor as 'self-reported hearing loss'. Frailty was defined as reporting three or more of the following criteria: weight loss, weakness, exhaustion, slow walking speed, and low physical activity.

Results: In unadjusted (odds ratio: 3.075; 95% confidence interval: 1.149, 8.233; $p = 0.025$) and adjusted (odds ratio: 7.509; 95% confidence interval: 1.797, 31.386; $p = 0.006$) models, self-reported hearing loss was associated with frailty in Afro-Caribbeans, but not in African Americans, Hispanics and European Americans. Out of the five frailty criteria, only exhaustion was significantly more common in the self-reported hearing loss group among Afro-Caribbeans.

Conclusion: Self-reported hearing loss was associated with frailty among Afro-Caribbeans, and this association was largely due to the frailty criterion of exhaustion.

Keywords: Afro-Caribbean, ethnicity, frailty, hearing loss

Pérdida de la audición autoreportada asociada con la fragilidad entre los afrocaribeños

MI Naharci¹, G Engstrom², C Keintz³, A Danesh³, R Tappen², JG Ouslander⁴

RESUMEN

Objetivo: Los datos sobre las diferencias étnicas en la relación entre la pérdida auditiva y la fragilidad son escasos. Investigamos la relación entre la pérdida de la audición autoreportada y la fragilidad en cuatro grupos étnicos.

From: ¹Division of Geriatrics, Gulhane Faculty of Medicine and Gulhane Training and Research Hospital, University of Health Sciences, Ankara, Turkey, ²Christine E Lynn College of Nursing, Florida Atlantic University, Boca Raton, Florida, United States of America, ³Department of Communication Sciences and Disorders, Florida Atlantic University, Boca Raton, Florida, United States of America and ⁴Department of Integrated Medical Sciences, Charles E Schmidt College of Medicine, Florida Atlantic University, Boca

Raton, Florida, United States of America and Christine E Lynn College of Nursing, Florida Atlantic University, Boca Raton, Florida, United States of America.

Correspondence: Dr MI Naharci, Division of Geriatrics, Gulhane Faculty of Medicine and Gulhane Training and Research Hospital, University of Health Sciences, Ankara, Turkey. Email: drnaharci@yahoo.com

Métodos: Se trató de un estudio transversal de una muestra de una comunidad de residentes afroamericanos, afrocaribeños, hispanos y euroamericanos de 60 años o más ($n = 484$). Para ser seleccionados, los participantes tenían que ser capaces de deambular independientemente o con la ayuda de un dispositivo, y tener una puntuación de >23 en el Mini Examen del Estado Mental ajustado a la edad y al nivel educacional. La pérdida de audición autoreportada fue medida con una sola pregunta: '¿Es tu audición excelente, muy buena, buena, satisfactoria, o pobre?'. Las respuestas de 'excelente', 'muy buena', y 'buena', se consideraron como 'sin pérdida de la audición', y las respuestas de 'satisfactoria' y 'pobre' como 'pérdida de la audición autoreportada'. La fragilidad se definió a partir de reportar tres o más de los siguientes criterios: pérdida de peso, debilidad, agotamiento, velocidad de marcha lenta, y baja actividad física.

Resultados: En los modelos no ajustados (odds ratio: 3.075; 95% intervalo de confianza: 1.149, 8.233; $p = 0.025$) y ajustados (odds ratio: 7.509; 95% intervalo de confianza: 1.797, 31.386; $p = 0.006$), la pérdida de audición autoreportada se asoció con la fragilidad en los afrocaribeños, pero no en los afroamericanos, hispanos y euroamericanos. De los cinco criterios de fragilidad, sólo el agotamiento fue significativamente más común en el grupo de pérdida de la audición autoreportada entre afrocaribeños.

Conclusión: La pérdida de audición autoreportada estuvo asociada con la fragilidad entre afrocaribeños, y esta asociación se debió en gran parte al criterio de agotamiento como aspecto de la fragilidad.

Palabras clave: Afrocaribeño, etnicidad, fragilidad, pérdida de la audición

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INTRODUCTION

Age-related hearing loss has been associated with lower quality of life, depression, social stress and isolation, functional impairment, fall risk, late-life cognitive decline, dementia, hospitalization and mortality (1–3). The estimated prevalence rates of hearing loss are approximately 20–40% in older adults aged over 65 years (2–4). Age-related hearing loss is caused by functional loss of sensory and neuronal elements of the inner ear and the auditory nerve, in which there is a loss of hair cells and cochlear nerve cells and degeneration in the central auditory pathways (4, 5).

Frailty, defined as an age-related decrease in physiological reserve and increased sensitivity of neuromuscular, metabolic and immune systems to environmental factors, has become a topic of increasing interest in recent years (6). An estimated 10.7% of community-dwelling older adults suffered from frailty based on a systematic review of 21 cohorts (7).

There are possible links between hearing loss and frailty, particularly in neuropathological aetiology and the causal interactions (8). A few studies have reported that hearing impairment is associated with an increased risk of frailty in older adults (8–10). Furthermore, slower

gait speed and low physical activity, which are characteristics of frailty, have been found to be predictors of hearing loss in older adults (11, 12).

It is not clear whether the relationship between self-reported hearing loss and frailty varies across ethnic groups. Identification of high-risk populations for both conditions is important in order to focus on preventive measures in specific populations. Using baseline data from the Healthy Aging Research Initiative (HARI), we investigated the relationship between self-reported hearing loss and frailty in a diverse community-based population. We hypothesized that hearing loss would be associated with frailty in each ethnic group.

SUBJECTS AND METHODS

Participants and study protocol

The HARI study was part of a multidisciplinary, multi-ethnic study conducted in South Florida, United States of America (USA). The overall study design involved data collection from four different ethnic groups: African American, Afro-Caribbean, Hispanic, and European American. Inclusion criteria were: age 60 years or older, an age- and education-adjusted score of 23 or higher on the Mini-Mental State Examination (13, 14), and ability

to ambulate independently or with the help of a device. The Institutional Review Board at Florida Atlantic University, USA, approved the study protocol, and eligible participants provided written informed consent.

Hearing assessment

Hearing status was measured by a single self-reported question: 'Is your hearing excellent, very good, good, fair or poor?'. The answers were dichotomized by specifying answers of excellent, very good and good as 'no hearing loss' and answers of fair and poor as 'self-reported hearing loss'. Since many people have difficulty admitting hearing loss, it was assumed that those with significant hearing loss (*ie* more than 40 dB HL) would respond at fair and poor categories (15).

Frailty definition

Frailty was defined and measured based on modified criteria used by Fried *et al* (6). Participants with three or more of the following criteria were considered frail; those with two or fewer criteria were considered not frail:

- Weight loss: participants who reported unintentional loss of 10 or more pounds in the last six months.
- Weakness: grip strength was measured using dynamometers on the dominant hand. The average of two attempts was used, and the cut-offs were stratified by gender and body mass index (BMI) quartiles. The lowest quartile in each gender group was considered weak for the frailty criteria.
- Exhaustion: exhaustion was measured using two questions on the 20-item CES-D Depression Scale (16). Participants were asked if and how often during the last week: 'I felt that everything I did was an effort' and 'I could not get going', and were classified as positive for exhaustion if they answered either of the two questions occasionally, a moderate amount of time (three to four days) or most or all of the time (five to seven days).
- Walking speed: participants were asked to walk without assistance for 25 feet, and the time was measured for the intermediate 15 feet. Cut-offs stratified by gender and height were used, and slow walking speed was defined according to Fried *et al*'s criteria (6).
- Physical activity: participants were asked how often they engaged in vigorous, moderate and mild activities (17), and were classified as having low physical activity if they answered 'hardly ever or never' or 'one to three times a month' to all three

of the following questions: 'How often do you take part in sports or activities that are vigorous such as running or jogging, swimming, cycling, aerobics, or gym workout, tennis, or digging with a spade or shovel?', 'How often do you take part in sports or activities that are moderately energetic such as gardening, cleaning the car, walking at a moderate pace, dancing, floor or stretching exercises?' and 'How often do you take part in sports or activities that are mildly energetic, such as vacuuming, laundry, home repairs?'.

Covariates

Data on demographic factors and clinical history were collected from interviews. Selected variables that might be associated with the risk of frailty and/or hearing loss were included in the analyses. Demographic factors included were ethnicity, age and gender. Participants were considered to have a smoking history if they answered 'yes' to 'Have you ever smoked?'. Participants were asked how often they had a drink containing alcohol and were classified as a 'regular alcohol drinker' if they answered 'more than two times a week'. Variables related to clinical history were hypertension and diabetes mellitus. In order to identify these conditions, participants were asked whether a physician or another healthcare provider told them that they had hypertension and diabetes mellitus. Body mass index was calculated as measured weight in kilograms/height in metre squared of the participants.

Statistical analysis

The data were analysed using SPSS Statistics for Windows (2013, Version 22.0. Armonk, New York, USA: IBM Corp) statistical program. The Kolmogorov-Smirnov test was used to evaluate normal distribution for continuous variables, and Pearson's χ^2 tests and Mann Whitney-U tests were used for comparisons between included and excluded participants. Pearson's χ^2 tests and Kruskal Wallis tests were used for comparisons among ethnic groups (Table 1). Hearing status was compared between frail and not-frail groups with Pearson's χ^2 tests. Associations between self-reported hearing loss and frailty were evaluated by calculating odds ratios in univariate analyses and in multivariate analyses which included covariates of age, gender, BMI, smoking history, regular alcohol drinker, hypertension, and diabetes mellitus (Table 2, model 1 and model 2). Model 2 was obtained using likelihood ratio backward method. Characteristics of frailty in Afro-Caribbeans were compared between

Table 1: Descriptive characteristics of participants, overall and by ethnicity

	Total (n = 484)	African American (n = 97)	Afro-Caribbean (n = 122)	Hispanic (n = 103)	European American (n = 162)
Age (years)	74.5 ± 8.4	72.3 ± 7.7	73.4 ± 7.5	72.8 ± 7.5	77.8 ± 9.1
Female	348 (71.9)	79 (81.4)	92 (75.4)	82 (79.6)	95 (58.6)
Body mass index (kg/m ²)	29.2 ± 6.1	33.1 ± 7.5	29.7 ± 5.8	27.5 ± 4.3	27.6 ± 5.2
Smoking history	219 (45.3)	50 (51.5)	38 (31.1)	36 (35.0)	95 (58.6)
Regular alcohol drinker	47 (9.7)	3 (3.1)	5 (4.1)	8 (7.8)	31 (19.1)
Hypertension	339 (70.9)	78 (83.0)	96 (79.3)	71 (68.9)	94 (58.8)
Diabetes mellitus	168 (36.0)	44 (47.3)	61 (52.6)	37 (36.3)	26 (16.7)
Frailty status					
Frail	79 (16.3)	21 (21.6)	25 (20.5)	21 (20.4)	12 (7.4)
Not frail	405 (83.7)	76 (78.4)	97 (79.7)	82 (79.6)	150 (92.6)
Hearing status					
Self-reported hearing loss	124 (25.6)	21 (21.6)	25 (20.5)	25 (24.3)	53 (32.7)
No hearing loss	360 (74.4)	76 (78.4)	97 (79.5)	78 (75.7)	109 (67.3)

Values shown are mean ± standard deviation or number (percentage).

Table 2: Association between self-reported hearing loss and frailty, overall and by ethnicity

	Overall (n = 484)		African American (n = 97)		Afro-Caribbean (n = 122)		Hispanic (n = 103)		European American (n = 162)	
	Odds ratio (OR) (95% confidence interval (CI))	<i>p</i>	OR (95% CI)	<i>p</i>	OR (95% CI)	<i>p</i>	OR (95% CI)	<i>p</i>	OR (95% CI)	<i>p</i>
Self-reported hearing loss										
Model 1	1.937 (1.159, 3.238)	0.012	2.214 (0.754, 6.500)	0.148	3.075 (1.149, 8.233)	0.025	1.778 (0.624, 5.066)	0.282	2.191 (0.671, 7.153)	0.194
Model 2	3.064 (1.422, 6.604)	0.004	1.378 (0.195, 9.745)	0.748	7.509 (1.797, 31.386)	0.006	2.690 (0.541, 13.380)	0.227	8.707 (0.976, 77.700)	0.058

Model 1: unadjusted.

Model 2: adjusted for age, gender, body mass index, smoking history, regular alcohol drinker, hypertension, and diabetes mellitus.

self-reported hearing loss and the no-hearing-loss groups with Pearson's χ^2 tests. Differences were considered to be significant when $p < 0.05$.

RESULTS

Of the 694 participants who were enrolled in the HARI study, 484 (69.7%) provided complete data on the relevant questions and were included in the analyses.

Descriptive characteristics of participants (overall and by ethnicity) are shown in Table 1. The majority of participants were European American (33.5%), followed by Afro-Caribbean (25.2%), Hispanic (21.3%) and African American (20.0%). The European American participants were older and more likely to be male than the African American, Afro-Caribbean and Hispanic participants ($p < 0.0001$, comparisons of age and gender among the four groups). Smoking history and regular alcohol drinker were more prevalent among European Americans than other ethnic groups ($p < 0.0001$, comparisons of smoking and alcohol

status among the four groups). Afro-Caribbeans had higher BMIs, more hypertension and diabetes mellitus than other ethnic groups ($p < 0.0001$, comparisons of BMI, hypertension and diabetes mellitus among the four groups).

European Americans had the greatest prevalence of self-reported hearing loss (32.7%), followed by Hispanics (24.3%), African Americans (21.6%) and Afro-Caribbeans (20.5%) ($p = 0.076$). European Americans had the lowest prevalence rate of frailty (7.4%), whereas African Americans (21.6%), Afro-Caribbeans (20.5%) and Hispanics (20.4%) had similar and higher prevalence rates ($p = 0.003$).

Self-reported hearing loss was more frequent in the frail group (36.0%) compared with the not-frail group (16.5%) in Afro-Caribbeans ($p = 0.031$). Self-reported hearing status did not differ by frailty status in other ethnic groups.

We evaluated whether self-reported hearing loss was associated with frailty in the whole group, then by

ethnicity (Table 2). In the whole group, self-reported hearing loss was associated with frailty in the unadjusted model ($p = 0.012$) and in the model adjusted for age, gender, BMI, smoking history, regular alcohol drinker, hypertension and diabetes mellitus ($p = 0.004$). When stratified by ethnicity, self-reported hearing loss was associated with a three-fold greater odds of frailty only among Afro-Caribbeans in unadjusted models ($p = 0.025$). This association remained significant among Afro-Caribbeans in adjusted models ($p = 0.006$).

Exhaustion was more frequent in the self-reported hearing loss group (40.0%) when compared with the no-hearing-loss group (15.1%) among Afro-Caribbeans ($p = 0.006$). Weight loss, weakness, slow gait speed and low physical activity did not differ by hearing status in this group.

DISCUSSION

This is the first study that investigates the relationship between self-reported hearing loss and frailty in four ethnic groups. In the multi-ethnic sample studied, self-reported hearing loss was significantly more common among those who met criteria for frailty compared to the not-frail in Afro-Caribbeans. This association remained significant in Afro-Caribbeans after adjustment. There was no difference in the African Americans, Hispanics and European Americans. Among the characteristics of frailty, only exhaustion was found to be related with self-reported hearing loss in Afro-Caribbeans.

The prevalence of self-reported hearing loss in those meeting criteria for frailty was higher than in the not-frail among all ethnic groups, but significant differences in rates of self-reported hearing loss by frailty status were observed only among Afro-Caribbeans. This is an original finding, suggesting that the relationship between hearing status and frailty may be influenced by ethnicity.

It is interesting to note that the rate of exhaustion was significantly higher in the self-reported hearing loss group than in the no-hearing-loss group among Afro-Caribbeans. This finding suggests that exhaustion as a characteristic of the frailty syndrome may mediate the association between hearing loss and frailty in older adults. Possible mechanisms by which hearing loss causes exhaustion (a state of extreme physical or mental tiredness) in older adults include depression, social isolation and loneliness, poor communication and low socio-economic status (18–21). The inter-relationship between exhaustion and hearing has not been studied previously, and it remains to be confirmed by future studies.

There are several potential explanations for the observed association between self-reported hearing loss and frailty: (a) the co-existence of cochlear and vestibular sense organ impairment could lead to balance and mobility challenges (22); (b) the shared atherosclerosis mediated by chronic inflammation (8); (c) the effect of frailty on increasing self-perception of hearing impairment (8); and (d) the deleterious effect of hearing impairment on frailty *via* declining cognition, social isolation, and poor awareness of the auditory environment (23).

There are several limitations of the present study. Firstly, like other cross-sectional studies, we can identify associations but cannot infer causality. Secondly, although we recruited a large and diverse group of participants, it was a sample in one geographic location. Thus, our findings cannot be readily generalized to other populations in other areas of the country. Thirdly, assessment of hearing loss was based on self-report information. Although standard pure-tone audiometry is accepted as the gold standard test for hearing loss evaluation, self-reported hearing loss has been previously shown to be a useful measure (24, 25).

Effective therapeutic options are limited for the frailty syndrome, but appropriate management for hearing loss may be helpful to restore both hearing and functional disability (23). It could be hypothesized that the identification of hearing loss and interventions to improve hearing will help mitigate or prevent frailty in older adults at risk.

CONCLUSION

In summary, this study provided evidence for the association between self-reported hearing loss and frailty (and in particular, the exhaustion criteria for frailty) in Afro-Caribbeans. Further studies to validate these ethnic-related associations and better understanding of the relationship among the potential underlying factors are needed to develop interventions that reduce both hearing loss and frailty.

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