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Uncorrected Hearing Loss and Psychosocial Health in Older Adults on the Main Island of Puerto Rico

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Abstract

Background

Hearing loss is one of the largest risk factors for dementia, yet most of its cognitive and affective consequences have not been characterized in older adults living in Puerto Rico. This study characterized the estimates prevalence of hearing loss in the oldest-old living in Puerto Rico and its associations with cognition, depressive symptoms, anxiety, and loneliness, as well as the differential associations by whether one used a hearing aid.

Methods

Data was used Puerto Rican Elder: Health Conditions study (PREHCO), specifically those completing wave 3 (n = 587; mean age = 83.9, SD = 4.1; 61.2% female) who were reassessed at wave 4 (n = 476, mean age = 85.8, SD = 4.04, mean follow-up years = 2.06, SD = .15). Hearing loss was characterized as self-reported “regular” or “bad” hearing or the report of a doctor diagnosis; hearing aid use was assessed by self-report. Cognition (Telephone Interview for Cognition 27-item screener), depressive symptoms (Geriatric Depression Scale), anxiety (Beck Anxiety Inventory), and loneliness (UCLA Loneliness Scale) was assessed at both waves. Change in these measures was captured as a residualized change score. Associations were tested using linear regressions, controlling for age, sex, education, comorbidities, and weighted for sampling design and selective survival to wave 3.

Results

Overall, 42.0% of people had hearing loss (n = 246) and of that group only 20.7% used a hearing aid (n = 51). Common reasons for not using a hearing aid were due to no opportunity to see doctor (19.8%) and no prescription (16.9%), followed by not believing a device was needed (11.6%). At wave 3, unaided hearing loss was related to greater anxiety (β = 0.32, p = .049), depressive symptoms (β = 0.45, p = .013), and loneliness (β = 0.33, p = .015), but there was no association with cognition. Corrected hearing loss showed no association with any outcome and hearing loss, aided or unaided, showed no association with changes in outcomes approximately 2 years later.

Conclusion

In the oldest-old in Puerto Rico, hearing loss was common but rarely aided. In those without hearing loss, there were generally higher levels of negative affect. These findings highlight the need to address unmet hearing care in those aging in Puerto Rico, which may meaningfully improve quality of life.

Introduction

Hearing loss is common in later life with consequences affecting multiple domains of health. First, prospective studies have linked hearing loss to accelerated cognitive decline and higher risk of incident dementia in the population (Lin et al., 2011; Loughrey et al., 2017; Tucker et al., 2025). The evidence is compelling that hearing loss accounts for 45% of dementia cases worldwide and is listed as one of the top modifiable risk factors by the Lancet standing Commission on Dementia Prevention and Care (Livingston et al., 2024). The social and emotional sequelae, while underexamined, are also substantial. Hearing loss has been shown to constrain one's ability to engage in conversation and detect everyday cues for social engagement, ultimately weakening connections with friends and family (Pichora-Fuller et al., 2016). Cross-sectional and prospective studies show that hearing loss relates to greater depressive symptoms, elevated anxiety, and loneliness (possibly as a result of this lost social participation) (Golub et al., 2019; Jayakody et al., 2018; Lawrence et al., 2020). However, psychosocial outcomes are less often examined alongside cognitive function, even though they may contribute to the corresponding cognitive decline (Dawes et al., 2015). Furthermore, most studies characterize hearing loss in midlife and the early sixties, leaving it uncertain how hearing loss affects cognitive and psychosocial outcomes in the oldest-old age group.

The evidence linking hearing loss to aging outcomes is also narrow with respect to the population examined. Most studies include non-Hispanic White samples, despite the fact that Hispanic and Latino adults carry elevated hearing loss prevalence (Stickel et al., 2024) and a disproportionate burden of dementia and poor mental health (Matthews et al., 2019). Recent work in the Hispanic Community Health Study/Study of Latinos found hearing loss was highest in Puerto Rican adults relative to other Hispanic/Latino background groups (reaching around 40% at age 45) and linked hearing loss to greater cognitive decline over seven years (Stickel et al., 2024). This study, however, focused on Puerto Ricans living in the continental United States, and those living on the island have unique challenges, including economically damaging catastrophes, a weakened healthcare system (Perreira et al., 2017), and heavy outmigration trimming family and community connections. The Puerto Rican Elder Health Conditions study (PREHCO) is the only population-representative longitudinal study of older adults on the island (Matos-Moreno et al., 2022; Palloni et al., 2013), and hearing loss has not yet been characterized or examined in relation to health outcomes.

A second consideration concerns hearing correction. Hearing aid use is the primary means of managing hearing loss, and some evidence shows it may reduce cognitive decline in those at higher risk (Lin et al., 2023) as well as improve psychosocial outcomes including loneliness, social isolation, and depressive symptoms (Jiang et al., 2025; Mamo et al., 2024). However, getting a hearing aid device requires clinical evaluation, prescription, and can be expensive even with insurance coverage (Arnold et al., 2019). This is likely a particular challenge in Puerto Rico, where audiological services and insurance coverage for hearing aids are limited (Marrone & Wong, 2021). The extent of uncorrected hearing loss in older adults living on the island, and the reasons for not using a hearing aid, have not been described, particularly among the oldest old, who face the greatest hearing loss prevalence (Reed et al., 2023) yet have been largely absent from the research base.

The present study addressed three aims using the PREHCO cohort, drawing on Wave 3 as the point at which hearing was first assessed in the study and Wave 4 as the follow-up approximately two years later. First, we characterized the prevalence of hearing loss and hearing aid use, and reported reasons for not using a hearing aid. Second, we examined whether uncorrected and corrected hearing loss related to cognitive status, depressive symptoms, anxiety symptoms, and loneliness, relative to older adults without hearing loss. Third, we examined whether hearing group at Wave 3 predicted change in these outcomes over approximately two years. We examined cognition alongside the psychosocial outcomes because none of the four domains has previously been characterized in relation to hearing in this cohort.

Methods

Participants

The PREHCO study is a longitudinal population-based investigation of community-dwelling older adults in Puerto Rico (Palloni et al., 2013). Researchers leveraged probability-based methods to representatively sample homes with at least one adult over 60 years of age. A multistage, stratified sample design was implemented, with oversampling of individuals over age 80 and regions with a larger proportion of people of African Caribbean descent. After identification of target households, researchers invited older adults to participate in interviews assessing health, lifestyle, psychosocial, and economic factors. Earlier waves of assessment occurred in this cohort, but for the present analyses we focus on Wave 3 (2021–2022) and Wave 4 (2023–2024), as these were the first assessments to include the anxiety measure. This focus also situates the analyses in the contemporary period, which is the relevant one for characterizing hearing care given the substantial changes to the hearing aid landscape in recent years, including the availability of over-the-counter hearing aids in the United States beginning in October 2022; hearing aid use documented in cohorts assessed two decades earlier would be of limited relevance to the present context.

Wave 3 served as the analytic baseline. We restricted analyses to self-report (non-proxy) participants with available hearing data. The hearing, anxiety, and loneliness items were administered only to participants completing the interview themselves; Wave 3 respondents participating by proxy (e.g., because of severe hearing loss, profound cognitive impairment, or other health limitations precluding self-report) were not administered these items by protocol. We further excluded those who were able to participate but had evidence of cognitive impairment, both to focus on hearing loss in relation to preclinical cognitive and affective status and to support the validity of self-reported affect and loneliness, which presupposes intact comprehension of interview items. Evidence of cognitive impairment was defined as a Mini-Mental Cabán (MMC) score below 11 at Wave 3, the validated impairment threshold for this instrument in Spanish-speaking Puerto Rican samples (Sánchez-Ayéndez et al., 2003). This yielded a final analytic baseline sample of 587 older adults (mean age = 83.9, SD = 4.1; 61.3% women). Participants completed follow-up assessment approximately two years later at Wave 4 (n = 476).

Hearing Loss and Correction

Hearing status at Wave 3 was assessed with two items. Self-rated hearing was measured on a five-point scale (“How is your hearing?”), rated from 1-Excellent, 2-Very Good, 3-Good, 4-Regular, 5-Bad. Physician-diagnosed hearing loss was assessed by asking whether a doctor had ever told the participant that they had hearing problems. Hearing loss was defined as self-rated hearing of Regular (the mid-scale rating between Good and Bad) or Bad, or a reported physician diagnosis. Hearing aid use was assessed by asking whether the participant normally used earphones or hearing aids. Note that the hearing aid item was administered only to participants who endorsed hearing difficulty on self-rated hearing, so some of those who only had a doctor diagnosis but not Good to Excellent hearing were missing. Participants were classified into three groups: no hearing loss, uncorrected hearing loss (loss without aid use), and corrected hearing loss (loss with aid use).

For people reporting uncorrected hearing loss (based on self-reported Regular or Bad hearing), they were asked reasons for not using a hearing aid over 8 items with multiple selections possible (bothers/dislikes, cost, no prescription, no opportunity to see a doctor, existing aids do not work, other, believes aids are not needed, physician has not recommended them). Reasons were summarized descriptively among the 79 participants with uncorrected hearing loss to whom the checklist was administered.

Cognition

Cognition was assessed using the 35-item modified Telephone Interview for Cognitive Status (TICS-35). This is a verbally administered battery validated in the Health and Retirement Study, which includes measures of episodic memory (immediate and delayed 10-word recall), executive function (serial 7 subtraction, backwards counting), orientation, naming, repetition, and language comprehension. Scores range from 0 to 35, which higher scores indicating better cognition. The TICS-35 was chosen as our cognitive measure as it has much more variability than the MMC, which includes fewer items (0 to 20) and was additionally restricted due excluding people with cognitive impairment (as it is validated for that purpose in this population, Sánchez-Ayéndez et al., 2003). Note that replacing the TICS-35 with the MMC in analyses did not alter any outcome.

Depressive Symptoms

Depressive symptoms were assessed using a Spanish-language version of the 15-item Geriatric Depression Scale (GDS; Sheikh & Yesavage, 1986; Yesavage et al., 1982). Respondents indicated with a yes or no response whether each of 15 statements described how they had felt over the past week. Items span questions on mood anhedonia, hopelessness, energy, memory concerns, and social withdrawal with five positively worded reverse-scored items. Responses were summed so that higher scores indicate greater depressive symptoms (range 0–15). Summed scores show acceptable reliability

(Cronbach's α = .77; Friedman et al., 2005) and convergent validity with other depressive symptom measures (Kørner et al., 2006).

Anxiety Symptoms

Anxiety symptoms were assessed with a five-item Spanish-language version of the Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988). Respondents rated how much each of five common anxiety symptoms (fear of the worst happening, feeling nervous, hands trembling, fear of dying, and feeling faint or lightheaded) had affected them over the past week, on a four-point scale ranging from not at all to severely. Item responses were summed, with higher scores reflecting greater anxiety symptom burden (possible range 0 to 15).

Loneliness

Loneliness was assessed using the Spanish-language version of the three-item UCLA Loneliness Scale (Hughes et al., 2004; Russell et al., 1980), a brief version of the Revised UCLA Loneliness Scale developed for use in large surveys and adopted by the Health and Retirement Study. The three items ask how often the respondent feels that they lack companionship, feels left out, and feels isolated from others, each rated as hardly ever or never, some of the time, or often. The three items were coded so that higher values indicate greater loneliness and summed to a composite ranging from 3 to 9.

Covariates

Covariates included baseline age, sex, years of education, and self-reported physician-diagnosed diabetes, hypertension, and stroke.

Statistical Analysis

We first computed descriptive statistics of study variables in the analytic sample. This involved means and standard deviations for continuous variables; and frequencies and percentages for categorical variables. For Aim 1, we use this data at Wave 3 to characterize the frequency of hearing loss and hearing aid use as well as reasons for not using a hearing aid.

For Aim 2, we fitted multiple linear regression models for Wave 3 data that estimated the association of hearing loss groups (uncorrected and corrected) with cognition, depressive symptoms, anxiety, and loneliness. In this model, the hearing loss groups were compared to those not reporting hearing loss; and models were adjusted for baseline age, sex, years of education, diabetes, hypertension, and stroke. For models with loneliness as an outcome, we additionally adjusted for whether the participant lived alone. Models used a compound weight combining the PREHCO complex sampling design with an inverse probability weight for Wave 1 to Wave 3 selection. Inverse probability weights were created by logistically regressing Wave 3 response onto Wave 1 age, sex, education, diabetes, hypertension, stroke,

and cognition based on the MMC (TICS-35 not given), and depressive symptoms. The predicted response probability was then inverted, rescaled to a mean of 1, and trimmed at the 99th percentile for weight stability. The survey package in R was used to derive design-based standard errors. Design weights and inverse probability weights were multiplied together.

For Aim 3, we fitted multiple linear regression models that predicted change in outcomes by hearing group. Change was calculated by regressing outcomes at Wave 4 onto Wave 3 measures. Residualization subtracts the predicted value from the observed value at Wave 3 and divides by the root mean square error. This approach is referred to as the residualization approach and has been shown to be less affected by ceiling and floor effects and regression to the mean than a simple difference score (Cronbach & Furby, 1970). These models were adjusted for baseline age, sex, years of education, diabetes, hypertension, and stroke, as well as months between Wave 3 to Wave 4, and were weighted using a compound of the PREHCO complex sampling design, the Wave 1 to Wave 3 inverse probability weight described above, and an outcome-specific inverse probability weight for Wave 3 to Wave 4 non-response. The inverse probability weight for Wave 4 participation was calculated by logistically regressing Wave 4 response onto Wave 3 age, sex, education, diabetes, hypertension, stroke, hearing loss status, and living alone. Predicted response probabilities were inverted, rescaled to a mean of 1, and trimmed at the 99th percentile. Design weights and inverse probability weights were multiplied together.

All models were assessed with statistical significance at $\alpha = .05$. Missingness was handled by model-specific listwise exclusion. We conducted several sensitivity analyses for Aim 2 and 3. First, we re-ran models by replacing hearing loss groups with a stricter definition. This involved coding hearing loss as “bad” self-rated hearing and a doctor diagnosis rather than “bad or regular” self-rated hearing. Second, while we excluded participants with cognitive impairment at Wave 3 as a safeguard against lack of awareness in hearing ability and other self-report variables, in the oldest old, this exclusion removes many individuals. Therefore, to compare how results differ due to this exclusion criteria, we refit models when those individuals are included. Third, we refit all primary models unweighted to characterize the contribution of weighting to the estimates. Fourth, models were refitted to use weights accounting for the complex sampling design but not inverse probability weighting for attrition. This allowed us to understand the unique role of attrition on model estimates.

Results

Our analytical sample included 587 older adults with a mean age at Wave 3 of 83.9 (SD = 4.1) who were 61.3% women and had a mean of 9.2 years (SD = 4.2). Wave 3 hearing status was available for 586 of these 587 participants (one missing); of these, 58.0% had no hearing loss, 33.3% had uncorrected hearing loss, and 8.7% had corrected hearing loss. Among the 246 participants with hearing loss, 79.3% did not use a hearing aid. Descriptive statistics for the full sample and by hearing group are presented in Table 1. Among participants with uncorrected hearing loss who were asked about reasons for not using a hearing aid, the most frequent reason was not having had the opportunity to see a doctor (19.8%), not having a prescription (16.9%), believing that a device was not needed (11.6%), that aids bother them or

they dislike them (11.6% combined across two related items), and that existing aids do not work (5.8%), respectively (see Table 2).

Results of the baseline models are presented in Table 3. Uncorrected hearing loss was associated with greater anxiety symptoms relative to participants without hearing loss (β = 0.32, p = .049), greater depressive symptoms (β = 0.45, p = .013), and greater loneliness (β = 0.33, p = .015). Uncorrected hearing loss was not associated with cognition (TICS-35; β = -0.09, p = .443). Corrected hearing loss was not associated with anxiety symptoms (p = .107), depressive symptoms (p = .980), loneliness (p = .391), or cognition (β = 0.08, p = .633).

Results of the change models are presented in Table 4. Neither uncorrected nor corrected hearing loss at Wave 3 was associated with residualized change in cognition, depressive symptoms, anxiety symptoms, or loneliness across the approximately two-year interval (all p > .13).

Regarding sensitivity analyses, first we assessed how models changed using a more stringent definition of hearing loss (removing those who only reported Regular hearing ability). The prevalence of uncorrected loss under this definition reduced to 17.5% and corrected hearing loss was 8.6% (total n = 587). The association of hearing loss with the psychosocial outcomes at Wave 3 were preserved but much smaller in magnitude (depression β = 0.10, p = .018; anxiety β = 0.11, p = .008; loneliness β = 0.09, p = .037, with the living-alone association preserved at β = 0.18, p < .001). Corrected loss was in the direction of greater loneliness (β = 0.29, p = .051), with no associations in the expected direction for anxiety (β = -0.08, p = .612) or depression (β = -0.01, p = .936). The lack of an association of hearing loss with cognition persisted (β = 0.01, p = .931 for uncorrected loss; β = 0.28, p = .061 for corrected loss). Next, when refitting the models to re-include people with cognitive impairment at wave 3 (MMC < 11), the sample size noticeably increased (n = 722 at Wave 3, n = 522 at Wave 4) but the association of corrected or uncorrected hearing loss with cognition at Wave 3 or change to Wave 4 remained (ps > .05) Lastly, unweighted models and models only account for the complex sampling design but not attrition were consistent with the main results (Supplementary Tables S3–S5).

Discussion

Studies of hearing loss and aging have focused predominantly on cognition and dementia risk in non-Hispanic samples (Lin et al., 2013; Deal et al., 2017). However, the impact of hearing loss on Hispanic older adults may be more profound and likely extends beyond cognition. Our study sought to understand the cognitive and psychosocial consequences of hearing loss among the oldest-old living in Puerto Rico (mean age = 84). In this sample, 42% of Puerto Rican older adults had hearing loss, which was mostly uncorrected. Contrary to predictions, participants with hearing loss did not differ from those without hearing loss on concurrent cognitive status. Instead, they differed mostly on psychosocial health, particularly those not using hearing aids. Participants with uncorrected hearing loss had greater concurrent anxiety, depressive symptoms, and loneliness than those without hearing loss. Participants with corrected hearing loss were similar to those without hearing loss on anxiety and depressive

symptoms, but they still showed greater loneliness. Longitudinal analyses across two years revealed that hearing loss, corrected or not, was unrelated to changes in any outcome. Below we discuss the implications of our findings, how they extend prior work, and the new research questions that emerge from them.

The lack of any difference in cognition by hearing loss status in this oldest-old group contrasts with previous evidence in younger samples. Hearing loss has been linked to cognitive decline and dementia risk across multiple cohorts, including Hispanic adults. In HCHS/SOL, hearing loss among 9,623 adults aged 45 to 74 years was associated with worse cognitive function across measures of episodic memory, verbal fluency, and processing speed (Stickel et al., 2021). One reason may be survivorship. Our participants were first assessed in PREHCO nearly two decades earlier, and those in whom hearing loss co-occurred with cognitive decline may have died, been institutionalized, or required proxy interviews before wave 3, leaving a cognitively resilient sample. Beyond age and survivorship, another reason our findings differ from prior research may be how hearing loss was captured. Most studies use audiometric screening, whereas we relied on self-reported poor hearing and a doctor's diagnosis. Although our prevalence was similar to that reported with audiometric screening, this approach likely misses people who are unaware of their hearing loss. In the English Longitudinal Study of Ageing, 30.2% of adults with screener-tested hearing loss (> 35 dB HL at 3 kHz) did not self-report hearing loss (Tsimpida et al., 2020). This problem increases with age. In NHANES, self-report has been found to undercount hearing loss by 15% among adults aged 70 to 79 years and by 36% among those aged 80 and older (Goman et al., 2020), an age range that includes many participants in our sample. This undercounting may be driven partly by cognitive impairment, which we excluded from our study to guard against this bias. We also attempted to strengthen the validity of our hearing loss measure by including a question about doctor diagnosis, whereas previous studies of self-report have focused only on self-rated severity, which undercounts mild hearing loss by as much as 42% (Goman et al., 2020). However, audiometric screening is challenging in this population. There is a shortage of audiologists in the United States, especially Spanish-speaking audiologists, and Hispanic older adults generally have less access to health care. Although most older adults in Puerto Rico are covered by Medicare, traditional Medicare does not cover hearing aids or the examinations used to fit them, which creates a heavy financial obstacle. Consistent with these barriers, among participants with uncorrected hearing loss, the most common reasons for not using a hearing aid were lacking the opportunity to see a doctor (19.8%) and lacking a prescription (16.9%), whereas fewer reported believing a device was unnecessary (11.6%) or disliking hearing aids (7.0%; Table 2). Furthermore, self-report items have shown acceptable sensitivity and specificity in Hispanic adults (Torre et al., 2006). Another likely reason for the lack of congruence with the hearing loss and cognition literature is our primary cognitive outcome, the TICS-35. The TICS-35 is a brief verbal battery rather than the broader test battery used in HCHS/SOL. Still, we were able to show that a self-report-based hearing loss measure captures important elevations in negative psychosocial outcomes. Hearing loss may also matter most as a cognitive risk factor when it occurs in midlife (Livingston et al., 2024), which precedes the current oldest-old sample by several decades.

Among people with uncorrected hearing loss, we found elevated concurrent anxiety and depressive symptoms, whereas people with corrected hearing loss were similar to those without hearing loss. These findings build on previous work in younger samples of older adults. In a meta-analysis of 35 studies (n = 147,148), hearing loss was associated with 47% greater odds of depression among older adults (Lawrence et al., 2020), and a later meta-analysis found a large effect in cross-sectional studies (g = .68; Li et al., 2025). Anxiety has been examined less often, but cross-sectional elevations have been shown in large studies including the National Health and Aging Trends Study (NHATS; Simning et al., 2019) and the Health, Aging and Body Composition Study among adults aged 76 to 85 years (Contrera et al., 2017), and hearing loss has been associated with greater psychological distress in the National Health Interview Survey (Bigelow et al., 2020). In Hispanic adults, associations with depression and anxiety have also been documented in HCHS/SOL. Among 5,328 adults aged 50 and older (median age 58 years), Golub et al. (2019) found that each 20-dB increment in hearing loss was associated with 44% higher odds of clinically significant depressive symptoms (OR 1.44; 95% CI, 1.27–1.63), adjusting for hearing aid use, demographics, cardiovascular risk factors, and antidepressant use. Additional work found that each 10-dB worsening in hearing was associated with higher anxiety (b = .41) and anger (b = .40), with smaller elevations in hostility, poor self-esteem, and pessimism (b = .16 to .25; Grewal & Golub, 2023). We extend this work by showing these associations in the oldest-old on the main island of Puerto Rico and by classifying participants by hearing aid use, rather than treating aid use only as a covariate as most prior work has done. That those with corrected hearing loss were similar to those without hearing loss points to a potential intervention for reducing psychological distress in this population, particularly through expanding access to and uptake of hearing aids. Similarly, in the National Health Interview Survey, adults with moderate hearing loss who used hearing aids had lower odds of psychological distress than those who did not (OR 0.66; Bigelow et al., 2020), although hearing aid use was not associated with lower anxiety among adults aged 76 to 85 years in Health ABC (Contrera et al., 2017). Our models adjusted for income and education, and health insurance coverage is near-universal among older adults on the island. However, because hearing aids are not covered by traditional Medicare, and because many older adults in Puerto Rico are enrolled in Medicare Advantage plans with coverage that varies, hearing aid users may differ in the quality of or access to health care, which we did not measure and which could partly account for their lower psychological distress. Randomized trial evidence on hearing aids for depression and anxiety remains limited; existing Cochrane evidence has focused on hearing-specific quality of life and listening ability rather than mental-health endpoints (Ferguson et al., 2017). Still, pilot data from randomized controlled trials have shown preliminary benefits for depressive symptoms (Brewster et al., 2020, 2022), and most trials have largely underrepresented Hispanic older adults, who may benefit most given their limited access to and use of hearing aids.

Another major finding was that uncorrected hearing loss was related to concurrent elevations in loneliness. This aligns with much of the growing literature on the topic. Of the 9 cross-sectional studies summarized by Shukla et al. (2020), 6 reported a significant association between hearing loss and loneliness, across studies using audiometric assessment or self-reported hearing loss. In a clinic-based sample of 145 adults aged 50 years and older presenting for hearing aids or cochlear implants, Sung et

al. (2016) found that each 10-dB increase in pure-tone average was associated with a 1.43-point increase on the revised UCLA Loneliness Scale (the same measure used in our study). In a community-based random sample of 3,107 adults aged 55 to 85 years from the Longitudinal Aging Study Amsterdam (LASA), self-reported hearing loss was related to 25% higher mean loneliness and a 10% smaller social network (Kramer et al., 2002). Evidence in Hispanic samples has been more limited. One of the most direct studies comes from the Mexican Health and Aging Study (MHAS), in which Giraldo-Rodríguez et al. (2026) used hybrid random-effects models across the 2015, 2018, and 2021 waves to separate between-person from within-person associations among adults aged 60 and older. Between people, self-reported hearing loss was not associated with short-form UCLA Loneliness scores after adjustment (within-person findings are discussed below). Also in MHAS, Hreha et al. (2025) found that associations between sensory impairment and loneliness among adults aged 50 and older did not survive adjustment for health status. Using MHAS and Health and Retirement Study (HRS) data from adults aged 50 and older, Tanner et al. (2026) found that sensory difficulties were less strongly related to social isolation among Mexican and US Hispanic older adults than among US non-Hispanic older adults. Audiometric evidence is even scarcer but informative. Among 1,817 HRS participants aged 50 and older with audiometrically determined hearing loss in 2022, Lewis et al. (2026) found that Hispanic participants (n = 391) had lower loneliness than non-Hispanic White participants (b = − .31) and non-Hispanic Black participants (b = − .13) after adjustment. Although this study did not compare these groups with participants without hearing loss, its findings align with the hypotheses of Tanner et al. (2026) and Hreha et al. (2025) that associations between hearing loss and social outcomes may be weaker in Hispanic adults, possibly because of familismo. Familismo is the cultural value that places family at the center of social life, emphasizing family obligation and mutual support. This value may help Hispanic family systems maintain social contact and support even as hearing-related communication difficulties arise.

Several reasons may explain why we observed a significant association between hearing loss and loneliness in a Hispanic sample, despite prior evidence suggesting weaker associations. The first feature of our study is its assessment of the oldest-old in the third wave of PREHCO, in which participants were aged 78 years and older (mean age = 84). In the oldest-old, hearing loss is likely more severe than in the samples assessed in previous studies, which included adults aged 50 years and older (Hreha et al., 2025; Lewis et al., 2026; Trujillo Tanner et al., 2022). Furthermore, at this age, widowhood, peer loss, and functional limitations are more frequent, eroding social resources that would otherwise offset communication difficulties related to hearing loss. In LASA, faster hearing decline was associated with greater increases in emotional loneliness among older adults who had recently lost a partner (Pronk et al., 2014). Moreover, because our participants survived nearly two decades from their first PREHCO assessment, selective survival would be expected to bias associations toward the null, suggesting that the associations we observed may be conservative. The second feature of our study is the context of residing in Puerto Rico. The current oldest-old in Puerto Rico have aged in tumultuous times, including a strong outmigration of working-age adults exacerbated by the 2006 economic crisis. The island has since incurred additional assaults, including Hurricane María in 2017, earthquakes in 2020, and the

COVID-19 pandemic. The resulting economic disruption, housing loss, and safety concerns further intensified outmigration, particularly among working-age adults and their children. Thus, this group of older adults has been characterized as "left behind" (Matos-Moreno et al., 2022), with disrupted social networks and fewer proximal family, friends, and caregivers. Kinship models estimate that, under 2021 demographic conditions, Puerto Ricans aged 65 have 69% of their close female kin and 71% of their daughters living in the United States, and that the average number of close kin declined from 6.7 in 2000 to 5.6 in 2021 (Matos-Moreno et al., 2025). If familismo is a buffering mechanism in Hispanic adults, it is likely disrupted by geographic distance, and hearing loss may compound this disruption. Ties maintained across distance rely on telephone contact, which removes the visual speech cues that people with hearing loss rely on. Thus, the familismo protection proposed for Mexican and mainland Hispanic samples (Hreha et al., 2025; Trujillo Tanner et al., 2022) may be less available to the oldest-old living in Puerto Rico. In contrast to this uncorrected-group association, participants with corrected hearing loss did not differ from those without hearing loss on loneliness in the primary analysis, pointing to a potential protective role of hearing aid use for social connectedness in this population. This possible explanation is consistent with the corrected group, who likely have better communication abilities for family connection, not differing on any of the affective outcomes – highlighting the potential value in expanding access to hearing care on the island.

In contrast to our concurrent findings, hearing loss, corrected or not, was unrelated to two-year changes in cognition, depressive symptoms, anxiety, or loneliness. This could be due to several factors. First, our 2-year follow-up window is short. Longitudinal studies that have detected hearing-cognition associations in Hispanic samples relied on follow-up intervals substantially longer than two years (Stickel et al., 2024). This is further compounded by our reliance on a cognitive screener, which limits detection of modest cognitive change. Second, evidence suggests that changes in hearing, rather than hearing status, may better predict changes in psychosocial outcomes. In MHAS, self-reported poor hearing was cross-sectionally associated with higher odds of loneliness among adults aged 50 and older, though this association attenuated after adjustment for functional limitation and depressive symptoms (Hreha et al., 2025). Third, in a sample with a mean age of 84, hearing loss is likely to represent long-standing differences, accumulated from changes in earlier periods. Thus, differences related to hearing loss are likely to be stable rather than predictive of later change. Additionally, the association of hearing loss with affective change appears much weaker than the differences noted cross-sectionally. In one meta-analysis, there were large associations between hearing loss and depressive symptoms in cross-sectional studies ($g = .68$) but weak and nonsignificant associations in longitudinal studies ($g = .06$; Li et al., 2025). Regarding the lack of association with changes in loneliness, our findings are incongruent with a previous study. In SHARE, poorer self-reported hearing predicted greater loneliness two years later, and loneliness did not differ by hearing aid use (Wagner et al., 2025). However, SHARE includes predominantly European adults who are considerably younger than our oldest-old sample, and its much larger sample ($n = 26,479$) provides greater power to detect modest change. Finally, our participants are survivors of those originally recruited at age 60 or older in the first wave of PREHCO. Because hearing loss is related to mortality (Contrera et al., 2015), those most impacted by hearing loss may have died or

been institutionalized before our analyses at wave 3, although we used inverse probability weighting to partly account for this.

Our study should be considered in light of limitations. First, our cross-sectional findings cannot establish direction. Depressive symptoms, anxiety, and loneliness may shape how individuals report issues in hearing, although we included self-reported doctor-diagnoses to rebut this bias. Second, hearing aid use was assessed as a single self-reported item. Our follow-up question asked about reasons for non-use, but did not ask about daily device use, quality of the device, or follow-up with audiologic care. There was also no measure of onset to exclude those with long-standing, developmental hearing impairment. Third, we did not assess the impact of events in Puerto Rico such as Hurricane Maria or the COVID-19 pandemic, although data related to these events were collected and being processed as part of PREHCO research efforts. Because PREHCO wave 3 data was collected during 2021 and 2022, these events may have increased feelings of distress and pandemic-related restrictions may have specifically increased feelings of loneliness. The goal of our study was to first capture the association of hearing loss with cognition and psychosocial health, and future work will be able to explore moderation by the impact of these events.

Among the oldest-old in Puerto Rico, hearing loss was common and, when uncorrected, related to higher levels of depressive symptoms, anxiety, and loneliness. This work points to the need to expand access to hearing care on the island and suggests that doing so may improve psychological health. Although insurance coverage is near universal on the island, that does not mean health care is accessible, and the most commonly reported reasons for not using hearing aids, lacking the opportunity to see a doctor or obtain a prescription, reflected this gap. Interventions that combine expanding hearing care with strategies to strengthen belonging in the community and connection with distant families may be especially suited to this population. Lastly, the associations we observed in the oldest-old, together with the lack of change over two years, suggest that the psychosocial consequences of hearing loss accumulate across earlier decades, and that hearing care as early as midlife, before these consequences take hold. For older adults who remain on the island as their families migrate, earlier and more accessible hearing care may help limit the psychosocial burden of untreated hearing loss.

Declarations

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Data Availability: Data from the Puerto Rican Elder: Health Conditions Study (PREHCO) are available through the National Archive of Computerized Data on Aging

(https://www.icpsr.umich.edu/web/NACDA/studies/39091).

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Tables

Table 1. Sample characteristics overall and by Wave 3 hearing group

	Overall (N = 587)	No loss (n = 340)	Uncorrected (n = 195)	Corrected (n = 51)
Age, M (SD)	83.9 (4.1)	83.7 (3.9)	84.2 (4.3)	84.5 (4.1)
Women, n (%)	359 (61.3)	216 (63.5)	119 (61.0)	24 (47.1)
Education, years, M (SD)	9.2 (4.2)	9.2 (4.2)	8.8 (4.1)	10.5 (4.4)
MMC, M (SD)	15.4 (2.5)	15.4 (2.5)	15.3 (2.6)	16.1 (2.0)
GDS, M (SD)	3.2 (3.0)	2.8 (2.7)	3.9 (3.3)	3.0 (3.0)
BAI, M (SD)	2.4 (2.9)	2.1 (2.6)	3.2 (3.3)	1.9 (2.2)
Loneliness, M (SD)	4.4 (1.8)	4.2 (1.7)	4.6 (1.9)	4.7 (1.7)

Note. MMC = Mini-Mental Cabán (range 0–20, higher = better); GDS = 15-item Geriatric Depression Scale; BAI = Beck Anxiety Inventory. Analytic sample restricted to Wave 3 self-respondents with MMC ≥ 11. Hearing loss = self-rated hearing of Regular or Bad or a reported physician diagnosis; correction = hearing aid use. Hearing status was missing for 1 participant. n = 587 (analytic sample); n = 586 (with non-missing hearing).

Table 2. Reasons for not using a hearing aid among participants with uncorrected hearing loss

Reason	n	%
No opportunity to see a doctor	34	19.8
No prescription	29	16.9
Believes a device is not needed	20	11.6
Aids bother them or they dislike them	12	7.0
Existing aids do not work	10	5.8
Aids bother them or they dislike them (secondary item)	8	4.7
Other	3	1.7

Note. Reasons drawn from Wave 3 item L90 (multiple response). Denominator is n = 172 participants with uncorrected hearing loss to whom the reasons checklist was administered. Categories are not mutually exclusive.

Table 3. Cross-sectional associations of Wave 3 hearing group with standardized outcomes

	Anxiety (BAI)	Depression (GDS)	Loneliness	Cognition (TICS-35)
Predictor	***β [95% CI], p***	***β [95% CI], p***	***β [95% CI], p***	***β [95% CI], p***
Loss, uncorrected a	0.32 [0.00, 0.64], .049	0.45 [0.10, 0.80], .013	0.33 [0.06, 0.60], .015	-0.09 [-0.32, 0.14], .443
Loss, corrected a	-0.25 [-0.56, 0.06], .107	0.00 [-0.36, 0.37], .980	0.16 [-0.21, 0.54], .391	0.08 [-0.25, 0.41], .633
Women	0.22 [-0.09, 0.52], .162	0.35 [0.04, 0.66], .028	0.34 [0.06, 0.61], .016	-0.40 [-0.61, -0.19], <.001
Age (z)	0.08 [-0.08, 0.23], .321	0.10 [-0.13, 0.32], .391	0.09 [-0.04, 0.22], .193	-0.07 [-0.17, 0.02], .128
Education (z)	-0.09 [-0.22, 0.04], .156	-0.16 [-0.31, -0.01], .037	-0.11 [-0.24, 0.02], .088	0.37 [0.27, 0.47], <.001
Diabetes	-0.09 [-0.37, 0.19], .529	0.04 [-0.32, 0.40], .826	0.16 [-0.12, 0.45], .262	-0.03 [-0.24, 0.18], .786
Hypertension	0.15 [-0.18, 0.48], .374	0.06 [-0.24, 0.36], .691	-0.27 [-0.65, 0.11], .160	-0.16 [-0.37, 0.05], .126
Stroke	0.57 [-0.06, 1.20], .076	0.18 [-0.40, 0.76], .542	0.25 [-0.51, 1.01], .521	-0.25 [-0.84, 0.33], .399
Lives alone	—	—	0.14 [-0.16, 0.44], .369	—

Note. All continuous predictors and outcomes were standardized (z), so *β* is in outcome SD units. Loneliness models additionally adjusted for living alone; dashes indicate the covariate was not included.

[a]No hearing loss is the reference.

Table 4. Associations of Wave 3 hearing group with residualized change to Wave 4

	Δ Anxiety (BAI)	Δ Depression (GDS)	Δ Loneliness	Δ Cognition (TICS-35)
Predictor	***β [95% CI], p***	***β [95% CI], p***	***β [95% CI], p***	***β [95% CI], p***
Loss, uncorrected a	-0.02 [-0.48, 0.45], .948	0.10 [-0.27, 0.47], .595	-0.11 [-0.45, 0.22], .516	0.15 [-0.06, 0.35], .169
Loss, corrected a	-0.32 [-0.74, 0.10], .137	-0.08 [-0.46, 0.30], .674	-0.35 [-0.77, 0.07], .106	-0.22 [-0.63, 0.20], .305
Lives alone	—	—	-0.15 [-0.54, 0.23], .430	—

Note. All continuous predictors and outcomes were standardized (z), so *β* is in outcome SD units. Δ symbol indicates that the outcome is a residualized change score (each Wave 4 outcome regressed on its Wave 3 value). Models additionally control for all covariates (gender, age, education, diabetes, hypertension, stroke, and living alone (for loneliness model only).

[a]No hearing loss is the reference.

Supplementary Files

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