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Hearing Aid Use and Its Associated Factors Among Older Adults in Mexico

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Abstract

Objective

To identify factors associated with current hearing aid (HA) use among Mexican adults aged 50 years and older who either use HAs, regardless of self-reported hearing, or do not use HAs but rate their hearing as fair or poor.

Materials and methods

We conducted a cross-sectional analysis of the 2021 Mexican Health and Aging Study (MHAS). The analytic sample included adults aged 50 years and older who reported current HA use or, if they did not use an HA, rated their hearing as fair or poor. Survey-weighted logistic regression accounting for sampling weights, strata, and primary sampling units was used to estimate odds ratios (ORs) and 95% confidence intervals (CIs).

Results

A total of 4,660 participants were included, representing a weighted analytic population of 8,024,133 individuals. Overall, 296 participants reported current HA use (unweighted 6.35%; weighted 5.35%, 95% CI: 4.27%-6.68%). Older age (OR 1.05 per year, 95% CI: 1.03-1.08), more years of education (OR 1.07 per year, 95% CI: 1.01-1.13), and belonging to the highest income tertile (OR 2.68, 95% CI: 1.42-5.06) were associated with greater odds of HA use. Rural residence (OR 0.46, 95% CI: 0.23-0.92) and poor vision or blindness (OR 0.26, 95% CI: 0.12-0.58) were associated with lower odds of use.

Conclusions

Current HA use was low among Mexican adults aged 50 years and older included in this analysis. Older age, more years of education, and higher income were associated with greater odds of HA use, whereas rural residence and poor vision or blindness were associated with lower odds. Further studies incorporating objective audiometric assessments are needed to better understand these associations and identify potential barriers to hearing rehabilitation in Mexico.

Categories: Otolaryngology, Geriatrics, Epidemiology/Public Health
Keywords: access to healthcare, hearing aid, hearing difficulty, hearing loss, older adult

Introduction

Hearing loss affects more than 1.5 billion people worldwide, of whom at least 430 million require rehabilitation [1]. According to the Global Burden of Disease estimates for 2021, the burden increases with age, with adults aged 50 years and older showing an estimated 64.3% prevalence of some degree of hearing loss [2]. Untreated hearing impairment has been associated with adverse cognitive, functional, social, and quality of life outcomes [3].

Hearing aids (HAs) are a central component of hearing rehabilitation, but their use remains limited. Despite their established benefits, approximately 17% of people who could benefit from HAs use them worldwide, and access is particularly limited in low- and middle-income settings [1]. HA use is associated with a range of sociodemographic, economic, health, and healthcare access factors [4].

Although several studies have examined factors associated with HA use, much of the evidence comes from high-income countries [5-12], whose healthcare systems and socioeconomic conditions differ from those in Mexico. Evidence from Latin America remains limited. Using data from the 2021 Mexican Health and Aging Study (MHAS), this study aimed to identify factors associated with current HA use among Mexican adults aged 50 years and older who either use HAs, regardless of self-reported hearing, or do not use HAs but rate their hearing as fair or poor.

Materials And Methods

Study design and participants

We conducted an observational, cross-sectional analytic study using data from the 2021 MHAS, a nationally representative longitudinal study of adults aged 50 years and older in Mexico and their spouses. The MHAS is partly sponsored by the National Institutes of Health/National Institute on Aging (NIH R01AG018016) in the United States and the Instituto Nacional de Estadística y Geografía (INEGI) in Mexico. Public-use data

and documentation are available through the MHAS website [13].

The MHAS protocol was approved by the Institutional Review Board of the University of Texas Health San Antonio (IRB ID: STUDY00000401), with approval covering all MHAS data waves. The present study used publicly available, de-identified data from the 2021 wave and involved no direct participant contact, intervention, or new data collection.

Data from the core survey, constructed variables, income, assets, and cognitive function datasets were merged using household, sub-household, and individual identifiers.

Participant selection is summarized in Figure *1*. Of 15,739 initial records, 23 were excluded because of incomplete record linkage. Additional exclusions were applied for proxy interviews, age younger than 50 years or missing age, participants who neither reported current HA use nor rated their hearing as fair or poor, nonresponse in sensory variables, and missing covariate data. Proxy interviews were excluded because the analysis relied on self-reported hearing and other subjective measures. The final complete-case analytic sample included 4,660 participants.

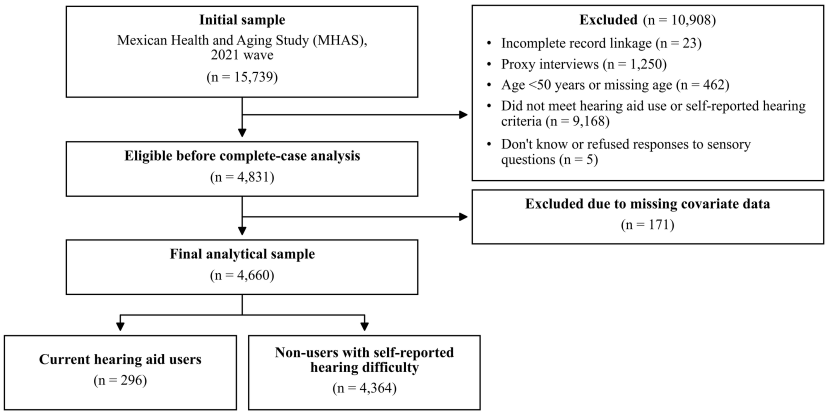


FIGURE 1: Participant Selection From the 2021 Wave of the Mexican Health and Aging Study (MHAS)

All counts are unweighted.

The analytic population consisted of current HA users and non-users reporting fair or poor hearing, the latter indicating potential hearing rehabilitation need. Current users were included regardless of self-reported hearing because MHAS assesses hearing in general, with an HA if normally used.

Dependent variable

The dependent variable was current HA use. Participants were classified as HA users if they reported currently using an HA or auditory device. Non-users were participants who did not use an HA and rated their hearing as fair or poor. Self-reported hearing difficulty was used as a proxy for potential unmet hearing rehabilitation need. It should not be interpreted as audiometrically confirmed hearing loss or formal HA candidacy.

Independent variables

Covariates were selected a priori based on the Andersen Behavioral Model of Health Services Use [14], previous literature, and the conceptual approach used by Assi et al. [6].

Predisposing characteristics included age, gender, education, living arrangement, vision, cognitive status, number of chronic conditions, depressive symptoms, technology use, loneliness, and limitations in activities of daily living (ADLs) and instrumental activities of daily living (IADLs). Enabling factors included income, assets, health insurance coverage, physician visits within the previous 12 months, and locality size.

Operationalization of variables

Age and years of education were modeled as continuous variables in the multivariable analysis. For descriptive analyses, age was categorized as 50-59, 60-69, 70-79, or ⩾80 years. Education was categorized as 0-5, 6-8, 9-11, 12-15, or ⩾16 years.

Self-reported vision was categorized as fair or better versus poor or legally blind. Cognitive status was dichotomized as dementia versus no dementia according to the MHAS constructed cognitive classification [15]. ADL and IADL limitations were each dichotomized as none versus one or more limitations.

Depressive symptoms were assessed using nine items derived from the Center for Epidemiologic Studies Depression Scale (CES-D) [16]. The MHAS-constructed indicator classifies participants reporting five or

more depressive symptoms as having elevated depressive symptoms [17]. The number of chronic conditions was obtained from the MHAS-constructed variable [17] and categorized as zero, one, two, or three or more. Loneliness was assessed using three MHAS items addressing lack of companionship, feeling ignored, and feeling isolated [17]. These items correspond conceptually to the three-item loneliness measure described by Hughes et al. [18]. Responses were summed to produce a score ranging from 3 to 9. For the present analysis, scores of 3-5 were classified as not lonely and scores of 6-9 as lonely.

Technology use indicated communication technology use, including talking on the telephone, sending messages, or using the web on a computer. Living arrangement was categorized as living with a partner versus unpartnered. Locality size was categorized as urban (⩾100,000 residents), semi-urban (2,500-99,999 residents), or rural (<2,500 residents).

Income and net assets were separately categorized into unweighted tertiles based on the linked dataset before applying the analytic sample restrictions. The lowest tertile was used as the reference category. According to MHAS documentation, total income is defined at the individual level, whereas total net assets are defined at the household level [19]. Health insurance coverage and physician visits within the previous 12 months were analyzed as binary variables.

Statistical analysis

Survey-based analyses accounted for the complex sampling design of the 2021 MHAS. Survey analyses used the individual sampling weight (factori_21), survey-design strata (est_dis_21), and primary sampling unit (upm_dis_21) specified by MHAS [20]. Subpopulation analyses retained the full survey design for variance estimation.

Unweighted frequencies and percentages were calculated for categorical descriptive characteristics, while unweighted means and standard deviations were calculated for continuous variables. Survey weights were used to estimate the analytic population size and the prevalence of HA use, including its 95% confidence interval (CI). Sample and population distributions were reported separately.

A multivariable survey-weighted logistic regression model was fitted to estimate adjusted ORs and 95% CIs. Age and education were entered as continuous variables, whereas categorical covariates were entered using indicator variables. Multicollinearity was assessed using variance inflation factors (VIFs). Statistical significance was defined as a two-sided p-value <0.05. Analyses were performed using Stata/BE 19.5 (StataCorp LLC, College Station, TX, USA).

Results

A total of 4,660 participants were included, representing a weighted analytic population of 8,024,133 individuals. The unweighted mean age was 68.91 ± 10.29 years, and 2,552 participants were female (54.76%). Overall, 296 participants reported current HA use (unweighted 6.35%; weighted 5.35%, 95% CI: 4.27%-6.68%). This prevalence estimate applies to the selected analytic population, not to all Mexican adults aged 50 years and older. The weighted analytic population included an estimated 428,959 HA users (95% CI: 330,334-527,584).

HA users were older than non-users, with unweighted mean ages of 73.33 ± 10.11 and 68.61 ± 10.24 years, respectively. HA users also had more years of education than non-users, with unweighted means of 6.77 ± 5.07 and 5.65 ± 4.29 years, respectively. Descriptive characteristics according to HA-use status are presented in Table *1*.

Characteristic	Total	Non-users	HA users
Sample size (unweighted)	4,660	4,364	296
Sample distribution (unweighted %)	100.00%	93.65%	6.35%
Population estimate (weighted)	8,024,133	7,595,174	428,959
Population distribution (weighted %)	100.00%	94.65%	5.35%
Age, mean (SD), years	68.91 (10.29)	68.61 (10.24)	73.33 (10.11)
Age group			
50-59 years	1,109 (23.80%)	1,070 (24.52%)	39 (13.18%)
60-69 years	1,315 (28.22%)	1,259 (28.85%)	56 (18.92%)
70-79 years	1,464 (31.42%)	1,344 (30.80%)	120 (40.54%)
≥80 years	772 (16.57%)	691 (15.83%)	81 (27.36%)
Female	2,552 (54.76%)	2,398 (54.95%)	154 (52.03%)
Education, mean (SD), years	5.72 (4.35)	5.65 (4.29)	6.77 (5.07)
Education category			

0-5 years	2,036 (43.69%)	1,915 (43.88%)	121 (40.88%)
6-8 years	1,345 (28.86%)	1,276 (29.24%)	69 (23.31%)
9-11 years	780 (16.74%)	727 (16.66%)	53 (17.91%)
12-15 years	270 (5.79%)	249 (5.71%)	21 (7.09%)
≥16 years	229 (4.91%)	197 (4.51%)	32 (10.81%)
Poor vision or blindness	531 (11.39%)	517 (11.85%)	14 (4.73%)
Dementia	323 (6.93%)	289 (6.62%)	34 (11.49%)
Number of chronic conditions			
No chronic conditions	1,429 (30.67%)	1,337 (30.64%)	92 (31.08%)
One chronic condition	1,633 (35.04%)	1,535 (35.17%)	98 (33.11%)
Two chronic conditions	1,177 (25.26%)	1,096 (25.11%)	81 (27.36%)
≥3 chronic conditions	421 (9.03%)	396 (9.07%)	25 (8.45%)
Elevated depressive symptoms	1,701 (36.50%)	1,610 (36.89%)	91 (30.74%)
≥1 ADL limitation	948 (20.34%)	887 (20.33%)	61 (20.61%)
≥1 IADL limitation	786 (16.87%)	730 (16.73%)	56 (18.92%)
Technology use	3,799 (81.52%)	3,558 (81.53%)	241 (81.42%)
Lonely	877 (18.82%)	827 (18.95%)	50 (16.89%)
Income tertile			
Lowest	1,710 (36.70%)	1,632 (37.40%)	78 (26.35%)
Middle	1,571 (33.71%)	1,468 (33.64%)	103 (34.80%)
Highest	1,379 (29.59%)	1,264 (28.96%)	115 (38.85%)
Assets tertile			
Lowest	1,558 (33.43%)	1,479 (33.89%)	79 (26.69%)
Middle	1,619 (34.74%)	1,530 (35.06%)	89 (30.07%)
Highest	1,483 (31.82%)	1,355 (31.05%)	128 (43.24%)
Health insurance	3,448 (73.99%)	3,192 (73.14%)	256 (86.49%)
Doctor visit in the previous 12 months	3,443 (73.88%)	3,215 (73.67%)	228 (77.03%)
Locality			
Urban	2,429 (52.12%)	2,231 (51.12%)	198 (66.89%)
Semi-urban	1,163 (24.96%)	1,100 (25.21%)	63 (21.28%)
Rural	1,068 (22.92%)	1,033 (23.67%)	35 (11.82%)
Living with a partner	2,977 (63.88%)	2,791 (63.96%)	186 (62.84%)

TABLE 1: Characteristics of the Analytic Sample According to Hearing Aid Use, MHAS 2021

Categorical characteristics are presented as unweighted frequencies and column percentages. Continuous variables are presented as unweighted means and standard deviations (SDs). Sample and population distributions are reported separately as unweighted and survey-weighted percentages, respectively. Population estimates account for sampling weights. The survey-weighted prevalence of HA use in the analytic population was 5.35% (95% CI: 4.27%-6.68%). Survey-weighted estimates account for the complex sampling design of the MHAS.

HA: hearing aid; CI: confidence interval; ADL: activities of daily living; IADL: instrumental activities of daily living; MHAS: Mexican Health and Aging Study

Results from the adjusted multivariable survey-weighted logistic regression model are presented in Table 2. Older age was associated with greater odds of HA use (OR 1.05 per year, 95% CI: 1.03-1.08; p<0.001). More years of education were also associated with greater odds of HA use (OR 1.07 per year, 95% CI: 1.01-1.13; p=0.032).

Variable	OR (95% CI)	p value
Age, per year	1.05 (1.03-1.08)	<0.001*
Female vs male	1.49 (0.87-2.56)	0.146
Living with a partner vs unpartnered	1.47 (0.89-2.45)	0.133
Poor vision or blindness	0.26 (0.12-0.58)	0.001*
Dementia	1.54 (0.56-4.21)	0.402
One chronic condition vs none	0.88 (0.50-1.54)	0.643
Two chronic conditions vs none	0.95 (0.53-1.68)	0.849
≥3 chronic conditions vs none	1.27 (0.51-3.17)	0.601
Elevated depressive symptoms	0.77 (0.46-1.31)	0.344
≥1 ADL limitation	1.33 (0.69-2.56)	0.399
≥1 IADL limitation	0.90 (0.32-2.50)	0.835
Technology use	1.41 (0.83-2.39)	0.200
Lonely	0.69 (0.38-1.25)	0.218
Education, per year	1.07 (1.01-1.13)	0.032*
Semi-urban vs urban	0.74 (0.42-1.30)	0.295
Rural vs urban	0.46 (0.23-0.92)	0.029*
Income, middle vs lowest tertile	1.86 (0.98-3.54)	0.057
Income, highest vs lowest tertile	2.68 (1.42-5.06)	0.002*
Assets, middle vs lowest tertile	1.33 (0.75-2.36)	0.336
Assets, highest vs lowest tertile	0.93 (0.48-1.82)	0.836
Health insurance	0.82 (0.40-1.68)	0.595
Doctor visit in previous 12 months	1.51 (0.83-2.77)	0.180

TABLE 2: Adjusted ORs for Current Hearing Aid Use, MHAS 2021

The model accounted for sampling weights, survey strata, and primary sampling units. Age and education were modeled continuously. An asterisk (*) indicates statistical significance (p<0.05).

OR: odds ratio; CI: confidence interval; ADL: activities of daily living; IADL: instrumental activities of daily living; MHAS: Mexican Health and Aging Study

Participants in the highest income tertile had greater odds of HA use than those in the lowest tertile (OR 2.68, 95% CI: 1.42-5.06; p=0.002). In contrast, rural residence was associated with lower odds of HA use compared with urban residence (OR 0.46, 95% CI: 0.23-0.92; p=0.029). Poor vision or blindness was also associated with lower odds of HA use (OR 0.26, 95% CI: 0.12-0.58; p=0.001).

No statistically significant independent associations were observed for gender, living arrangement, cognitive status, number of chronic conditions, elevated depressive symptoms, ADL limitations, IADL limitations, technology use, loneliness, health insurance, physician visits, or assets.

The overall adjusted model was statistically significant (F(22, 7838)=4.20; p<0.001). No evidence of problematic multicollinearity was identified (mean VIF=1.37; maximum VIF=2.09).

Discussion

Using data from a nationally representative survey, this study examined factors associated with current HA use among Mexican adults aged 50 years and older who reported current HA use regardless of self-rated hearing, or who did not use an HA and rated their hearing as fair or poor. Of the 4,660 participants included in the analytic sample, 296 (6.35%) reported current HA use, corresponding to a survey-weighted prevalence of 5.35% within this analytic population. This low level of use is consistent with cross-national evidence showing relatively low HA use in Mexico [21]. In the adjusted model, older age, more years of education, and higher income were associated with greater odds of HA use, whereas rural residence and poor vision or blindness were associated with lower odds of use.

Older age was independently associated with HA use, with each additional year associated with approximately 5% higher odds of use. Similar associations between age and HA use have been reported in

other populations [5,6,8-12]. However, another study found that age was no longer significantly associated with HA adoption after adjustment for hearing loss severity [7], suggesting that the observed association may partly reflect the greater burden of hearing impairment among older adults rather than age itself. Given the cross-sectional design, the mechanism underlying this association cannot be determined.

More years of education were independently associated with greater HA use. Each additional year of formal education was associated with approximately 7% higher odds of use. This finding is consistent with previous studies reporting greater HA use among individuals with higher educational attainment [6,9-11]. In a study of older adults in Chile, higher educational attainment was associated with greater self-efficacy in basic and advanced HA handling, while greater self-efficacy was also associated with better adherence to HA use [22]. The authors suggested that higher educational attainment may facilitate understanding of HA user manuals and improve device handling, which may help explain the association observed in our study.

Income was independently associated with HA use. Participants in the highest income tertile had approximately 2.7 times the odds of HA use compared with those in the lowest tertile. Financial barriers may contribute to lower HA use among individuals with fewer economic resources. The cost of HAs can represent a substantial barrier to hearing rehabilitation [8,11,23]. Associations between socioeconomic resources and HA use have also been reported in other populations [6-8,10,11].

Rural residence was associated with approximately 54% lower odds of HA use than urban residence. Rural disparities in hearing healthcare have been described in other settings [24,25]. Potential barriers include longer travel distances, fewer hearing care providers, lower awareness of available services, and transportation or affordability constraints [25]. These disparities may be particularly relevant in low- and middle-income countries, where geographic inequalities have been documented in the distribution of ear and hearing care professionals [26,27].

Poor vision or blindness was associated with approximately 74% lower odds of HA use. This finding is clinically relevant because concurrent hearing and visual impairment is common among older adults [28]. Visual impairment may lead to competing priorities and concerns about managing HAs [29]. Previous studies have also identified visual impairment as a correlate of lower HA use [6,12].

No statistically significant associations were observed for gender, number of chronic conditions, elevated depressive symptoms, cognitive status, ADL and IADL limitations, living arrangement, loneliness, assets, health insurance, technology use, or physician visits during the previous 12 months in the adjusted model. Previous studies have reported inconsistent associations for many of these factors [4-12]. Differences in population characteristics, healthcare systems, variable definitions, and analytical methods may explain some of this heterogeneity.

Strengths include the use of national survey data and an analysis that accounted for the complex sampling design and multiple relevant covariates. However, this study has several limitations. The relatively small number of participants reporting current HA use (n=296) may have reduced the precision of some estimates in the adjusted model. The exclusion of proxy interviews may have led to underrepresentation of individuals with cognitive or functional limitations who could not respond directly. Hearing difficulty was self-reported and was not confirmed by audiometry. Consequently, hearing loss severity could not be objectively assessed or accounted for in the adjusted model, potentially contributing to residual confounding. The analytic population therefore should not be interpreted as having audiometrically confirmed hearing loss or established HA candidacy. Previous population-based studies have documented discrepancies between self-reported hearing difficulty and audiometric findings [30]. Additionally, eligibility criteria differed between HA users and non-users, as current users were included regardless of their self-reported hearing status, whereas non-users were required to report fair or poor hearing. This approach allowed the inclusion of current users whose perceived hearing may have improved with HA use, but the differing eligibility criteria may have introduced selection bias and may limit comparisons with studies using audiometrically defined populations. Although the MHAS employs a nationally representative sampling design, these eligibility restrictions limit the generalizability of the weighted prevalence estimate. Complete-case analysis may have introduced further selection bias if missingness was not random. Moreover, the measure of current HA use did not capture previous or discontinued use or assess frequency of use. Finally, the cross-sectional design precludes causal inference.

Conclusions

Current HA use was low among Mexican adults aged 50 years and older included in this analysis. Older age, more years of education, and higher income were associated with greater odds of HA use, whereas rural residence and poor vision or blindness were associated with lower odds. These findings suggest that socioeconomic, geographic, and sensory factors may be relevant to HA use in this population. However, the cross-sectional design does not allow causal relationships to be established. Further studies incorporating objective audiometric assessments are needed to better understand these associations and identify potential barriers to hearing rehabilitation in Mexico.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. Institutional Review Board Office, University of Texas Health San Antonio issued approval STUDY00000401. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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