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Association Between Hearing Aid Use and Health Care Use and Cost Among Older Adults With Hearing Loss

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IMPORTANCE Hearing loss (HL) is common among older adults and is associated with poorer health and impeded communication. Hearing aids (HAs), while helpful in addressing some of the outcomes of HL, are not covered by Medicare.

OBJECTIVE To determine whether HA use is associated with health care costs and utilization in older adults.

DESIGN, SETTING, AND PARTICIPANTS This retrospective cohort study used nationally representative 2013-2014 Medical Expenditure Panel Survey data to evaluate the use of HAs among 1336 adults aged 65 years or older with HL. An inverse propensity score weighting was applied to adjust for potential selection bias between older adults with and without HAs, all of whom reported having HL. The mean treatment outcomes of HA use on health care utilization and costs were estimated.

EXPOSURES Encounter with the US health care system.

MAIN OUTCOMES AND MEASURES (1) Total health care, Medicare, and out-of-pocket spending; (2) any emergency department (ED), inpatient, and office visit; and (3) number of ED visits, nights in hospital, and office visits.

RESULTS Of the 1336 individuals included in the study, 574 (43.0%) were women; mean (SD) age was 77 (7) years. Adults without HAs (n = 734) were less educated, had lower income, and were more likely to be from minority subpopulations. The mean treatment outcomes of using HAs per participant were (1) higher total annual health care spending by $1125 (95% CI, $1114 to $1137) and higher out-of-pocket spending by $325 (95% CI, $322 to $326) but lower Medicare spending by $71 (95% CI, −$81 to −$62); (2) lower probability of any ED visit by 2 percentage points (PPs) (24% vs 26%; 95% CI, −2% to −2%) and lower probability of any hospitalization by 2 PPs (20% vs 22%; 95% CI, −3% to −1%) but higher probability of any office visit by 4 PPs (96% vs 92%; 95% CI, 4% to 4%); and (3) 1.40 more office visits (95% CI, 1.39 to 1.41) but 0.46 (5%) fewer number of hospital nights (95% CI, −0.47 to −0.44), with no association with the number of ED visits, if any (95% CI, 0.01 to 0).

CONCLUSIONS AND RELEVANCE This study demonstrates the beneficial outcomes of use of HAs in reducing the probability of any ED visits and any hospitalizations and in reducing the number of nights in the hospital. Although use of HAs reduced total Medicare costs, it significantly increased total and out-of-pocket health care spending. This information may have implications for Medicare regarding covering HAs for patients with HL.

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Hearing loss (HL) is estimated to affect two-thirds of adults older than 70 years and is associated with worse health care professional-patient communication, more frequent hospitalization, more social isolation, functional declines, and falls.[1-4] With the aging population expected to increase to 98 million individuals by 2040, the need to address HL and issues associated with use of and access to hearing aids (HAs) continues to grow.[1,5,6] Poor communication adversely affects many health outcomes, including patient satisfaction, treatment adherence, use of health services, education regarding healthy behaviors, and medical costs.[7-12] Hearing loss represents a major source of poor health care communication that can potentially affect delivery of health care.[13] Hearing aids have been shown to reduce communication barriers and disability-related outcomes of HL.[14,15]

In addition, HL affects individual finances as well as health and well-being.[16] Medical expenditures associated with self-reported HL in individuals aged 65 years or older in the United States totaled approximately $3.1 billion in 2010.[17] Medicare and many private insurers, however, do not cover routine hearing examinations, HAs, or fitting examinations.[18] The Over-the-Counter Hearing Aid Act recently signed into law[19] created some regulations regarding over-the-counter HAs for people with hearing difficulty. Although this law is a positive move, the large price associated with the purchase, adjustment, and maintenance of this assistive technology and the lack of coverage of it by either private or public health insurance may keep people from using HAs. In the United States, only 14% of adults aged 50 years or older with HL use HAs.[18] Insurance plans that include HA packages often have minimal coverage, which leaves people pursuing HA remedies with substantial out-of-pocket costs.[20] Research shows that older adults with HL experience more hospitalization than those without hearing difficulties.[21] Whether use of HAs would help to reduce emergency department (ED) visits and hospitalizations for older adults with HL is not known. In addition, owing to the high cost of HAs, the association of HA use and out-of-pocket and total health care spending is not clear.

The purpose of this study is to examine the mean treatment outcomes of HA use on health service cost and use. We hypothesized that use of HAs reduces hospitalizations and ED visits and increases out-of-pocket costs for patients with HL. The findings from this study will have policy implications for payers, particularly Medicare, and policymakers in their decisions regarding HA coverage for patients with HL.

Key Points

Question Is the use of hearing aids associated with the probability of hospitalizations and emergency department visits as well as health care use and spending among older people with self-reported hearing loss?

Findings In this cohort study of nationally representative data from 1336 US Medicare beneficiaries who reported hearing loss, self-reported use of hearing aids was associated with reducing any visits to the emergency department and hospitalizations, both by means of 2 percentage points. Use of hearing aids increased the number of office visits, if any, by 1.40 days and reduced the number of nights in the hospital, if any, by 0.46 nights; hearing aids also increased total health care spending by $1125 and out-of-pocket costs by $325 but decreased Medicare spending by $71.

Meaning This information might be useful for the Centers for Medicare & Medicaid in deciding on insurance coverage of hearing aids for older adults with hearing loss.

Methods

Data Source

We performed a retrospective study using 2013-2014 data from the Medical Expenditure Panel Survey (MEPS), a nationally representative sample of noninstitutionalized individuals in the United States.[22] The Agency for Healthcare Research and Quality collects, verifies, and manages data for MEPS. We used the MEPS Household Component files. At the time of data analysis, 2014 was the last year for which data were available. MEPS provides data that are publicly available and cannot be tracked to humans. Therefore, our study was exempt from review by an institutional review board and was approved by the University of Michigan.

Patient Selection

We selected all people aged 65 years or older who self-reported having hearing loss (eFigure 1 in the Supplement). Our original sample included 1360 individuals with positive values for the person weight variable—provided by the Agency for Healthcare Research and Quality—who responded yes to whether they had serious difficulty hearing.[23] Among those, 612 individuals responded yes to a query on whether they used an HA.[23] After excluding individuals with missing values (24 patients [1.8%]), our final sample included 1336 individuals, 602 of whom used HAs and 734 of whom did not.

Dependent and Explanatory Variables

Our outcomes of interest were the mean annual treatment outcomes of using HAs on (1) total, out-of-pocket, and Medicare expenses; (2) any hospitalizations, any visits to the ED, and any office visits; and (3) number of nights hospitalized, number of ED visits, and number of office visits, if any. We adjusted our regression models for age, sex, race/ethnicity, marital status, any physical limitations, presence of certain chronic conditions, interview language, region of the country, educational level, and federal poverty level. Objective audiometric data are not available in MEPS and, therefore, we could not control for the degree and type of hearing loss.

Age was measured as a continuous variable in years (range, 65-85 years). We also included square of age in our models to account for nonlinear outcomes of age on use of HAs rather than assuming a constant association for all ages (eFigure 2 in the Supplement). Sex (male/female); marital status (married/unmarried); physical limitations based on any self-reported difficulty with standing, walking, climbing stairs, bending, reaching, and grasping; whether the individual was ever diagnosed with any of 10 chronic conditions (hypertension, any heart disease [including coronary heart disease, angina, myocardial in-

farction, and other heart diseases], stroke, emphysema, high cholesterol levels, cancer, diabetes, joint pain, arthritis, and asthma); and interview language (English/other) were dichotomous variables. We also controlled for race/ethnicity (white, Hispanic, African American, Asian, other minority, or mixed race), educational attainment (less than high school, high school diploma or general educational development, some college education, and college degree), and residential region (Northeast, Midwest, South, and West) as categorical variables. Finally, household income was measured according to the federal poverty level (FPL). We used 5 mutually exclusive categories (poor [<100% of the FPL], near poor [100%-124% of the FPL], low income [125%-199% of the FPL], middle income [200%-399% of the FPL], and high income [≥400% of the FPL]).

Statistical Analysis

We examined the mean treatment outcomes[24] of using HAs on use and costs of health care services, particularly hospitalizations, ED visits, and office visits. Mean treatment outcome is a counterfactual analysis estimating the adjusted estimated difference in an outcome variable, such as total costs of health care or any hospitalization, assuming that everyone in the population of interest uses the treatment option vs assuming that no one in the population of interest uses it.[25] This method provides a mechanism to estimate causal inferences for observational data to examine the outcome of a treatment option.[26-28] Our target population was older adults (aged ≥65 years) who reported having difficulty hearing. The treatment option was self-reported use of HAs. First, we used mean treatment outcome without any adjustments (eFigures 3-5 in the Supplement). Second, to adjust for potential selection bias between older adults who use and do not use HAs, we applied an inverse propensity score weighting.[29] We used all independent variables (**Table 1**) to estimate an inverse probability of treatment weighting to generate a synthetic distributional equivalence of older adults with and without HA (eTables 1 and 2 in the Supplement).[30] We assessed and confirmed the balance in covariates between those with and without HA by computing standardized differences (eTable 3 and eFigure 6 in the Supplement).[31] Percent changes were calculated as (with HA − without HA) / without HA • 100. Percentage points (PPs) were calculated as percent of individuals with HA − percent of those without HA.

Finally, we used the *teffects* command in Stata,[24] applying ordinary least-square, binary, and Poisson distributions for estimating cost, any use of services, and number of services used, respectively (**Figure 1**, **Figure 2**, and **Figure 3**). Because not all distributions are available via the *teffects* command, as a sensitivity analysis, we also ran a series of regression analyses to estimate the outcomes of HAs manually. We used a generalized linear model[32] with γ distribution for our cost outcomes, logistic distribution for our binary outcomes, and negative binomial distribution for our count outcomes (eFigures 7-9 in the Supplement).[33] To measure the SEs for these estimations, we replicated our entire sample 100 times (with replacement), using a bootstrapping procedure for the case of complex survey design.[34] Throughout the process, we adjusted for the survey design of MEPS and weighted all estimates using Agency for Healthcare Research and Quality-supplied weights. Conducting the analysis manually with different adjustments and distributions showed similar results. We used Stata, version 15 (StataCorp) for all analyses. Findings were significant at $\alpha = .05$ determined with 2-tailed, paired testing.

Results

In a sample of 1336 older adults with self-reported HL, 734 (54.9%) were not using any HA devices (Table 1). The mean (SD) age was 77 (7) years, with individuals using HAs being a mean of 2 years older (95% CI, 1.23 to 3.23 years) than those not using HAs; 574 (43.0%) were women. A higher percentage of white compared with African American and Hispanic individuals reported using HAs. For example, white persons had 11 PPs more of HA use (91% vs 80%; 95% CI, 6% to 14%). Lower percentages of African American (4% vs 8%; 95% CI, −6% to −2%) and Hispanic (2% vs 7%; 95% CI, −7% to −3%) individuals reported using HAs. Despite being older, a lower percentage of people who reported using HAs had hypertension (by 8 PPs; 95% CI, −14% to −1%) and diabetes (by 7 PPs; 95% CI, −13% to −1%).

There were substantial geographic and socioeconomic variations between the 2 groups, with a higher percentage of educated and affluent people reporting use of HAs. For example, a higher percentage of people with English fluency, compared with those without, used HAs (97% vs 95%; 95% CI, 1% to 4%). Compared with the other 3 regions, a higher percentage of people who lived in the South did not use HAs (43% vs 35%; 95% CI, −15% to −1%). In addition, a lower percentage of people without a high school diploma (18% vs 30%; 95% CI, −18% to −6%) but a higher percentage of people with a college degree (25% vs 20%; 95% CI, 0% to 12%) used HAs. Similarly, a lower percentage of people who were poor (8% vs 12%; 95% CI, −7% to 0%) or had a low income level (14% vs 19%; 95% CI, −11% to 0%) vs a higher percentage of people with a high income level (40% vs 31%; 95% CI, 2% to 16%) reported using HAs.

Nationally representative, unadjusted means of the outcomes of interest are presented in **Table 2**. Total annual out-of-pocket spending among older adults with HAs was $534 ($1997 vs $1463; 95% CI, $94-$973) higher than out-of-pocket spending among those without. Ninety-eight percent of older adults with HAs compared with 93% of those without HAs had at least 1 office visit over a year (95% CI, 2%-7%). Also, older adults with HAs compared with those without HAs had 2 additional annual office visits (15 vs 13; 95% CI, 0.86-4.57).

Mean adjusted estimated treatment outcomes of using HAs on 3 different cost measures are shown in Figure 1. For an older adult with self-reported HL, the mean treatment outcome of HA use on total health care costs was an additional $1125 (95% CI, $1114 to $1137). Although the use of HAs increased annual out-of-pocket expenditures by $325 (95% CI, $322 to $326), it reduced total Medicare expenditures by only $71 (95% CI, −$81 to −$62).

Table 1. Nationally Representative Characteristics of Adults 65 Years or Older With Self-reported Hearing Loss[a]

Patient Characteristic	% (95% CI)			
		Hearing Aids		
	Total	Without	With	Difference
No. of patients	1336	734	602	
Age, mean, y[b]	77 (76 to 78)	76 (75 to 77)	78 (77 to 79)	2 (1.23 to 3.23)[c]
Women	43 (39 to 46)	45 (40 to 50)	40 (35 to 45)	−5 (−12 to 2)
Married	53 (49 to 58)	50 (45 to 56)	56 (51 to 62)	6 (−0.01 to 0.13)
Race/ethnicity				
White	85 (83 to 88)	80 (77 to 83)	91 (88 to 93)	11 (6 to 14)[c]
African American	6 (5 to 7)	8 (6 to 10)	4 (2 to 6)	−4 (−6 to −2)[c]
Hispanic	5 (4 to 6)	7 (6 to 10)	2 (2 to 4)	−5 (−7 to −3)[c]
Asian	2 (1 to 3)	2 (1 to 3)	2 (1 to 3)	0 (−1 to 1)
Other/mixed race	2 (1 to 3)	3 (1 to 5)	1 (1 to 3)	−2 (−3 to 1)
Physical limitation	65 (61 to 69)	66 (61 to 71)	65 (59 to 70)	−1 (−8 to 6)
Hypertension	76 (72 to 79)	79 (75 to 84)	72 (67 to 77)	−8 (−14 to −1)[c]
Any heart problem	49 (45 to 53)	48 (43 to 52)	51 (44 to 57)	3 (−5 to 10)
Stroke	20 (17 to 23)	22 (18 to 26)	19 (15 to 24)	−3 (−9 to 4)
Emphysema	9 (7 to 12)	10 (7 to 13)	8 (6 to 11)	−2 (−5 to 2)
High cholesterol level	69 (66 to 73)	70 (66 to 74)	69 (64 to 74)	0 (−7 to 6)
Cancer	36 (32 to 40)	35 (30 to 40)	38 (32 to 43)	3 (−4 to 10)
Diabetes	26 (23 to 30)	30 (25 to 34)	23 (18 to 28)	−7 (−13 to −1)[c]
Arthritis	69 (65 to 72)	66 (61 to 70)	72 (67 to 76)	6 (−1 to 13)
Asthma	9 (7 to 12)	10 (7 to 13)	9 (6 to 12)	−1 (−4 to 3)
English language	96 (95 to 97)	95 (93 to 96)	97 (96 to 99)	2 (1 to 4)[c]
Region				
Northeast	17 (14 to 20)	16 (12 to 20)	18 (14 to 23)	2 (−4 to 7)
Midwest	22 (19 to 27)	20 (16 to 25)	25 (19 to 30)	5 (−2 to 10)
South	39 (35 to 43)	43 (38 to 48)	35 (29 to 41)	−8 (−15 to −1)[c]
West	22 (19 to 25)	21 (17 to 25)	23 (18 to 28)	2 (−4 to 8)
Education				
Less than high school	24 (22 to 28)	30 (26 to 35)	18 (15 to 22)	−12 (−18 to −6)[c]
High school or GED	29 (25 to 32)	27 (23 to 32)	30 (25 to 36)	3 (−4 to 10)
Some college/other	24 (21 to 28)	22 (18 to 27)	26 (22 to 31)	4 (−2 to 9)
Undergraduate/graduate	23 (20 to 26)	20 (16 to 24)	25 (21 to 30)	5 (0 to 12)[c]
FPL[d]				
Poor	11 (8 to 13)	12 (10 to 15)	8 (7 to 12)	−4 (−7 to 0)[c]
Near poor	7 (6 to 10)	8 (6 to 11)	7 (4 to 10)	−1 (−5 to 2)
Low income	17 (14 to 19)	19 (16 to 24)	14 (11 to 18)	−5 (−11 to 0)[c]
Middle income	30 (27 to 33)	29 (26 to 33)	31 (27 to 35)	2 (−4 to 7)
High income	35 (32 to 39)	31 (26 to 36)	40 (35 to 45)	9 (2 to 16)[c]

Abbreviations: FPL, federal poverty level; GED, general educational development.

[a] Source: The 2013-2014 Medical Expenditure Panel Survey, Household Component Files.[22]

[b] Age is a continuous variable; therefore, we provided the mean instead of the percentage.

[c] Significant at α = .05.

[d] Poor, less than 100% of the FPL; near poor, 100% to 124%; low income, 125% to 199%; middle income, 200% to 399%; and high income, 400% or more.

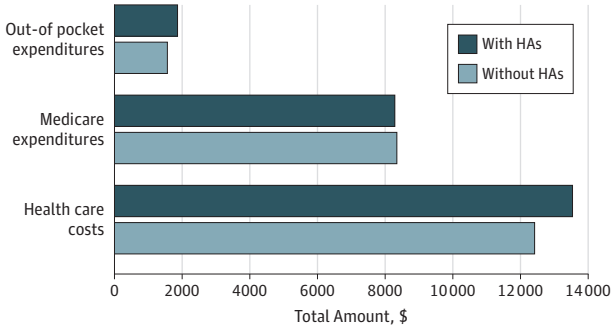
Figure 2 shows the mean adjusted estimated treatment outcomes of using HAs on at least 1-time use of health services. Use of HAs increased any office visits by 4 PPs (96% vs 92%; 95% CI, 4% to 4%) but decreased the likelihood of a visit to the ED by 2 PPs (24% vs 26%; 95% CI, −2% to −2%) and an inpatient stay in the hospital by 2 PPs (20% vs 22%; 95% CI, −3% to −1%).

For those who had at least 1 office visit (n = 1286) (Figure 3), use of HAs increased the number of office visits by 1.40 (10%) days (15.05 vs 13.65 days; 95% CI, 1.39 to 1.41). For those who were hospitalized (n = 288), use of HAs reduced the number of nights in the hospital by 0.46 (5%) nights (95% CI, −0.47 to −0.44). For those who visited the ED at least once (n = 359), use of HAs had no association with the number of visits (1.70 vs 1.69; 95% CI, 0.01 to 0).

Discussion

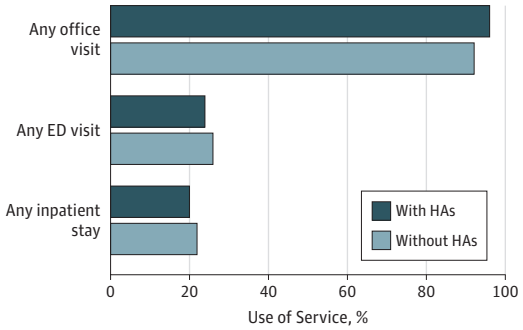
This study underlined 3 key findings pertaining to the adjusted estimated mean treatment outcomes of using HAs among older adults who reported having HL. First, use of HAs increased mean out-of-pocket and total health care costs by $325 and $1125, respectively. Second, their use increased any office visit by 4 PPs and reduced any ED visit and any hospitalization each by 2 PPs. Finally, for individuals who used the

Figure 1. Adjusted Estimated Mean Treatment Outcome of Hearing Aids (HAs) on Health Care Costs



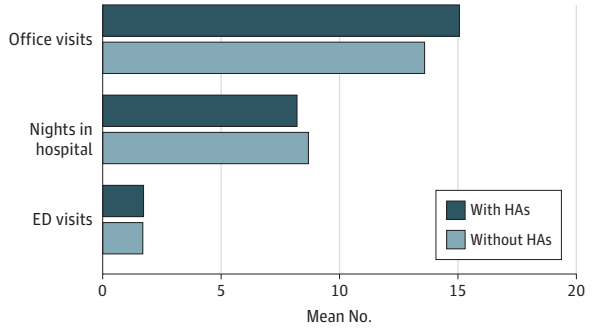
Data obtained from the 2013-2014 Medical Expenditure Panel Survey, Household Component File.[22] All differences are significant at α = .05.

Figure 2. Adjusted Estimated Mean Treatment Outcome of Hearing Aids (HAs) on Any Use of Health Care Services



Data obtained from the 2013-2014 Medical Expenditure Panel Survey, Household Component File.[22] Results are based on manually estimating the treatment outcomes of HAs on cost, using generalized linear models with a logistic distribution. All differences are significant at α = .05. Percent change is calculated as (with HA − without HA) / without HA • 100. Percentage points are calculated as percent of individuals with HA − percent of those without HA. ED indicates emergency department.

Figure 3. Adjusted Estimated Mean Treatment Outcome of Hearing Aids (HAs) on Number of Health Care Services Used, if Any



Data obtained from the 2013-2014 Medical Expenditure Panel Survey, Household Component File.[22] Results are based on manually estimating the treatment outcomes of HAs on cost, using generalized linear models with a negative binomial distribution. Differences in office visits and nights in the hospital are significant at α = .05. Percent change is calculated as (with HA − without HA) / without HA • 100. ED indicates emergency department.

corresponding services at least once, using HAs increased the number of office visits by 1.4 visits (9%) and reduced the number of nights in the hospital by 0.46 nights (5%), with no association with the number of visits to the ED.

Hearing loss is the third most prevalent chronic condition among older adults[35,36] and is linked to a wide range of adverse social and medical conditions.[35-38] Given that hypertension and diabetes are associated with an increased risk of HL,[39-41] our findings indicating a lower prevalence of these conditions among individuals with HAs may suggest a healthier and more active life style among this population. The National Academy of Sciences, Engineering, and Medicine recently issued a report on hearing health care for adults that outlines recommendations on improving the accessibility and affordability of hearing health care, including HAs.[42] Despite their documented benefits,[43-46] HAs are not covered by most insurance plans and the prevalence of their use is low.[47] In addition, large disparities in the use of HAs exist, with greater use among white individuals and those with higher incomes and more education compared with racial/ethnic minorities and individuals of lower socioeconomic status.[17,48,49] Variation in the use of HAs is a multidimensional issue associated not only with barriers to access (location of audiologists or multiple points of contact [family physicians, audiologists, hearing aid specialists]) for screening and testing and affordability of the HAs[20] but also likely with some social and cultural differences in the use of HAs between white individuals and racial/ethnic minorities.[49,50]

The market for HAs is dominated and controlled by a handful of companies.[51] Thus, owing to patients' limited options because of restrictive contractual agreements between insurers and manufacturers, prices of HAs remain substantially high.[52] In 2014, for example, the mean cost for a pair of fitted HAs ranged between $2200 and $7000.[47]

Insurance coverage can reduce the financial barriers that are associated with HAs. Despite evidence demonstrating the benefits of HAs among individuals with HL,[53,54] Medicare—the main health insurance provider for people aged 65 years or older—does not cover the cost of purchasing or maintaining HAs.[47] If a health care professional orders a hearing test as part of a medical evaluation or to determine the appropriate treatment, the cost associated with initial testing is covered by Medicare; otherwise, Medicare does not cover the initial hearing test.[55] Furthermore, even if the hearing test is covered, Medicare does not cover additional costs associated with HAs, including the price of the device, a visit to a specialist to fit the device, or an annual evaluation visit for adjusting the device.[56] Some Medicare Advantage plans may offer limited HA coverage,[57] and some Medicare beneficiaries use supplemental insurance; however, people with HL usually pay out of pocket for most, if not all, of the cost.[55] Medicaid coverage of HAs is also not federally mandated: 28 states offer some coverage and the other 22 states have no coverage.[48] As for private insurance, although a few states (ie, Arkansas, Connecticut, New Hampshire, and Rhode Island) mandate coverage of HAs for both children and adults, benefits offered by insurers are limited.[58]

The association between use of HAs and health care spending may be explained by its diverging association with the use

Table 2. Unadjusted Data of Nationally Representative Health Care Costs and Use Outcomes Among Older People With Self-reported Hearing Loss[a]

Patient Characteristic	Total	Hearing Aids		Difference (95% CI)
		Without	With	
No. of patients	1336	734	602	
Total cost, mean (SD), $				
Health care	12 839 (20 478)	12 254 (20 254)	13 435 (20 082)	1181 (−1247 to 3609)
Out of pocket	1727 (4448)	1463 (4792)	1997 (4098)	534 (94 to 973)[b]
Medicare	8293 (169 50)	8269 (17 000)	8317 (16 793)	48 (−1928 to 2024)
Any hospitalization, % (95% CI)	21 (19 to 24)	21 (17 to 24)	22 (18 to 26)	1 (−4 to 6)
Any ED visits, % (95% CI)	26 (23 to 29)	26 (22 to 31)	25 (21 to 30)	−1 (−7 to 4)
Any office visits, % (95% CI)	95 (93 to 96)	93 (90 to 95)	98 (95 to 99)	5 (2 to 7)[b]
Health care intervention, No. (SD)				
Hospitalization	1.60 (7.00)	1.80 (8.85)	1.39 (4.82)	−0.41 (−1.16 to 0.34)
ED visits	0.45 (1.21)	0.47 (1.35)	0.42 (1.07)	−0.05 (−0.18 to 0.08)
Office visits	14 (17.61)	13 (19.20)	15 (15.86)	2.71 (0.86 to 4.57)[b]

Abbreviation: ED, emergency department.

[a] Source: The 2013-2014 Medical Expenditure Panel Survey, Household Component Files.[22]

[b] Significant at α = .05.

of different health care services. Research has shown an association between HL and a higher risk of hospitalization and longer hospital stays.[1] Hospitalization and ED visits are among the most expensive health care services in the United States. They have also been shown to be positively associated with disease burden and negatively associated with quality of life, especially among patients with HL.[59] Our study shows positive results of HA use on increasing the number of office visits and reducing hospitalization and any ED visits among patients with self-reported HL. However, we did not examine the causes of these visits and whether they might differ between individuals with and without HAs. It may be that reductions in the use of this type of service reflect fewer critical incidents, such as falls, that require urgent and immediate intervention. Alternatively, because ED visits and unplanned hospitalizations have been associated with less access to a regular source of primary care,[60] it may be that the differences in ED visits and hospitalization between older adults with self-reported HL who do or do not use HAs reflect variations in patterns of health care use. It is also plausible that individuals who use HAs are willing to spend more on preventable health care services.

Our results indicate that patients who reported using HAs had higher numbers of office visits and lower probability of ED visits or hospitalizations. People who use HAs need to be tested by a specialist, and their hearing devices need to be fitted regularly.[61] Perhaps owing to better communication, patients with HAs are more aware of their well-being and health conditions and are more likely to request primary or specialty care visits as needed.[62,63] Although the specific association between the increase in office visits and decrease in probability of ED and inpatient visits was not examined in this study, improvement in physician-patient communication, better understanding of and adherence to recommended treatments, and therefore better awareness of preventive care may explain the outcomes of HA use on the differing use of health care services.[64]

Limitations

This study had a few limitations. First, because MEPS is a self-reported survey, we had no objective measure of an individual's degree of HL. The survey question asks whether a person has any hearing difficulty, and a self-reported HL to one person might not be considered a serious condition by another. Although the literature shows a correlation between self-reported HL and audiometric measures of hearing,[65-67] the association might vary by age, sex, and race/ethnicity.[68] Furthermore, older and white individuals with severe HL are more likely to use HAs.[3] We applied inverse propensity score weighting to adjust for differences in the baseline characteristics of older adults with and without HAs; the differences, however, may not be captured in our covariates. For example, the same characteristics that may lead someone to purchase HAs may lead the same individual to seek more care in general.

Second, for people who self-reported using HAs, we could not control for the type and number of their hearing devices and whether they used them consistently. There is a wide range of HA devices on the market. Hearing-assistive devices, some of high quality, designed for mild to moderate HL are available over the counter and are relatively inexpensive; HAs, however, are more sophisticated, better fit to patients with HL, and more expensive.[69] Finally, we used cross-sectional data for this analysis. Analyzing the results of HA use longitudinally would provide more granular estimations of health care use and cost. The cost-effectiveness of these devices is an important subject for future study.

Conclusions

Our study examined the mean treatment outcomes of HAs on total and out-of-pocket costs of health care and the use of different health care services. Our results indicate higher total and out-of-pocket costs among patients using HAs, lower probabilities of any ED visits and hospitalizations, fewer hospital nights, and a greater number of office visits.

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Invited Commentary

Hearing Aid Use and Health Care Costs Among Older Adults

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A number of studies have attempted to quantify the cost of hearing loss, including ones using the same data source but an earlier time.[1] A systematic review that summarized many of these findings documented the financial results of hearing loss, but also highlighted the variability across studies and lack of standardization of how hearing loss is defined when using large data sets.[2] Fewer data are available, however, on whether the use of hearing aids (HAs) mitigates, attenuates, or contributes to these costs.

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Given the lack of data, the increasing numbers of older adults who might benefit from the use of HAs and the current lack of health care coverage for hearing health care, Mahmoudi et al[3] is exploring an important topic in this issue of *JAMA Otolaryngology–Head and Neck Surgery*. Elucidating the outcomes of HA use on health care costs could provide valuable data for those designing health care policy. The findings are interesting, yet raise a number of issues that could inform data interpretation as well as highlight additional research priorities.

Mahmoudi and colleagues[3] use the Medical Expenditure Panel Survey data to identify adults aged 65 years or older who reported severe difficulty with hearing and divide this group into those who did or did not report having a HA. Given the criteria used for hearing loss, it is less surprising that the rate of HA use (45.1%) is higher than the rates reported in most studies because, as the authors acknowledge, HA use becomes more prevalent with age and in those with more severe hearing loss. The mean age of the study population was 77 years. This selection criterion may also have affected the findings, as the overall use of health care services for concurrent conditions in both those with and without HAs may attenuate any potentially positive results of using a HA. Furthermore, although a decrease in Medicare spending in the HA group is noted, the data suggest only a modest difference in Medicare expenditure between the 2 groups because there is no comparative baseline.

However, what appears to be most salient in the findings is the disparities across geographic regions and minority groups. These differences further support prior data documenting that