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Satisfaction with Quality of Health Care among Medicare Beneficiaries with Functional Hearing Loss

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Abstract

Background/Objectives: Nearly 38 million Americans have hearing loss. Understanding how sensory deficits such as hearing loss, which limit communication, impact satisfaction has implications for Medicare value-based reimbursement mechanisms. The aim of this study was to characterize the association of functional hearing loss and dissatisfaction with quality of health care over the past year among Medicare beneficiaries.

Methods: Cross-sectional study of satisfaction with quality of health care among Medicare beneficiaries with self-reported trouble hearing from the 2015 Medicare Current Beneficiaries Survey. There were 11,441 Medicare beneficiaries representing a 48.6 million total weighted nationally-representative sample.

Results: Forty-eight percent of Medicare beneficiaries reported a little or a lot of trouble hearing. Medicare beneficiaries with a little trouble hearing (Odds Ratio [OR] = 1.496; 95% Confidence Interval [CI] = 1.079–2.073; P=0.016) and a lot of trouble hearing (OR = 1.769; 95% CI = 1.175–2.664; P=0.007) had 49.6% and 76.9% higher odds of being dissatisfied with the quality of their health care over the previous year, respectively.

Conclusions: Medicare beneficiaries with functional hearing loss had higher odds of dissatisfaction with health care over the past year compared to those without functional hearing loss. Given Medicare's reliance on patient satisfaction as a value-based measure for hospital reimbursement, interventions to address hearing loss in the health care system are needed.

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Introduction

Satisfaction with care is a universal goal across the health care system. As articulated in the Institute of Medicine's Quality Chasm Report, communication is at the heart of patient satisfaction and is fundamental to the delivery of patient-centered care that respects the preferences, needs, and values of an individual.[1–3] Satisfaction with care and patient-provider communication have previously been associated with important health care outcomes such as treatment adherence, medication errors, and 30-day readmissions.[4–8] Moreover, effective communication is vital to important information exchange, such as obtaining complete and accurate history and delivering diagnosis and/or treatment plans. Importantly, since 2012, the Centers for Medicare and Medicaid Services (CMS) have included patient satisfaction scores in their value-based payment models for reimbursing hospitals with four of the eight key measurable areas related to patient-provider communication.[9,10]

Hearing loss limits a patient's ability to engage in oral communication and has a negative impact on patient-provider communication.[11] This could be compounded by the difficult (i.e. noisy) listening environment in many medical settings as even adults with more mild hearing loss tend to experience exacerbated difficulty understanding speech in noise.[12] Despite hearing loss' impact on effective communication, it is often ignored in patient-provider communication literature[13]; however, studies that do include hearing loss in patient-provider analyses suggest it is associated with negative perceptions of patient-provider communication.[14]

Although traditionally viewed as a benign and common aspect of aging, hearing loss has recently emerged as a public health concern. Estimates place the number of Americans with hearing loss at approximately 38 million and prevalence increases with age such that two-thirds of adults over the age of 70 have hearing loss.[15,16] Given demographic aging trends in the United States, the number of adults with hearing loss is expected to double by the year 2060.[17] Importantly, hearing loss has been independently associated with negative markers of aging such as cognitive decline, dementia, and falls.[18–20] Further, hearing loss is associated with negative health care utilization outcomes including increased overall health care spending, higher rates of 30-day readmission, and longer length of stay, which could be mediated, in part, by patient-provider communication. [21]

There is a paucity of research examining hearing loss and satisfaction with medical care. One study of 2004 Medicare Current Beneficiary Survey (MCBS) identified that difficulty communicating on a telephone was associated with less satisfaction with care. Even for those without hearing loss, telephone use is a potentially difficult task given factors such as strength of teleconnection and loss of visual input. In addition, in that study perceived hearing trouble was not associated with less satisfaction with care.[22] Since that study, the number of Americans on Medicare has swelled from 41.7 million to 55.5 million as the number of Americans over the age of 65 continues to increase.[23] Concurrently, the absolute number of Americans with hearing loss has increased due to hearing loss' close correlation with age.[16, 17] More recently, a small pilot study of 250 persons revealed objectively measured hearing loss was associated with satisfaction with care. However, this study's

generalizability was limited by the small sample size and highly homogenous population of a small town in western Maryland.[24]

An updated understanding of the impact of hearing loss on satisfaction with the quality of care has implications for future health care planning, service delivery models, and spending given CMS' recent shift towards incorporating patient reported satisfaction in reimbursement models. Specifically, the implementation of the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey, which includes questions on satisfaction with communication with nurses and doctors, as a means of ranking hospitals for reimbursement tiers provides a financial incentive for hospitals to identify potentially modifiable conditions that influence satisfaction.[9,10] In this analysis, we used the MCBS to estimate the impact of hearing loss and poor communication from hearing loss on satisfaction with quality of care among a nationally representative sample of Medicare beneficiaries.

Methods

Data Source

Medicare is the United States federal health insurance program for all adults aged 65 and older as well as adults younger than 65 with disabilities and end stage renal disease. This retrospective cohort study was conducted with de-identified data from the 2015 public use MCBS file. The MCBS survey is an annual in-person interview of nationally-representative sample of Medicare beneficiaries[25]. Trained interviewers use computer-assisted personal interviewing software on laptop computers to elicit demographic, socioeconomic, health status, medical condition, health care utilization, access, and satisfaction information of the Medicare population. Participants may use a proxy to respond to questioning. In 2015, a reported 55,496,222 individuals received Medicare health benefits.[23] Of these enrollees, 12,311 community-dwelling Medicare beneficiaries participated in the 2015 MCBS (8.08% by proxy). Due to the public availability and de-identified nature of the data set, this study was exempt from institutional review board audit.

Satisfaction

The primary outcome of this study was satisfaction with the quality of care over the past year. Participants were asked: "Please tell me how satisfied you have been with the following: The overall quality of the health care [you have] received [over the past year/ since (reference date)]." Participants were able to respond from a selection of four answers: "very satisfied," "satisfied," "dissatisfied," "very dissatisfied." We defined this as a binary outcome of satisfied (very satisfied or satisfied) and dissatisfied (dissatisfied or very dissatisfied).

Hearing and Communication

The primary analysis of this study was to investigate the association of functional hearing status and satisfaction. Functional hearing status was defined as perceived trouble hearing (with a hearing aid if applicable). Medicare beneficiaries with perceived functional hearing trouble (i.e., with the use of a hearing aid, if applicable) were identified from a self-report

question. Participants were asked, “Which statement best describes your hearing [with a hearing aid]?” - “no trouble”, “a little trouble”, and “a lot of trouble.” Participants were categorized into one of these three functional hearing loss categories according to their answer.

In a secondary analysis, we explored the association of reported communication difficulties specifically related to hearing loss among those with hearing loss and satisfaction with care. A subpopulation of all adults with reported functional hearing difficulty (i.e. participants who reported “a little trouble” or “a lot of trouble” hearing) were further asked “How much trouble [do you] have communicating with [your] doctor or other medical personnel because of [your] difficulty hearing? - “no trouble”, “a little trouble”, and “a lot of trouble.” Due to the rare (2.88%) nature of reporting “a lot of trouble” with communication, this group was defined as a binary variable: no (no trouble) or yes (a little or a lot of trouble) trouble communicating with medical personnel because of difficulty hearing.

Covariates

Covariates that may confound the association were identified.[26] Sociodemographic variables included age (categorized as younger than 65, 65 to 74 years old, and older than 75 years), self-reported race (Non-Hispanic White, Non-Hispanic Black, Hispanic, and other), and sex (male or female), educational attainment (less than high school, high school or vocational/technical/business degree, more than high school), and income (less than $25,000 or greater than or equal to $25,000). Factors specifically related to health status included functional limitations defined by the number of Instrumental Activities of Daily Living (IADLs) and Activities of Daily Living (ADLs) the participant could not complete without help (no functional limitations, only IADLs, 1–2 ADLs, 3–4 ADLs, and 5–6 ADLs), a count of chronic conditions (categorized as 0, 1–2, 3–5, ≥6 of the following conditions: cancer, chronic obstructive pulmonary disease/asthma, chronic heart disease, serious mental illness, acute myocardial infarction, hypertension, diabetes, stroke, depression, arthritis, dementia or Alzheimer disease), self-perceived general health status compared to others of the same age (excellent, very good, good, fair, or poor), and reporting a usual place of care to visit when sick or seeking medical advice (no or yes).

Statistical Analysis

Survey weighting was applied to the data to account for MCBS oversampling of subpopulations and cluster sampling design. Descriptive and univariate chi-square analyses were used to explore association and identify trends between functional hearing status and covariates and outcome variables. Multivariate logistic regression models were used to describe the association between functional hearing status and satisfaction with quality of care and the association of hearing contributing to poor patient-provider communication and satisfaction with quality of care while taking into account confounding variables. Given the ambiguity in the literature on the determinants of satisfaction,[26] a combination of a framework and model building approach was utilized. The β-coefficients (log-odds) were converted into odds ratios for ease of interpretation. Significance testing for all analyses was 2-sided with a type I error of 0.05. Subjects with missing data were excluded from analyses. Post hoc contrast analyses were completed to detect statistical differences between

categories of hearing trouble. A sensitivity analysis that included the addition of cognition variables (self-report memory loss that interferes with daily activity and self-report trouble concentrating) in the model was conducted. In addition, a sensitivity analysis that removed all participants who reported disability (i.e., under 65 years of age) as the reason for Medicare status was completed to ensure this subgroup did not substantially affect the results. The statistical software used was Stata 15 (StataCorp, College Station, TX).

Results

Description of Study Cohort

After excluding those who said they did not interact with the health care system in the past year (n=573) and missing responses (n=297), there were 11,441 Medicare beneficiaries in the unweighted sample which represents 48.6 million Medicare beneficiaries in the weighted sample. Table 1 displays the characteristics of the weighted sample by functional hearing status. Among the weighted sample, 53.63% reported no trouble hearing while 39.77% and 6.60% reported a little and a lot of trouble hearing, respectively. A significantly greater proportion of Medicare beneficiaries who reported a little (38.99%) or a lot of trouble (48.20%) hearing were more likely to be 75 years or older compared to those with no trouble hearing (29.97%). Moreover, univariate chi-square revealed a significantly higher percentage of those with a little and a lot trouble hearing were white males. In addition, a smaller proportion of Medicare beneficiaries with a lot of trouble hearing made over $24,999 a year (51.63%) compared to and of those with no trouble (59.00%) and a little trouble (63.59%).

Overall, Medicare beneficiaries who reported hearing trouble were more likely to report poorer general health, more functional limitations, and a greater number of chronic comorbidities. Only 6.18% of those with no trouble hearing reported having poor general health relative to others the same age compared to 8.23% of those with a little trouble and 14.12% of those with a lot of trouble hearing. Unadjusted chi-square revealed no difference in having a usual place of care among groups (93.91% vs 93.81% vs 93.17%). Lastly, a significantly higher percentage of Medicare beneficiaries who reported a lot of trouble hearing reported being dissatisfied with care (6.53%) compared to those who reported a little trouble hearing (4.65%) and no trouble hearing (3.11%).

Primary Analysis

Table 2 displays multivariate logistic regression model for the odds of being dissatisfied with quality of care over the past year. Compared to participants with no reported trouble hearing, those with a little trouble hearing had 1.5 times the odds (Odds Ratio [OR] = 1.496; 95% Confidence Interval [CI] = 1.079–2.073; P=0.016) of being dissatisfied with the quality of care over the past year. Medicare beneficiaries who reported a lot of trouble hearing had 1.7 times the odds (OR = 1.769; 95% CI = 1.175–2.664; P=0.007) of being dissatisfied with the quality of care over the past year compared to those with no trouble hearing. Post hoc analyses revealed no statistically significant (P=0.430) difference between those with a little trouble and a lot of trouble hearing.

Sociodemographic factors such as sex, race, educational attainment, and income were not significantly associated with odds of dissatisfaction. Older age (> 75 years) and marriage were associated with decreased odds of dissatisfaction with care. Poorer general health status and a greater number of functional limitations were both associated with increased odds of dissatisfaction. Those with reported poor general health compared to their same age peers had 4.9 times the odds (OR = 4.921; 95% CI = 2.661–9.100; *P*=<0.001) compared to those with excellent health. Similarly, those unable to complete 5–6 ADLs without help had higher odds (OR = 2.310; 95% CI = 1.291–4.132; *P*=0.005) compared to those with no functional limitations. Chronic comorbidities count was not associated with a change in odds of dissatisfaction with care. Having a usual place of care was significantly associated with decreased odds of dissatisfaction (OR = 0.320; 95% CI = 0.220–0.465; *P*=<0.001) compared to those without a usual place of care.

Sensitivity analysis that included cognitive variables is presented in table 3. Neither self-report memory loss that infers with daily activities (OR = 1.022; 95% CI = 0.684–1.526; *P*=0.915) or trouble concentrating (OR = 1.457; 95% CI = 0.950–2.234; *P*=0.084) were significantly associated with higher odds of dissatisfaction with care. In addition, the main findings of the model remained the same when these variables were included. Sensitivity analysis that removed participants on Medicare due to disability rather than age did not change the main findings of the model.

Secondary Analysis:

Among those with reported hearing trouble, 18.27% (weighted n=4.1 million) reported that hearing trouble negatively impacted communication with health care providers. Table 4 displays the logistic regression model for the odds of dissatisfaction among those who reported hearing interfered with communication with health care providers. Medicare beneficiaries with hearing trouble who felt like hearing impacted communication with health care providers had significantly higher odds (OR = 1.618; 95% CI = 1.099–2.381; *P*=0.015) of dissatisfaction with health care quality over the past year compared to those who felt hearing did not interfere with communication. Results for other included variables were consistent with trends seen in table 2.

Discussion

In a study of a nationally representative sample of Medicare beneficiaries, persons with self-reported hearing trouble had significantly higher odds of dissatisfaction with care over the past year when controlling for other sociodemographic and health variables. Similarly, in a subpopulation analysis, those with hearing trouble who reported it interfered with health care provider communication had higher odds of dissatisfaction. These findings suggest that hearing loss and its limitations on communication impact satisfaction with care. The relative rarity of the outcome of interest, dissatisfaction (3.94% of study population) may be due to the crude nature of the question and limits clinical interpretation of the current study but lends support for future analyses using more expansive and sensitive measures of satisfaction with care (e.g., HCAHPS). Further exploration of this association has potential

financial implications in the health care system given current value-based reimbursement models linked to patient satisfaction.[9,10]

This study builds upon previous research that suggested hearing loss is associated with lower satisfaction with quality of care. In an analysis of the 1996 MCBS Medicare Beneficiaries, hearing loss and deafness were associated with dissatisfaction with care after adjusting for sociodemographic covariates; however models did not include adjustment for overall health.[27] A study[22] that used the 2004 MCBS data reported difficulty using the telephone (a proxy of communication difficulties in the study) was associated with decreased odds of satisfaction with quality of care over the past year (OR = .31). However, they did not find reported hearing trouble or communication difficulties from hearing status to be associated with satisfaction with quality of care over the past year. Larger effect size and the association between communication difficulties from hearing status and dissatisfaction in the current study may be due to the older age demographics seen in the 2015 MCBS survey versus 2004 survey consistent with the aging population trends of the United Status. It is possible that with an older cohort, a larger proportion are impacted by the effect of hearing loss on communication as severity and prevalence are related to age. Further, the aforementioned study did not apply survey weighting which could allow oversampled populations to impact results nor did it include potential confounders including functional limitations and chronic conditions in regression models. A more recent study[24] that used objective measures of hearing found hearing loss was associated with reduced satisfaction with care only among the oldest persons in the cohort and did not impact younger study participants' satisfaction with care which was not the case in the present study. That study was limited by small sample size and homogenous population.

Perceived poorer health status compared to peers was associated with the greatest odds of dissatisfaction. This is a previously established relationship with in the MCBS dataset[28] and is consistent with the literature in clinical populations.[29] Frequent interaction with the health care system, frustration with poor health, and possible subconscious preferences of providers for healthier patients have been suggested as causal mechanisms.[30] Interestingly, in the primary analysis, perceived health status was associated with satisfaction with care while a more specific count of chronic conditions was not. It is possible that the population (i.e., adults on Medicare due to disability and age) of this study is such that experiencing multiple chronic conditions is relatively common and may limit statistical inference. This finding warrants further research. In sensitivity analysis, trouble concentrating was not statistically significant per p-value or confidence interval; however, there appears to be a signal of interest there. It is highly plausible that trouble concentrating could impact communication in the health care setting resulting in poorer patient-provider rapport and decreased overall satisfaction with care.

Inconsistent with previous research[29], older age was associated with decreased odds of dissatisfaction with care in the primary model. Specifically, previous work in the MCBS population suggests dissatisfaction with care is higher among older Medicare beneficiaries with disability relative to younger Medicare beneficiaries. The findings in the current study may reflect the poorer health or disability status required to qualify for Medicare under 65 years of age (i.e., adults with Social Security Disability benefits, End Stage Renal Disease,

etc.). Aside from more complicated care regimes, this population is more likely to interact with the health care system more frequently allowing more opportunity for dissatisfaction with care. Given the complexity of satisfaction with care (i.e., communication, timeliness, access, outcome, etc.), the crude nature of the outcome question may result in an inability to capture the true nature of satisfaction with care resulting in measurement error. Alternatively, a response bias may exist such that older adults may be more reluctant to complain or report dissatisfaction.

Given the importance of communication in building rapport, history taking for diagnostics, and understanding and complying with treatment, it is unremarkable that poorer functional hearing status and perceived poor communication from it are associated with dissatisfaction with quality of care. Moreover, the high out-of-pocket cost of hearing care may impact satisfaction perceptions. Previous research indicating hearing loss is associated with poor health care outcomes such as 30-day readmissions and length of stay may also be manifestations of poor communication that contribute to dissatisfaction. Lastly, hearing loss' association with increased rate of cognitive decline, especially working memory,[31] may pose another mechanistic pathway between the association of hearing loss and dissatisfaction with health care as cognitive vitality could impact communication with health care providers.

This study has implications for clinical care. Systematic programs to address hearing loss in adults are needed to improve patient-provider communication. Unfortunately, many current programs to address hearing loss among adults often do not focus on immediate interventions but rather referral to audiologists for long-term hearing treatment such as a hearing aid. Immediate interventions such as handheld amplification devices could mitigate the impact of hearing trouble on patient-provider communication. Further, communication training for staff that focuses on best-practice communication with someone with hearing loss may improve results.[32] These interventions offer low-risk, low-cost potential solutions to improve satisfaction with care.

While hospitals have been required by Medicare to report on patient satisfaction measures since 2005, it has only been in the last six years that patient satisfaction has been tied to Medicare reimbursements as part of the Hospital Value-Based Purchasing Program.[9,10] Four of the eight key areas measuring patient satisfaction relate directly to patient-provider communication. Patient satisfaction is also one of the optional quality measures clinicians participating in the Merit-based Incentive Payment System (MIPS) can elect as a payment adjuster of their Medicare payments.[9,10,33] These changes all indicate a shift towards greater accountability within the health system for ensuring satisfaction with the care and services received. With the prevalence of hearing loss among older adults increasing, the specific communication challenges experienced by those with hearing loss need to be addressed if hospitals and clinicians hope to maximize their Medicare reimbursement.

This study is limited by the crude outcome question of satisfaction with care. In addition, it utilizes self-report hearing trouble data which may under or overestimate the true prevalence of hearing loss. Perceived difficulty hearing could be influenced by other factors related to age such as slower cognitive processing. However, it is notable that the overall prevalence of

hearing trouble in the present study (46.37%) is comparable to nationally representative data of objectively measured hearing loss among adults 60+ (approximately 50%).[16] Further, the present study captures trouble hearing (even with hearing aids) rather than actually reporting *'hearing loss'* which may capture a different construct. In addition, hearing aid usage could not be measured as a protective factor because hearing status included that with a hearing aid (if applicable). The MCBS public use file uses categories for age which could be unrepresentative of the individuals within them. Missingness, albeit a relatively small percentage (2.5%), could impact the analysis. This study is further limited by the cross-sectional nature of the data in that causal relationships cannot be explored. Unmeasured residual confounding could exist. Lastly, Future research should focus on objective measurement of hearing loss, better measures of satisfaction (i.e., more specific survey questions used in clinics and/or those used in the Medicare reimbursement mechanism [e.g., HCAHPS]), and longitudinal data to further explore the causal relationship and whether it is a clinically-meaningful relationship beyond simple statistical significance. Moreover, the impact of hearing aid use should be explored as a potential protective factor. In addition, data could be used to create cost-benefit models of addressing hearing loss on satisfaction-linked reimbursement. Lastly, novel approaches beyond simply providing an amplification device, such as communication and hearing loss awareness training, to mitigate the impact of hearing loss on satisfaction with care could be implemented and assessed in various settings throughout the health care system.

Conclusion

The present study suggests hearing status and its interference with communication with health care providers is associated with dissatisfaction with care over the past year in a nationally-representative sample of Medicare beneficiaries. Specifically, individuals who reported a lot of trouble hearing had 1.769 times the odds of reporting dissatisfaction. Mitigating the impact of hearing on patient-provider communication to improve patient satisfaction is of interest to health care systems given Medicare's efforts to link reimbursement with patient satisfaction.

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Table 1 –

Characteristics of the Medicare beneficiaries by functional hearing status[a,b]

Variable	Total	Functional Hearing Status		
		No Trouble	A Little Trouble	A Lot of Trouble
Unweighted Sample	11,441	5912	4665	864
Weighted Sample	48,562,591	26,043,232	19,313,279	3,206,081
Dissatisfied with care	3.94%	3.11%	4.65%	6.53%
Usual Place of Care = Yes	93.28%	92.91%	93.81%	93.17%
Age (years) *				
64 and younger	16.21%	17.61%	14.45%	15.40%
65–74	49.03%	52.42%	46.56%	36.40%
75 and older	34.76%	29.97%	38.99%	48.20%
Female *	55.17%	59.94%	50.47%	44.73%
Race *				
Non-Hispanic White	74.47%	70.24%	79.39%	79.15%
Non-Hispanic Black	9.52%	11.48%	7.64%	4.84%
Hispanic	9.13%	10.99%	6.92%	7.41%
Other	6.88%	7.28%	6.05%	8.60%
Educational attainment *				
Less than 9th grade	16.87%	17.11%	15.12%	25.53%
High school or vocational, technical degree	35.58%	34.36%	36.64%	39.12%
More than high school	47.54%	48.53%	48.24%	35.35%
Income Greater or equal to $25,000 *	60.34%	59.00%	63.59%	51.63%
Married = Yes **	54.15%	52.85%	56.71%	49.39%
General health *				
Excellent	16.48%	19.67%	13.67%	7.60%
Very good	28.45%	29.25%	28.67%	20.59%
Good	29.94%	28.84%	31.32%	30.51%
Fair	17.61%	16.06%	18.12%	27.18%
Poor	7.52%	6.18%	8.23%	14.12%
Functional limitations *				
No functional limitations	52.50%	57.67%	49.97%	25.52%
only IADLs[c]	11.98%	11.41%	11.97%	16.79%
1–2 ADLs[d]	24.06%	21.97%	25.36%	33.17%
3–4 ADLs	7.79%	6.21%	8.47%	16.55%
5–6 ADLs	3.67%	2.72%	4.23%	7.98%
Chronic Comorbidities[e] Count *				
0	05.84%	07.67%	04.67%	00.98%
1–2	36.61%	40.97%	32.62%	25.24%

Variable	Total	Functional Hearing Status		
		No Trouble	A Little Trouble	A Lot of Trouble
3–5	47.13%	43.43%	50.95%	54.11%
≥ 6	10.42%	8.29%	11.76%	19.67%

Ref – Reference

[a] Data derived from the 2015 Medicare Current Beneficiary Survey public use file

[b] Survey weights applied according to Medicare Current Beneficiary Survey; percentages are based on weighted survey sample

[c] IADL – Instrumental Activity of Daily Living (e.g., financial management, meal preparation, housework [light or heavy], shopping, using the telephone)

[d] ADL – Activity of Daily Living (e.g., bathing or showering, dressing, getting in and out of bed or a chair, walking, using the toilet, and eating)

[e] Chronic Comorbidities include: cancer, chronic obstructive pulmonary disease/asthma, chronic heart disease, serious mental illness, acute myocardial infarction, hypertension, diabetes, stroke, depression, arthritis, dementia or Alzheimer disease

* denotes significantly different univariate chi-square at P<0.001

** denotes significantly different univariate chi-square at P<0.01

Table 2 –

Odds of dissatisfaction with quality of care over the past year among Medicare beneficiaries by functional hearing loss[a,b]

Variable	Adjusted[b] Odds Ratio(95% CI)	Standard Error	*P*-Value
Functional Hearing Loss			
No trouble	REF		
A little trouble	1.496(1.079 – 2.073)	0.246	0.016
A lot of trouble	1.769(1.175 – 2.664)	0.365	0.007
Usual Place of Care = Yes	0.320(0.220 – 0.465)	0.060	<0.001
Age (years)			
64 and younger	REF		
65–74	0.929(0.675 – 1.278)	0.149	0.648
75 and older	0.603(0.441 – 0.824)	0.095	0.002
Female	1.070(0.799 – 1.434)	0.158	0.647
Race			
Non-Hispanic White	REF		
Non-Hispanic Black	1.015(0.609 – 1.691)	0.261	0.955
Hispanic	1.533(0.911 – 2.581)	0.402	0.107
Other	1.754(1.000 – 3.078)	0.497	0.050
Educational attainment			
Less than 9th grade	REF		
High school or vocational, technical degree	1.370(0.967 – 1.940)	0.240	0.076
More than high school	1.199(0.836 – 1.721)	0.218	0.320
Income Greater or equal to $25,000	0.965(0.637 – 1.461)	0.202	0.864
Married = Yes	0.583(0.407 – 0.834)	0.105	0.004
General health			
Excellent	REF		
Very good	1.546(0.873 – 2.738)	0.445	0.134
Good	2.684(1.515 – 4.755)	0.774	0.001
Fair	2.979(1.559 – 5.692)	0.972	0.001
Poor	4.921(2.661 – 9.100)	1.524	<0.001
Functional limitations			
No functional limitations	REF		
only IADLs	1.418(0.769 – 2.613)	0.437	0.260
1–2 ADLs	1.761(1.107 – 2.800)	0.412	0.017
3–4 ADLs	1.934(1.171 – 3.195)	0.489	0.011
5–6 ADLs	2.310(1.291 – 4.132)	0.677	0.005
Chronic Comorbidities Count**			
0	REF		
1–2	0.905(0.371 – 2.208)	0.407	0.825
3–5	0.718(0.287– 1.796)	0.332	0.475
≥ 6	0.784(0.301 – 2.040)	0.378	0.614

IADL – Instrumental Activity of Daily Living, ADL – Activity of Daily Living, Ref – Reference

[a]Data derived from the 2015 Medicare Current Beneficiary Survey public use file (n=11,441)

[b]Survey weights applied according to Medicare Current Beneficiary Survey (weighted n = 48,562,591)

[c]Logistic regression model adjusted for usual place of care, age, sex, race/ethnicity, education, income, marital status, general health, functional limitations, and chronic comorbidities count (cancer, chronic obstructive pulmonary disease/asthma, chronic heart disease, serious mental illness, acute myocardial infarction, hypertension, diabetes, stroke, depression, arthritis, dementia or Alzheimer disease)

Table 3 –

Sensitivity analysis of odds of dissatisfaction with quality of care over the past year among Medicare beneficiaries by functional hearing loss including cognitive variables[a,b]

Variable	Adjusted[c] Odds Ratio(95% CI)	Standard Error	*P*-Value
Functional Hearing Loss			
No trouble	REF		
A little trouble	1.453(1.044 – 2.022)	0.242	0.027
A lot of trouble	1.707(1.175 – 2.664)	0.360	0.013
Usual Place of Care = Yes	0.320(0.220 – 0.466)	0.061	<0.001
Age (years)			
64 and younger	REF		
65–74	1.023(0.727 – 1.439)	0.176	0.896
75 and older	0.657(0.472 – 0.915)	0.110	0.013
Female	1.032(0.766 – 1.390)	0.155	0.835
Race			
Non-Hispanic White	REF		
Non-Hispanic Black	1.002(0.596 – 1.686)	0.263	0.994
Hispanic	1.459(0.850 – 2.504)	0.397	0.169
Other	1.737(0.998 – 3.023)	0.485	0.051
Educational attainment			
Less than 9th grade	REF		
High school or vocational, technical degree	1.375(0.969 – 1.950)	0.242	0.074
More than high school	1.190(0.828 – 1.712)	0.218	0.344
Income Greater or equal to $25,000	0.951(0.631 – 1.434)	0.197	0.809
Married = Yes	0.596(0.418 – 0.849)	0.107	0.005
General health			
Excellent	REF		
Very good	1.641(0.912 – 2.953)	0.486	0.098
Good	2.762(1.530 – 4.985)	0.822	0.001
Fair	3.080(1.581 – 6.000)	1.035	0.001
Poor	4.945(2.645 – 9.246)	1.560	<0.001
Functional limitations			
No functional limitations	REF		
only IADLs	1.344(0.716 – 2.524)	0.427	0.354
1–2 ADLs	1.660(1.049 – 2.628)	0.384	0.031
3–4 ADLs	1.769(1.067 – 2.931)	0.450	0.027
5–6 ADLs	2.083(1.146 – 3.786)	0.627	0.017
Chronic Comorbidities Count			
0	REF		
1–2	0.862(0.353 – 2.108)	0.386	0.743
3–5	0.664(0.265– 1.166)	0.307	0.378
≥ 6	0.689(0.259 – 1.829)	0.339	0.450

Variable	Adjusted[c] Odds Ratio(95% CI)	Standard Error	*P*-Value
Memory Loss = Yes	1.022(0.684 – 1.526)	0.207	0.915
Trouble Concentrating = Yes	1.457(0.950 – 2.234)	0.314	0.084

IADL – Instrumental Activity of Daily Living, ADL – Activity of Daily Living, Ref - Reference

[a]Data derived from the 2015 Medicare Current Beneficiary Survey public use file (n=11,441)

[b]Survey weights applied according to Medicare Current Beneficiary Survey (weighted n = 48,562,591)

[c]Logistic regression model adjusted for usual place of care, age, sex, race/ethnicity, education, income, marital status, general health, functional limitations, chronic comorbidities count (cancer, chronic obstructive pulmonary disease/asthma, chronic heart disease, serious mental illness, acute myocardial infarction, hypertension, diabetes, stroke, depression, arthritis, dementia or Alzheimer disease), self-report memory loss, and self-report trouble concentrating

Table 4 –

Odds of dissatisfaction with quality of care over the past year among Medicare beneficiaries with functional hearing loss who report hearing interferes with provider communication[a,b]

Variable	Adjusted[c] Odds Ratio(95% CI)	Standard Error	*P*
Hearing Influences Provider Communication	1.618(1.099 – 2.381)	0.315	0.015
Usual Place of Care	0.315(0.194 – 0.512)	0.077	<0.001
Age (years)			
64 and younger	REF		
65–74	0.975(0.608 – 1.565)	0.233	0.916
75 and older	0.515(0.323 – 0.821)	0.121	0.006
Female	0.890(0.592 – 1.340)	0.183	0.574
Race			
Non-Hispanic White	REF		
Non-Hispanic Black	0.891(0.449 – 1.766)	0.307	0.738
Hispanic	1.584(0.813 – 3.086)	0.532	0.174
Other	1.496(0.664 – 3.370)	0.612	0.328
Educational attainment			
Less than 9th grade	REF		
High school or vocational, technical degree	1.653(0.955 – 2.862)	0.457	0.072
More than high school	1.422(0.821 – 2.462)	0.393	0.206
Income Greater or equal to $25,000	0.838(0.488 – 1.439)	0.228	0.519
Married = Yes	0.971(0.404 – 1.115)	0.172	0.122
General health			
Excellent	REF		
Very good	1.266(0.520 – 3.083)	0.568	0.601
Good	3.524(1.376 – 9.021)	1.669	0.009
Fair	3.297(1.109 –9.808)	1.811	0.032
Poor	5.649(1.998 – 15.974)	2.959	0.001
Functional limitations			
No functional limitations	REF		
only IADLs	1.551(0.785 – 3.063)	0.532	0.204
1–2 ADLs	1.661(0.901 – 3.061)	0.512	0.103
3–4 ADLs	1.725(0.891 – 3.340)	0.574	0.105
5–6 ADLs	2.749(1.271 – 5.948)	1.069	0.011
Chronic Comorbidities Count			
0	REF		
1–2	0.553(0.125 – 2.442)	0.414	0.430
3–5	0.453(0.102– 2.013)	0.341	0.295
≥ 6	0.476(0.100 – 2.259)	0.374	0.436

IADL – Instrumental Activity of Daily Living, ADL – Activity of Daily Living, Ref - Reference

[a]Data derived from the 2015 Medicare Current Beneficiary Survey public use file (n=5,519)

[b] Survey weights applied according to Medicare Current Beneficiary Survey (weighted n = 22,482,627)

[c] Logistic regression model adjusted for usual place of care, age, sex, race/ethnicity, education, income, marital status, general health, functional limitations, and chronic comorbidities count (cancer, chronic obstructive pulmonary disease/asthma, chronic heart disease, serious mental illness, acute myocardial infarction, hypertension, diabetes, stroke, depression, arthritis, dementia or Alzheimer disease)