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Vision Impairment and Patient Activation among Medicare Beneficiaries

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ABSTRACT

Purpose: Low patient activation is associated with poor patient outcomes. People with vision impairment may have low patient activation as a result of communication and access barriers. We examined the association of patient activation with vision impairment.

Methods: Cross-sectional study using the 2016 Medicare Current Beneficiary Survey. Older Medicare beneficiaries, without dementia, who completed the topical patient activation questionnaire were included. The primary exposure was self-reported vision impairment (no vision impairment, a little vision impairment, a lot of vision impairment), and the secondary exposure was dual sensory impairment (no sensory impairment, vision impairment only, hearing impairment only, dual sensory impairment). Patient activation scores were categorized as low, moderate, or high based on their distribution around the mean. Multivariable-adjusted ordinal regression models examined the association of patient activation with vision impairment, and then with dual sensory impairment.

Results: In total, 6,683 participants were included. Those with a little vision impairment had 20% lower odds of higher patient activation (odds ratio [OR] = 0.80, 95% confidence interval [CI] = 0.71–0.90), and those with a lot of vision impairment had 26% lower odds of higher patient activation (OR = 0.74, 95% CI = 0.55–0.98). In the second model, having vision or hearing impairment only was associated with lower odds of higher activation than having no sensory impairment. Having dual sensory impairment was associated with even lower odds of higher activation.

Conclusion: Older Medicare beneficiaries with sensory impairment may be a group to target to improve patient activation levels, which could potentially improve health outcomes and health care utilization patterns in this population.

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Introduction

Patient activation, a measure of people's knowledge, skills and confidence to manage their own health, is a key element in population health. Low patient activation is associated with greater chronic disease incidence, rates of avoidable hospitalizations, emergency department use, and health care costs, and decreased preventive care use.^{1,2} Likewise, vision impairment has been associated with similar negative health and health care utilization outcomes, such as higher prevalence of comorbidities,³ hospital use and cost,⁴ and lower prevalence of knowledge of heart attack symptoms,⁵ and preventive care use.⁶

Vision impairment could be associated with lower patient activation due to patient-provider communication barriers and decreased access to health information.^{7–9} which could lead to decreased confidence caring for one's

health. A focus group conducted among a group of people with legal blindness in Washington, DC, reported difficulty gaining health care knowledge due to health professionals' reliance on written instructions and lack of accessible information about general and preventive health.⁷ Additionally, it has been reported that health care professionals often communicate with caregivers rather than the patient with vision loss, excluding them from the conversations about their own health and well-being.⁹ A bibliometric analysis of health care research on visual impairment and blindness identified gaps in the literature on effective health care delivery for this patient population, especially in terms of improving self-care and knowledge about health care.⁹

Barriers to accessing health care information and communicating with health professionals may lead to poor patient activation among people with vision impairment, and this could potentially affect their access to general and

vision-specific health care, which may be important to avoid irreversible progression of some chronic eye conditions.¹⁰ Importantly, patient activation could be improved via low-cost interventions.² A previous study conducted among patients in one vision center found no differences in the 13-item Patient Activation Measure (PAM-13) scores by visual acuity; however, the study was limited to a small convenience sample of ophthalmology patients.¹¹ In this study, we examined the association of self-reported vision impairment and patient activation in a nationally representative sample of community-dwelling Medicare beneficiaries 65 years and older.

Materials and methods

This study follows the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline for cross-sectional studies.

Study population

Data from the 2016 Medicare Current Beneficiary Study (MCBS), when the full patient activation supplement was included, were used. The MCBS is a nationally representative survey of all Medicare beneficiaries, including those aged 65 years and older and working-age adults with a qualifying disability. The MCBS collects information about beneficiaries' health and health care utilization through multiple interviews over a four-year period in a rotating panel design.

Potential participants first receive information about the MCBS by mail, followed by a phone call to schedule an appointment. Respondents have the option to choose language or other assistance, and to select a proxy respondent if needed. In 2016, in-person interviews were conducted by trained field interviewers using a Computer-Assisted Personal Interviewing (CAPI) in participants' residence or chosen public locations. The Institutional Review Board of NORC, University of Chicago, approved the MCBS protocol and consent procedures.

In this study, participants 65 years and older without dementia who were non-institutionalized and who completed the MCBS topical questionnaire on patient activation in 2016 were eligible for inclusion (N = 7,211). Those younger than 65 years and those with dementia, defined as having a self-reported physician diagnosis of Alzheimer's disease or another type of dementia, were not eligible for inclusion as they may experience sensory impairment and interact

with the health care system differently. Participants with "no usable vision" (10 of 7,211, 0.1%) were excluded as their experience with the health care system may be very different from those with vision difficulty but not blindness. In line with previous analyses of the MCBS patient activation supplement,¹² those who completed less than 50% of the patient activation items were also excluded (61 of 7,211, 0.9%). Participants with missing vision impairment information (34 of 7,211, 0.5%) and covariate information (423 of 7,150, 5.9%) were excluded.

Patient activation

The overall patient activation measure was computed based on participants' answers to a selected number of questions from the supplement on patient activation. The ten questions that measured confidence and information seeking,¹² the same domains assessed by the commonly used 13-item Patient Activation Measure,¹³ were selected (Figure 1) (internal consistency [Cronbach alpha] = 0.70).

Responses were graded from 0 (lowest activation) to 3 (highest activation). Consistent with previous MCBS studies,^{12,14} weighted scores were computed by summing the responses for each question and dividing it by the number of non-missing items. Scores were categorized as high (above the mean plus one-half of the standard deviation [SD]), moderate (within one-half SD around the mean), and low (below the mean minus one-half of the SD).^{12,14}

Vision impairment

The primary exposure variable was self-reported vision impairment, defined as any trouble seeing even with glasses. Participants were asked: "Which statement best describes your vision [while wearing glasses or contact lenses] ... no trouble seeing, a little trouble, a lot of trouble, or no usable vision". Those who reported "a little trouble" or "a lot of trouble" seeing were considered to have "a little" and "a lot" of vision impairment respectively, and were compared with those who reported "no trouble" seeing (no vision impairment). Participants with "no usable vision" were excluded as their experience with the health care system may be very different from those with vision difficulty but not blindness. Given hearing impairment's previously

How confident are you that you can:
 0: Not confident at all - 1: Somewhat confident - 2: Confident - 3: Very confident

- Follow instructions to care for yourself at home?
- Follow this kind of instruction, to change your habits or lifestyle?
- Identify when it is necessary for you to get medical care?
- Identify when you are having side effects from your medications?

Do you:
 0: Never- 1: Sometimes- 2: Usually - 3: Always

- Bring with you to your doctor visits a list of questions or concerns you want to cover?
- Read about health conditions in newspapers, magazines, or on the internet?
- Take a list of all of your prescribed medicines to your doctor visits?
- Talk with your doctor or other medical person about your options if you need tests or follow-up care?
- Read information about a new prescription, such as side effects and precautions?
- Make sure you understand the results of any medical test or procedure?

Figure 1. Patient activation questions. Selected items from the patient activation supplement used to compute a patient activation score in line with the 13-item patient activation measure (PAM).

described association with low activation,¹⁴ we examined the interaction between vision and hearing impairment in secondary analyses using a dual sensory impairment variable (no sensory impairment, hearing impairment only, vision impairment only, dual sensory impairment).

Confounders

Potential confounders were identified in the literature and based on the hypothesized pathway between sensory impairment and patient activation. These included age (in years), sex (male, female), race/ethnicity (White, Black, Hispanic, Other), educational attainment (less than high school, high school, some college, college degree), income poverty ratio (<100%, 100–125%, 125–150%, 150–200%, >200% of the federal poverty level), number of chronic conditions, including self-reported hypertension, diabetes, stroke, coronary artery disease, other heart disease, cancer, lung disease, and arthritis (0, 1–2, 3+), and depression (Patient Health Questionnaire-2 [PHQ-2] less than 3, PHQ-2 greater than or equal to 3). In the primary analyses with vision impairment as the exposure, the model was adjusted for self-reported hearing impairment status (hearing impairment, no hearing impairment).

Statistical analysis

Survey-weighted ordinal regression models adjusted for the potential confounders examined the association of the ordered patient activation outcome variable (levels: 1-low, 2-moderate, 3-high) with self-reported vision impairment (primary exposure), and in a second model with dual sensory impairment (secondary exposure). In the secondary model, having dual sensory impairment was compared with having vision or hearing impairment only using linear combinations of coefficients.

First, simple ordinal regression models were fitted. Because the proportional odds assumption was violated in both models, the Stata (Stata/SE 15.1) program “gologit2” was then used to estimate partial proportional odds models using the “autofit” option, which uses an iterative process to obtain the best model for the data.¹⁵ In the final models presented, which do not violate the proportional odds assumption, the constraints for proportional odds were imposed for all variables except educational attainment. In other words, for all other variables, including vision impairment and dual sensory impairment, the odds ratios were the same for each pair of outcome groups (e.g., high or moderate vs low patient activation, and high vs moderate patient activation). Predicted probabilities after ordinal regression were obtained by setting the exposure variables (vision impairment in the first model, and dual sensory

impairment in the second model) at different values, with the rest of variables at their mean value. Analyses were conducted using R Studio (Version 1.3.1093) and Stata (Stata/SE 15.1).

Results

A total of 6,683 participants were included. The mean age was 74.1 years (SD = 6.7 years), 3,862 (57.6%) were female, and 5,860 (87.0%) non-Hispanic White (Table 1). A third (2,098) had self-reported vision impairment. Of them, 1,898 reported a little difficulty seeing and 200 reported a lot of trouble seeing. A greater proportion of those with vision impairment than without had hearing impairment, depression, and chronic conditions.

Overall, 23.1% had low, 37.7% moderate, and 39.3% high patient activation. A greater proportion of those with vision impairment than without had low (26.2% vs 21.7%, $p < .001$) and moderate (40.0% vs 36.3%, $p < .001$) patient activation.

The odds of having a higher patient activation score were 20% lower for those with a little vision impairment relative to those without vision impairment (odds ratio [OR] = 0.80, 95% confidence interval [CI] = 0.71–0.90), 26% lower for those with a lot of vision impairment relative to those without vision impairment (OR = 0.74,

95% CI = 0.55–0.98) (Table 2), and 18% lower for those with hearing impairment than those without hearing impairment (OR = 0.82, 95% CI = 0.79–0.92). When all variables were set at their mean value, the probability of having low patient activation was 21.5% (95% CI = 20.2–22.9%) among those without vision impairment, 25.2% (95% CI = 23.2–27.7%) among those with a little vision impairment, and 27.2% (95% CI = 21.3–33.1%) among those with a lot of vision impairment (Table 3).

In a second model with dual sensory impairment, those with vision (OR = 0.83, 95%CI = 0.71–0.98) or hearing impairment only (OR = 0.84, 95% CI = 0.73–0.97) had lower odds of higher activation compared with those without sensory impairments (Table 2). Having dual sensory impairment was associated with 36% reduced odds of higher activation compared with having no sensory impairment (OR = 0.64, 95%CI = 0.56–0.73). Those with dual sensory impairment also had lower odds of higher activation compared with those with vision (OR = 0.78, 95% CI = 0.66–0.91) or hearing impairment (OR = 0.77, 95% CI = 0.67–0.88) only. With the rest of the variables set at their mean value, the probability of having low patient activation was 20.3% (95% CI = 18.8–21.7%) among those with no sensory impairment, 23.2% (95% CI = 21.1–25.4%) among those with hearing impairment only,

Table 1. Weighted study population characteristics.

	Overall	No Vision Impairment	Vision Impairment	p-valued
Total, No. (%)	6683 (100.0)	4585 (68.9)	2098 (31.1)	NA
Hearing Impairment, No. (%)	3137 (44.1)	1905 (38.7)	1232 (56.0)	<0.001
Age, mean (SD)	74.06 (6.74)	74.00 (6.67)	74.22 (6.90)	0.256
Women, No. (%)	3862 (57.6)	2609 (56.9)	1253 (59.1)	0.237
Race/ethnicity, No. (%)				0.032
Non-Hispanic White	5860 (87.0)	4051 (87.9)	1809 (85.0)	
Non-Hispanic Black	523 (8.3)	327 (7.3)	196 (10.4)	
Hispanic	149 (1.8)	101 (1.8)	48 (1.8)	
Non-Hispanic Othra	151 (2.9)	106 (3.0)	45 (2.9)	
Income poverty ratio Medicare threshold, FPL, No. (%)				0.043
≤100%	697 (9.5)	454 (8.9)	243 (10.8)	
101–125%	407 (5.6)	256 (5.2)	151 (6.4)	
126–150%	491 (6.1)	315 (5.6)	176 (7.3)	
151–200%	832 (11.2)	563 (11.2)	269 (11.3)	
>200%	4256 (67.6)	2997 (69.1)	1259 (64.3)	
Education, No. (%)				0.085
Less than high school	999 (13.3)	666 (12.9)	333 (14.2)	
High school or equivalent	2249 (31.0)	1533 (30.6)	716 (32.0)	
Some college	1143 (17.7)	774 (17.3)	369 (18.6)	
College degree	2292 (38.0)	1612 (39.2)	680 (35.2)	
Number of comorbidities ^b , No. (%)				<0.001
0 conditions	561 (10.5)	418 (11.1)	143 (9.1)	
1–2 conditions	3044 (47.6)	2214 (50.5)	830 (41.2)	
>2 conditions	3078 (41.9)	1953 (38.3)	1125 (49.7)	
Depression ^c , No. (%)	387 (5.9)	171 (3.8)	216 (10.7)	<0.001

Abbreviations: FPL, federal poverty level.

^aIncluding American Indian or Alaska Native, Asian, Native Hawaiian or other Pacific Islander.

^bIncluding cancer, chronic lung disease, chronic heart disease, myocardial infarction, hypertension, diabetes, stroke, arthritis.

^cDefined as Patient Health Questionnaire-2 (PHQ-2) score >2.

^dBased on groupwise comparisons using survey-weighted chi-square tests.

Table 2. Multivariable-adjusted proportional odds ratios of higher patient activation by sensory impairment status.

	Reference	OR ^a (95% CI)	p-value
<i>Model 1: Vision impairment^b</i>			
A little trouble seeing	No vision impairment	0.80 (0.71–0.90)	<0.001
A lot of trouble seeing	No vision impairment	0.74 (0.55–0.98)	0.035
<i>Model 2: Dual sensory impairment^c</i>			
Vision impairment only	No sensory impairment	0.83 (0.71–0.98)	0.025
Hearing impairment only	No sensory impairment	0.84 (0.73–0.97)	0.018
Dual sensory impairment	No sensory impairment	0.64 (0.56–0.73)	<0.001

Abbreviations: CI, confidence interval; OR, odds ratio.

^aOdds ratios obtained from ordinal regression models. These describe the odds of having higher patient activation (i.e., high or moderate) vs lower patient activation (i.e., low). Because the models do not violate the proportional odds assumption, the odds ratios are the same for each pair of outcome groups (e.g., high or moderate vs low, and high vs moderate).

^bModel adjusted for age (in years), sex (male, female), race/ethnicity (White, Black, Hispanic, Other), educational attainment (less than high school, high school, some college, college degree), income poverty ratio (<100%, 100–125%, 125–150%, 150–200%, >200% of the FPL), number of chronic conditions (0, 1–2, 3+), depression (PHQ-2 less than 3, PHQ-2 greater than or equal to 3), hearing impairment (hearing impairment, no hearing impairment).

^cModel adjusted for age (in years), sex (male, female), race/ethnicity (White, Black, Hispanic, Other), educational attainment (less than high school, high school, some college, college degree), income poverty ratio (<100%, 100–125%, 125–150%, 150–200%, >200% of the FPL), number of chronic conditions (0, 1–2, 3+), depression (PHQ-2 less than 3, PHQ-2 greater than or equal to 3).

23.4% (95% CI = 20.7–26.2%) among those with vision impairment only, and 28.3% (95% CI = 25.7–30.1%) among those with dual sensory impairment (Table 3).

Discussion

In this nationally representative study of community-dwelling older Medicare beneficiaries, vision impairment was associated with lower patient activation. Those with dual sensory impairment had even lower odds of higher patient activation. This builds on previous work on the association of vision and hearing impairment with low patient activation using the 2011–2013 MCBS.^{11,14}

In this study, we found that having vision impairment, with or without hearing impairment, was associated with lower patient activation. A previous

study examining vision impairment and patient activation reported that visual acuity and ocular diagnoses were not associated with PAM scores.¹¹ However, the study used a small (N = 146) clinical convenience sample from one vision rehabilitation center. Clinical samples may introduce selection bias by relying on adults who already engage with the health care system, and likely already perceive vision difficulty. In our study, we used a functional definition of vision impairment, which may better capture day-to-day visual function and its impact on people's engagement with their care.

Difficulty accessing health information and communicating with providers among those with sensory impairment^{7,16} may be contributing to decreased confidence and information-seeking, and as a result, poor patient activation. Moreover, vision impairment, especially when combined with hearing impairment, is associated with dissatisfaction with care.¹⁷ This

Table 3. Adjusted predicted probabilities of patient activation levels by sensory impairment status.

	Low patient activation	Moderate patient activation	High patient activation
<i>Model 1: Vision impairment^a</i>			
No vision impairment, % (95% CI)	21.5 (20.2, 22.9)	40.0 (38.2, 41.8)	38.4 (36.5, 40.4)
A little vision impairment, % (95% CI)	25.5 (23.2, 27.7)	41.1 (39.4, 42.9)	33.4 (30.8, 35.9)
A lot of vision impairment, % (95% CI)	27.2 (21.3, 33.1)	41.3 (39.5, 43.2)	31.5 (25.0, 37.9)
<i>Model 2: Dual sensory impairment^b</i>			
No sensory impairment, % (95% CI)	20.3 (18.8, 21.7)	39.4 (37.6, 41.3)	40.3 (38.0, 42.5)
Hearing impairment only, % (95% CI)	23.2 (21.1, 25.4)	40.6 (38.7, 42.5)	36.1 (33.2, 39.1)
Vision impairment only, % (95% CI)	23.4 (20.7, 26.2)	40.7 (38.7, 42.6)	35.9 (32.3, 39.5)
Dual sensory impairment, % (95% CI)	28.3 (25.7, 30.1)	41.4 (39.7, 43.2)	30.3 (27.7, 32.8)

Abbreviations: CI, confidence interval.

^aPredicted probabilities computed from the ordinal regression model adjusted for age (in years), sex (male, female), race/ethnicity (White, Black, Hispanic, Other), educational attainment (less than high school, high school, some college, college degree), income poverty ratio (<100%, 100–125%, 125–150%, 150–200%, >200% of the FPL), number of chronic conditions (0, 1–2, 3+), depression (PHQ-2 less than 3, PHQ-2 greater than or equal to 3), hearing impairment (hearing impairment, no hearing impairment).

^bPredicted probabilities computed from the ordinal regression model adjusted for age (in years), sex (male, female), race/ethnicity (White, Black, Hispanic, Other), educational attainment (less than high school, high school, some college, college degree), income poverty ratio (<100%, 100–125%, 125–150%, 150–200%, >200% of the FPL), number of chronic conditions (0, 1–2, 3+), depression (PHQ-2 less than 3, PHQ-2 greater than or equal to 3).

could translate into future perceptions and attitudes about health care, including low engagement. Loneliness and social isolation, common with sensory impairment,^{18,19} could also have a negative impact on knowledge and confidence caring for one's own health.

Low patient activation could be contributing to the worse health outcomes and negative health care utilization patterns identified among people with vision impairment.^{3–6} People with vision impairment are more likely to have multiple comorbidities than people without vision impairment,³ thus having the knowledge, skills, and self-confidence managing multiple health conditions is important for this patient population. Moreover, managing chronic eye conditions such as glaucoma or neovascular age-related macular degeneration requires long-term therapy and follow-up,^{20,21} and patient engagement may play an important role in ensuring compliance.

Importantly, patient activation can be increased by addressing barriers to health information using simple techniques to improve patient-provider communication and accessibility to health information.² Such interventions could be designed to address the communication and access barriers faced by those with dual sensory impairment, as they may be the most likely to have poor patient activation. In health care settings, screening for vision and hearing impairments could be a low-cost strategy to identify those who may be more likely to have low patient activation. Providing accommodations and creating inclusive health care environments to improve accessibility (e.g., low-cost magnifiers and voice amplifiers), and using communication techniques such as the teach back method may help improve patient understanding and eventually result in greater activation.

Our study results are limited by the questions available in the MCBS survey. First, in addition to confidence and information-seeking behavior, the PAM also includes questions about believing in the importance of taking an active role in one's health, which are missing here. Second, Medicare beneficiaries with vision impairment may have been more likely to not participate in the MCBS or to have missing responses due to difficulty completing the questionnaires. However, those with the most severe impairments (i.e., “no usable vision”), and who may have the greatest difficulty completing the questionnaires despite the assistance offered, were not eligible for inclusion in our study. Moreover, due to the cross-sectional nature of the data, we cannot establish temporality. However, our results suggest that

people with sensory impairment may be an important group to target for interventions that improve confidence and information-seeking behavior.

In conclusion, older Medicare beneficiaries with vision, hearing, and dual sensory impairment were found to have lower activation levels than those without sensory loss. Patient activation could be a modifiable pathway to improve the health and health care utilization for people with sensory impairment.

Disclosure statement

NSR reports being a scientific advisory board member (no financial compensation) to Shoebox, Inc and Good Machine Studio. LA, KK, and BKS have no conflicts of interest to report.

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References

- Hibbard JH, Greene J, Sacks RM, Overton V, Parrotta C. Improving population health management strategies: identifying patients who are more likely to be users of avoidable costly care and those more likely to develop a new chronic disease. *Health Serv Res.* 2017;52(4):1297–1309. doi:10.1111/1475-6773.12545.
- Hibbard JH, Greene J. What the evidence shows about patient activation: better health outcomes and care experiences; fewer data on costs. *Health Aff (Millwood).* 2013;32(2):207–214. doi:10.1377/hlthaff.2012.1061.
- Crews JE, Chou CF, Sekar S, Saaddine JB. The prevalence of chronic conditions and poor health among people with and without vision impairment, aged ≥ 65 years, 2010–2014. *Am J Ophthalmol.* 2017;182:18–30. doi:10.1016/j.ajo.2017.06.038.
- Morse AR, Seiple W, Talwar N, Lee PP, Stein JD. Association of vision loss with hospital use and costs among older adults. *JAMA Ophthalmol.* 2019;137(6):634–640. doi:10.1001/jamaophthalmol.2019.0446.
- Assi L, Karam ES, Swenor BK, Deal JA, Willink A, Reed NS. Association of sensory loss with the knowledge of heart attacks. *Am J Prev Med.* 2022;62(2):265–269. doi:10.1016/j.amepre.2021.07.003.

6. Assi L, Varadaraj V, Shakarchi AF, et al. Association of vision impairment with preventive care use among older adults in the United States. *JAMA Ophthalmol.* 2020;138(12):1298–1306. doi:10.1001/jamaophthalmol.2020.4524.
7. O'Day BL, Killeen M, Iezzoni LI. Improving health care experiences of persons who are blind or have low vision: suggestions from focus groups. *Am J Med Qual.* 2004;19(5):193–200. doi:10.1177/106286060401900503.
8. Spencer C, Frick K, Gower EW, Kempen JH, Wolff JL. Disparities in access to medical care for individuals with vision impairment. *Ophthalmic Epidemiol.* 2009;16(5):281–288. doi:10.1080/09286580902999439.
9. Choi S, Seo J. Trends in healthcare research on visual impairment and blindness: use of bibliometrics and hierarchical cluster analysis. *Ophthalmic Epidemiol.* 2021;28(4):277–284. doi:10.1080/09286586.2020.1863993.
10. Morse AR. The importance of patients' perspectives in providing ophthalmic care—lessons from the covid-19 pandemic. *JAMA Ophthalmol.* 2021;139(5):516. doi:10.1001/jamaophthalmol.2021.0121.
11. Morse AR, Seiple W. Activation in individuals with vision loss. *J Health Psychol.* 2020;26(13):2603–2612. doi:10.1177/1359105320922303.
12. Parker JL, Regan JF, Petroski J. Beneficiary activation in the medicare population. *Medicare Medicaid Res Rev.* 2014;4(4):E1–E14. doi:10.5600/mmrr.004.04.b02.
13. Hibbard JH, Mahoney ER, Stockard J, Tusler M. Development and testing of a short form of the patient activation measure. *Health Serv Res.* 2005;40(6p1):1918–1930. doi:10.1111/j.1475-6773.2005.00438.x.
14. Chang JE, Weinstein BE, Chodosh J, Greene J, Blustein J. Difficulty hearing is associated with low levels of patient activation. *J Am Geriatr Soc.* 2019;67(7):1423–1429. doi:10.1111/jgs.15833.
15. Williams R. Gologit2: a program for generalized logistic regression/partial proportional odds models for ordinal dependent variables. <https://www.stata.com/meeting/4nasug/gologit2.pdf>. Published 2005. Updated May 12, 2005. Accessed April 24, 2022.
16. Shukla A, Nieman CL, Price C, Harper M, Lin FR, Reed NS. Impact of hearing loss on patient-provider communication among hospitalized patients: a systematic review. *Am J Med Qual.* 2019;34(3):284–292. doi:10.1177/1062860618798926.
17. Assi L, Shakarchi AF, Sheehan OC, Deal JA, Swenor BK, Reed NS. Assessment of sensory impairment and health care satisfaction among medicare beneficiaries. *JAMA Netw Open.* 2020;3(11):e2025522. doi:10.1001/jamanetworkopen.2020.25522.
18. Gopinath B, Hickson L, Schneider J, et al. Hearing-impaired adults are at increased risk of experiencing emotional distress and social engagement restrictions five years later. *Age Ageing.* 2012;41(5):618–623. doi:10.1093/ageing/afs058.
19. Coyle CE, Steinman BA, Chen J. Visual acuity and self-reported vision status: their associations with social isolation in older adults. *J Aging Health.* 2017;29(1):128–148. doi:10.1177/0898264315624909.
20. Sleath B, Blalock S, Covert D, et al. The relationship between glaucoma medication adherence, eye drop technique, and visual field defect severity. *Ophthalmol.* 2011;118(12):2398–2402. doi:10.1016/j.ophtha.2011.05.013.
21. Okada M, Mitchell P, Finger RP, et al. Nonadherence or nonpersistence to intravitreal injection therapy for neovascular age-related macular degeneration: a mixed-methods systematic review. *Ophthalmol.* 2021;128(2):234–247. doi:10.1016/j.ophtha.2020.07.060.