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Self-Reported Dual Sensory Impairment and Subjective Cognitive Complaints Among Older Adults in the 2019 National Health Interview Survey

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ABSTRACT

Purpose: Subjective cognitive complaints (SCCs) are associated with poor quality of life, important for clinical care planning and management, and may predict dementia diagnosis. Dual sensory impairment (DSI) is a risk factor for dementia, but whether DSI is associated with SCCs is unknown. We evaluated whether self-reported DSI is associated with SCCs.
Method: We performed a cross-sectional analysis of 9,899 community-dwelling respondents aged 60+ years without dementia or depression in the 2019 National Health Interview Survey. Participants self-reported difficulty remembering or concentrating, seeing even when wearing corrective lenses, and hearing even when using a hearing aid. We defined SCCs and sensory impairment for each mode as reporting at least some difficulty. We categorized sensory impairment into no sensory impairment, vision impairment only, hearing impairment only, and DSI. We then estimated weighted prevalence ratios (PRs) of SCCs by impairment category.
Results: After weighting (9,899 participants representing a weighted n = 59,261,749), 12% of participants reported vision impairment only, 19% reported hearing impairment only, and 7% reported DSI. Relative to no impairment, after adjustment for potential confounders, vision impairment (PR = 2.07; 95% confidence interval [CI] [1.79, 2.39]), hearing impairment (PR = 2.26; 95% CI [2.00, 2.55]), and DSI (PR = 3.21; 95% CI [2.83, 3.63]) were associated with an increased prevalence of SCCs.
Conclusions: In this nationally representative survey of older Americans, DSI was associated with a threefold increased prevalence of SCCs. Although cross-sectional, these data underscore the importance of assessing multiple impairments as exposures when studying subjective cognition in older adults.
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Subjective cognitive complaints (SCCs) are self-reported concerns with memory or other cognitive domains in the absence of clinically diagnosed cognitive impairment. The prevalence of SCCs is high among community-dwelling older adults, estimated between 17% and 32% among those without cognitive impairment (Mitchell, 2008; Montejo et al., 2011). SCCs are associated with increased risk of transition to mild cognitive

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impairment and dementia (Kryscio et al., 2014; Luck et al., 2015; Mitchell et al., 2014; Reisberg et al., 2010). SCCs also independently predict 5+ years of incident dementia of all causes (Rönnlund et al., 2015) and are linked to Alzheimer's disease pathology (Barnes et al., 2006; Kryscio et al., 2014; Saykin et al., 2006; Schultz et al., 2015). Importantly, SCCs are also associated with poorer quality of life (Hill et al., 2017). A potential phase of preclinical dementia, SCCs could therefore be a key target for enhancing the quality of life of older adults and preventing subsequent dementia.

Sensory impairments, for example, vision and hearing impairment, have consistently been documented as strong independent mid- and late-life risk factors for dementia diagnosis (Livingston et al., 2020; Loughrey et al., 2018; Vu et al., 2021). Recent reports (Livingston et al., 2020) posit these factors confer risk by increasing cognitive load and by inducing neuropathological changes in the brain and advocate for research focused on interventions for these impairments to mitigate subsequent dementia. In lieu of this, one study demonstrated dual sensory impairment (DSI; i.e., concurrent vision and hearing impairment) is associated with a 50% increased risk of dementia over time relative to no impairments (Kuo et al., 2021), suggesting intervening on concurrent, rather than single, impairments could be an important strategy to reduce dementia risk.

Although the majority of these studies have focused on associations between objective measures for sensory impairments and cognition (Loughrey et al., 2018; Vu et al., 2021), these associations might plausibly differ from those between subjective, self-reported measures and SCCs. To begin elucidating the association of sensory impairments with SCCs, some recent studies indicated self-reported hearing impairments and vision impairments alone are positively associated with SCCs (Curhan et al., 2019; Jacob et al., 2019; Koyanagi et al., 2021). No studies to date, however, have examined the association between these two impairments concurrently and SCCs. To address this gap, we evaluated whether self-reported DSI is associated with increased prevalence of SCCs by leveraging data from the 2019 National Health Interview Survey (NHIS), a nationally representative survey of community-dwelling older adults in the United States.

Method

Study Design and Population

The NHIS is an ongoing household health survey sampling 35,000 households each year. By design, the survey is representative of the community-dwelling population living in the United States. Sampling areas and representative households within each area are selected, and all members of the household are invited to participate in the survey. Further details on the survey methods and the multistage sampling procedures are made publicly available by the NHIS (https://www-cdc-gov.proxy1.library.jhu.edu/nchs/nhis/2019nhis.htm).

We restricted our sample to older adult respondents aged 60+ years without a self-reported history of dementia or pharmacologically treated depression from the 2019 NHIS. The final study sample consisted of 9,899 participants with complete hearing, vision, SCCs, and covariate data. This study did not require institutional review board approval owing to the NHIS data being publicly available.

SCC

We ascertained SCCs via the one survey question that assessed presence of a complaint in a cognitive domain, "Do you have difficulty remembering or concentrating?" In this study, we dichotomized SCCs into yes (i.e., response indicating "Some difficulty," "A lot of difficulty," or "Cannot do at all") or no (i.e., response indicating "No difficulty").

Self-Reported Sensory Impairments

We ascertained self-reported hearing impairment via the survey question, "Do you have difficulty hearing [even when using your hearing aid]?" and self-reported vision impairment via the question, "Do you have difficulty seeing [even when wearing glasses or contact lenses]?" We dichotomized self-reported hearing into hearing impairment (response indicating "Some difficulty," "A lot of difficulty," or "Cannot do at all") and no hearing impairment (i.e., response indicating "No difficulty"). We further dichotomized self-reported vision into visual impairment (i.e., response indicating "Some difficulty," "A lot of difficulty," or "Cannot do at all") and no visual impairment (i.e., response indicating "No difficulty").

We classified participants who reported both hearing and visual impairments as having DSI. We then categorized participants into mutually exclusive groups of no sensory impairment, hearing impairment only, vision impairment only, and DSI.

Covariates

Given a review of plausible risk factors confounding the relationship between sensory impairments and SCCs, and prior research into self-reported DSI and dementia (Kuo et al., 2021), we identified several demographic

and clinical covariates a priori. Demographic covariates included age (a continuous variable for model building in the primary analysis and then categorized into six intervals for descriptive analyses), sex, race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, and other), education (< high school diploma, high school diploma or equivalent, some or full college, graduate/professional degree), and marital status (married or living with partner unmarried vs. not).

Clinical covariates included self-reported history of smoking (i.e., never smoker, former smoker, current smoker), body mass index (kg/m^2) categorized into four groups (underweight, < 18.5; healthy weight, 18.5–24.99; overweight, 25–29.99; and obesity, ≥ 30), and self-reported status (i.e., yes, no) of six chronic diseases (i.e., diabetes, hypertension, stroke, heart disease, cancer, and arthritis) that we combined into a chronic disease score covariate (i.e., a continuous value ranging from 0 to 6, indicating the total number of conditions present). A list of the variables and questions from the 2019 NHIS is presented in Supplemental Material S1.

Statistical Analysis

Because of the multistage sampling design of the NHIS, we leveraged survey weights in all of our analyses in accordance with National Center for Health Statistics procedures (https://www-cdc-gov.proxy1.library.jhu.edu/nchs/nhis/2019nhis.htm). Using these survey weights, we summarized the demographic and clinical characteristics of the sample by sensory impairments. To compare these groups, we used two-sided tests with α levels of .05. In the weighted sample, we estimated the prevalence of SCCs by sensory impairment; because age is the largest risk factor for sensory impairment, we also described the prevalence of SCCs by sensory impairment stratified by six age intervals.

To estimate the prevalence ratio (PR) of sensory impairment and SCCs, we fit log-binomial regression models; when these failed to converge, we fit Poisson models with robust variance estimators to approximate the PR (Barros & Hirakata, 2003). We fit several nested models in a sequential approach to estimate the cross-sectional association between sensory impairments and SCCs: (a) unadjusted model, (b) a model adjusted only for demographic characteristics, and (c) a model adjusted for demographic and clinical characteristics. Among the adjusted models, we performed model diagnostics by checking residuals and collinearity. As a secondary analysis, we investigated potential interactions (a) between age category and DSI category and (b) between sex and DSI category.

Because of the small number of respondents in the oldest-old age range (> 85 years; $n = 34$), we estimated the PR of SCCs between DSI categories after restricting the sample to only those respondents where we observed sufficient overlap of impairments by age (i.e., aged 60–85 years) in sensitivity analysis. We performed all analyses using R Version 4.0.2 (2020, the R Foundation for Statistical Computing).

Results

Study Sample Characteristics

After applying survey weights, the analytic sample ($n = 9{,}899$) represented 59,261,750 individuals. Overall, 12% reported vision impairment only, 19% reported hearing impairment only, and 7% reported DSI (see Table 1). The prevalence of these impairments was fairly consistent even among the lower age categories: Among participants aged 60–64 years, for example, 12% reported vision impairment only, 14% reported hearing impairment only, and 6% reported DSI. Compared to those reporting no sensory impairment, those reporting DSI were older on average ($M_{age} = 73$ years, $SD = 8$), and a higher percentage were non-Hispanic White (78%; see Table 1).

A fifth of the participants in this sample reported SCCs. Those reporting SCCs were, on average, older ($M_{age} = 73$ years, $SD = 8$) than those without SCCs ($M_{age} = 70$ years, $SD = 8$). When stratified by age, the prevalence of SCCs among participants with DSI increased with age (see Figure 1).

DSI and SCC

Relative to those without any sensory impairments, hearing impairment only, vision impairment only, and DSI were all associated with a higher prevalence of SCCs after multivariable adjustment (see Table 2). DSI, notably, was associated with a higher prevalence of SCCs relative to those without sensory impairments (PR = 3.21; 95% confidence interval [CI] [2.83, 3.63]).

There was an interaction between age group category and DSI category such that associations were attenuated among older age categories (e.g., PR = 0.51, $p < .01$ for hearing impairment and PR = 0.51, $p < .01$ for DSI among the 80–84 years age group; $p < .001$ for all DSI categories among the 85+ years age group; see Supplemental Material S2) after multivariable adjustment. There was no interaction between sex and DSI category.

Sensitivity Analysis

Restricting the study sample to older adults aged ≤ 85 years, the association between sensory impairments and SCCs in the fully adjusted model was consistent with

Table 1. Demographic and clinical characteristics by sensory impairment among participants aged 60 years or older without dementia and depression history in the 2019 National Health Interview Survey.

Characteristics	No impairment[a]	Vision impairment only[b]	Hearing impairment only[c]	Dual sensory impairment[d]
Age, *M* (*SD*)	70 (7)	70 (7)	72 (8)	73 (8)
Female, % [95% CI]	55 [53, 56]	56 [52, 59]	40 [37, 42]	47 [42, 51]
Race/ethnicity, % [95% CI]				
Non-Hispanic White	72 [70, 74]	67 [63, 70]	85 [82, 87]	78 [74, 82]
Non-Hispanic Black	11 [10, 12]	14 [12, 17]	6 [4, 7]	8 [6, 11]
Hispanic	10 [8, 11]	12 [9, 15]	5 [3, 6]	9 [6, 12]
Other[e]	7 [6, 8]	7 [5, 9]	5 [3, 7]	5 [3, 7]
Education, % [95% CI]				
< High school	13 [11, 14]	20 [16, 23]	14 [12, 17]	22 [17, 26]
High school or equivalent	27 [26, 29]	29 [26, 33]	29 [27, 32]	30 [26, 33]
Some or full college	47 [45, 48]	41 [37, 44]	45 [42, 47]	39 [35, 43]
Graduate degree	13 [12, 14]	10 [8, 12]	12 [10, 13]	9 [7, 11]
Married or living with partner, % [95% CI]	66 [64, 67]	61 [57, 64]	65 [63, 67]	57 [52, 61]
Smoking status, % [95% CI]				
Never smoker	56 [54, 57]	54 [51, 58]	49 [47, 52]	47 [43, 52]
Current smoker	10 [9, 11]	13 [10, 15]	10 [8, 12]	11 [8, 14]
Former smoker	34 [33, 35]	33 [29, 36]	41 [38, 43]	42 [38, 46]
BMI (kg/m^2), % [95% CI]				
< 18.5	2 [1, 2]	2 [1, 3]	1 [1, 2]	2 [1, 3]
18.5–24.99	32 [30, 33]	28 [25, 31]	30 [28, 32]	28 [24, 32]
25–29.99	38 [36, 39]	37 [34, 41]	38 [35, 41]	37 [33, 41]
≥ 30	29 [28, 30]	32 [29, 36]	31 [28, 33]	33 [29, 37]
CDS, *Mdn* (IQR)	1 (1, 2)	2 (1, 3)	2 (1, 3)	2 (1, 3)

Note. The data presented use survey weights. CI = confidence interval; BMI = body mass index; CDS = chronic disease score (i.e., sum of history of diabetes, hypertension, heart disease, stroke, cancer, and arthritis); IQR = interquartile range.

[a]Weighted n = 36,710,755. [b]Weighted n = 6,940,669. [c]Weighted n = 11,276,056. [d]Weighted n = 4,334,269. [e]Includes non-Hispanic Asian only, non-Hispanic American Indian, and other single and multiple races.

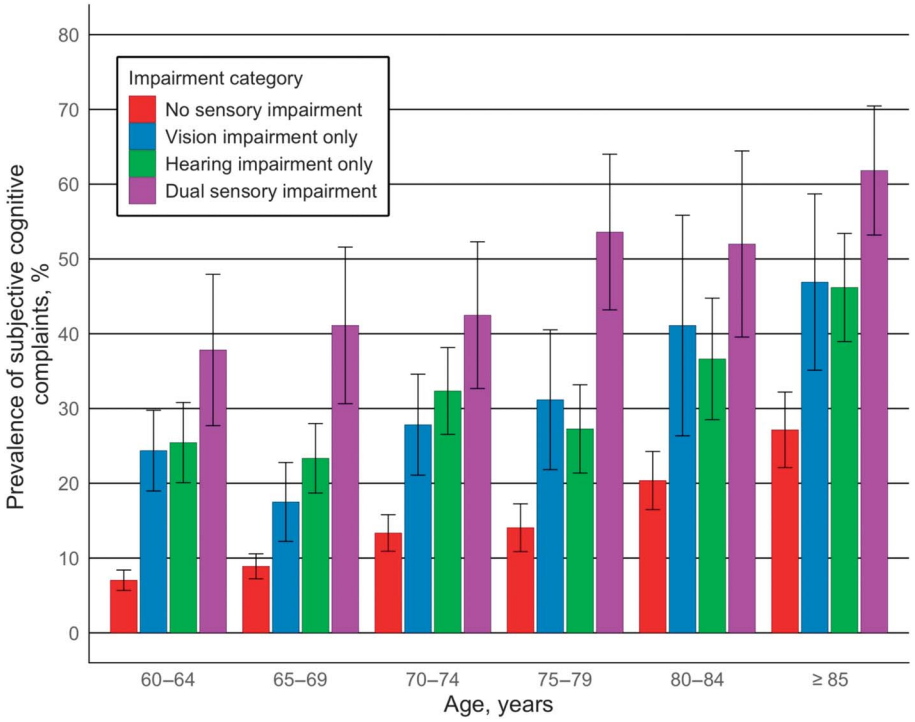
the primary analysis (e.g., for DSI, PR = 3.17; 95% CI [2.79, 3.60]; see Supplemental Material S3).

Discussion

Leveraging a nationally representative survey of community-dwelling older adults aged 60 years and older without a history of dementia or pharmacologically treated depression, we found DSI was cross-sectionally associated with a higher prevalence of SCCs. Nearly one of five older adults had self-reported hearing impairment only, one in 10 had self-reported vision impairment only, and 7% had DSI. Critically, one in five reported SCCs. DSI was associated with a greater than threefold higher prevalence of SCCs relative to having no self-reported sensory impairments. Because SCCs are associated with subsequent cognitive impairment and poorer health-related quality of life, these data suggest that to fully understand the impact of sensory impairments on cognition, multiple sensory impairments should be examined.

One main finding is the observed higher prevalence of SCCs among those with DSI relative to those with each impairment alone and no impairment. To our knowledge, this is the first study using nationally representative data to evaluate this relationship. This association between DSI and increased prevalence of SCCs could be explained by DSI conferring a greater cognitive load, or increased processing effort (e.g., through impoverished auditory or visual signals), on the brain than individual impairments alone. For example, the cognitive mechanisms recruited to compensate for the impoverished auditory and visual input might plausibly place a higher burden on domains pertinent for encoding information, such as memory, attention, and executive function (Powell et al., 2021). Persistent sensory deprivation from both hearing and vision loss, moreover, might also lead to permanent cerebral restructuring and other functional changes in the brain. Among older adults without dementia, for example, hearing loss has been associated with subsequent decrease in white matter microstructural integrity in the temporal lobe region and gray matter integrity in the hippocampus (Croll et al., 2020), areas that are critical for memory and attention processes and observed to decline in early Alzheimer's disease. The presence of multiple, concurrent impairments could possibly confer an even greater risk of SCCs through these two mechanisms. Alternatively, links could be attributed to a common cause (e.g., vascular disease) acting upon both DSI and SCCs. This study cannot directly address these questions but indicates that further studies are warranted to examine the plausibility of these proposed mechanisms.

Figure 1. Prevalence of subjective cognitive complaints (SCCs) by sensory impairment and age among participants aged 60 years or older without dementia or depression history in the 2019 National Health Interview Survey. The prevalence of SCCs by sensory impairment, stratified by age category. Error bars indicate 95% confidence intervals. These weighted survey data indicate a high prevalence of SCCs among all age groups with dual sensory impairment (DSI). The prevalence of SCCs among those with DSI tended to be higher than that among other impairment categories and tended to increase as age increased.



Our analysis also alluded to an interaction between age and sensory impairment, which tended to weaken associations between DSI and SCCs in some later age groups. Given that the prevalence of hearing and vision impairments, as well as of SCCs, increases with age, this is to be expected. This increased prevalence of SCCs among both exposed and unexposed groups would necessarily tend to weaken relative measures of association (Murphy et al., 2011).

The prevalence of SCCs (20%) among community-dwelling older adults in the NHIS is consistent with prior literature; previous studies estimate the prevalence of SCCs among community-dwelling older adults to be between

Table 2. Prevalence ratios of subjective cognitive complaints by impairment status among participants aged 60 years or older without dementia or depression history in the 2019 National Health Interview Survey (NHIS).

Status of sensory impairment	Prevalence ratio [95% CI]		
	Model 1[a]	Model 2[b]	Model 3[c,d]
None	1 [reference]	1 [reference]	1 [reference]
Vision impairment only	2.30 [1.99, 2.67]	2.20 [1.91, 2.54]	2.07 [1.79, 2.39]
Hearing impairment only	2.61 [2.32, 2.94]	2.37 [2.10, 2.67]	2.26 [2.00, 2.55]
Dual sensory impairment	4.09 [3.62, 4.62]	3.44 [3.03, 3.90]	3.21 [2.83, 3.63]

Note. Poisson regression modeling the cross-sectional association between sensory impairments and subjective cognitive complaints among participants in the 2019 NHIS study. These analyses utilize survey weights. CI = confidence interval.

[a]Unadjusted model. [b]Adjusted for age, sex (reference group: male), race/ethnicity (reference group: non-Hispanic White), education (reference group: less than high school diploma), and marital status (reference group: neither married nor living with partner). [c]Adjusted for age, sex, race/ethnicity, education, marital status, smoking history (reference group: never smoker), body mass index (reference group: normal weight, body mass index = 18.5–24.99), and chronic disease score (i.e., sum of history of diabetes, hypertension, heart disease, stroke, cancer, and arthritis; modeled continuously). [d]When impairment is treated as a continuous variable in the fully adjusted model, we also observe a positive trend (prevalence ratio = 1.47; 95% CI [1.41, 1.53]; $p < .001$).

17% and 32% (Mitchell, 2008; Montejo et al., 2011). Although this is novel work on the association between DSI and SCCs, our findings concerning self-reported hearing impairment only are largely consistent with previous work into individual impairments. Older adult men self-reporting hearing impairment had at least a 1.3-fold higher incidence of reporting at least one new SCCs over 8 years of follow-up relative to no impairment in the Health Professionals Follow-up Study (Curhan et al., 2019); a 4-year follow-up study among women in the Nurses' Health Study reported similar results (Curhan et al., 2020), and one study reported older adults with objectively measured vision impairment had 1.3-fold greater odds of concurrent subjective memory complaints relative to those without vision impairment in the National Health and Nutrition Examination Survey between 1999 and 2006 (Lee et al., 2019).

We recognize several limitations to our analysis. Given the cross-sectional design, we could not examine the temporality of sensory impairments relative to SCCs. To our knowledge, however, this is the first analysis examining the relationship between DSI and SCCs. Future prospective analyses should be undertaken to support these data.

Error in self-report measures for sensory impairment and SCCs that correlate with one another (i.e., same-source bias; Diez Roux, 2007) could also induce bias. This could, for example, manifest as an underlying personality trait that increases one's propensity to answer all self-report measures in a consistent manner. Given the design of the NHIS, we are unable to directly evaluate this possibility. However, older adults are more likely to underreport hearing impairment (Kamil et al., 2015), in which case our analyses likely underestimate the magnitude of impairment. Moreover, self-reported hearing and vision impairments by definition do not necessarily capture clinical definitions for hearing and vision impairments; however, these are clinically relevant insofar as it captures an individual's experienced limitations. Future studies using objective measures for peripheral auditory processing (e.g., audiometry) and presenting visual acuity are needed to investigate relationships between sensory impairment and SCCs.

Finally, one outstanding issue in the literature is no consensus on a formal definition of SCCs, leading to several operationalizations outside of subjective cognitive decline (Jessen et al., 2014). Although our conceptualization of SCCs does not capture the nuances of progressive cognitive decline or objective cognitive impairment, the single questions we used that assessed self-reported sensory impairments and cognition have important clinical utility (Olivari et al., 2021). For example, it is argued that initial subjective memory complaints, even in the absence of objective impairment, should be discussed with health care providers to facilitate early identification of individuals at risk of dementia and care planning (Olivari et al., 2021; Rönnlund et al., 2015).

Given the role SCCs play in older adults' quality of life and their importance in predicting dementia, our data indicate further characterization of risk factors for SCCs is important to improve the health outcomes of older adults. In our nationally representative sample, the prevalence of self-reported hearing impairment, vision impairment, and DSI was noteworthy even among participants aged 60–64 years. Therefore, if the relationship we observed between self-reported sensory impairments and SCCs bears out in future studies, it might be worthwhile for the presence of one or more sensory impairments to trigger screening for SCCs in clinical settings, or vice versa. In primary care, this could be feasible, as SCCs screening would not require intensive questionnaires or neuropsychiatric batteries.

Conclusions

DSI was prevalent among a nationally representative sample of community-dwelling older adults without dementia or depression in the 2019 NHIS study and was associated with a threefold increased prevalence of SCCs. Although these data indicate a cross-sectional association between multiple self-reported impairments and cognition and underscore the importance of analyzing concurrent impairments in the context of studies of cognition, future longitudinal and randomized studies are necessary to better elucidate the relationship.

Data Availability Statement

This study was based on publicly available data from the National Health Interview Survey (data available at https://www.cdc.gov/nchs/nhis/2019nhis.htm).

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