Hypertension and Cognitive Health Among Older Adults in India

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Long Title: Hypertension and Cognitive Health Among Older Adults in India

Short Title: Hypertension and Cognition in Older Indians

Abstract:

Objectives: To assess the prevalence of diagnosed and undiagnosed hypertension, and their relationship to cognitive function in older adults in India.

Design: Longitudinal Aging Study in India-Diagnostic Assessment of Dementia (LASI-DAD), an in-depth national study of late-life cognition and dementia.

Setting: Geriatric hospitals and respondents' homes across 14 states in India.

Participants: N=2,874 individuals 60 and older from LASI-DAD.

Measurements: Hypertension was identified by self-report of physician-diagnosis or measured blood pressure (BP) $\geq$140/90 mm Hg. Undiagnosed hypertension was defined as hypertensive BP measurements, but no physician-diagnosis. Controlled hypertension was defined as BP<140/90 among those with a physician-diagnosis. Total hypertension included both diagnosed and undiagnosed hypertension. A summary cognition score, derived from the sum of 18 cognitive tests administered in the LASI-DAD (range 0 to 360) was used to assess cognitive function.

Results: Total hypertension prevalence was 63.2% (41.5% diagnosed and 21.6% undiagnosed). Among those with hypertension, 34.5% were undiagnosed, 34.2% were

diagnosed but uncontrolled, and 31.3% were diagnosed and controlled. Neither diagnosed nor undiagnosed hypertension were related to cognitive function in fully-adjusted models. Older age, female sex, less education, being widowed, rural residence, residing in the North or Central regions, being in a Scheduled Caste or Tribe, low consumption, being underweight, and history of stroke were all independently associated with worse cognitive test performance.

Conclusion: Two-thirds of older Indian adults had hypertension, with the majority being undiagnosed, or diagnosed but not adequately controlled. Hypertension was not independently associated with cognitive function, while sociodemographic factors were independently related to cognitive function.

Abstract Word Count: 250 words

Key Words: Hypertension, Cardiovascular risk factors, Dementia risk factors, Cognition, India

BACKGROUND

India, like much of the rest of the world, is experiencing significant demographic change driven by lower fertility rates, increasing life expectancy, and subsequent aging of the population.[1,2] The share of the Indian population aged 60 and above is projected to nearly double in the next 30 years from 10% in 2020 to 19% in 2050.[1] This aging of the Indian population has important implications for public health, family dynamics and caregiving, and public policy in India, especially since India is expected to surpass China as the most populous country in the world in 2027.[1] The growth in the older population will increase the importance of better understanding the burden, prevention, and treatment of common noncommunicable diseases (NCDs) associated with aging, such as hypertension, heart disease, and dementia. The growing evidence that common cardiovascular risk factors (CRFs), such as hypertension, increase the risk for cognitive decline and dementia[3] also underscores the importance of collecting data on CRFs and cognitive function in representative population-based samples in India.

Several recent studies have examined the prevalence of hypertension in Indian adults, using various approaches and datasets. For example, one study found a crude hypertension prevalence of 21.1% using only systolic blood pressure (SBP) to define hypertension among adults aged 30 and older[4]; another study using SBP and diastolic blood pressure (DBP) found a crude hypertension prevalence of 25.3% among Indians aged 20 and older[5], and a third recent study found a crude prevalence of 14.4% by

SBP/DBP readings among Indian women 15-49 and men 15-54 years old.[6] All three studies found considerable heterogeneity in hypertension prevalence based on socioeconomic status (SES)[5,6], state/territory of residence[4,5], urbanicity[5,6], and gender.[4-6]

Recent studies have estimated that three to four million older Indians had dementia in 2015, and that number is expected to increase significantly due to demographic changes.[7,8] The Longitudinal Aging Study in India-Diagnostic Assessment of Dementia (LASI-DAD) was recently fielded to collect nationally-representative data from across India to better document and understand the risk factors and outcomes of dementia in the growing population of Indian older adults. We report initial findings on diagnosed and undiagnosed hypertension and their relationship with cognitive test performance in the baseline LASI-DAD sample.

METHODS

The Longitudinal Aging Study in India-Diagnostic Assessment of Dementia (LASI-DAD)

LASI-DAD is a new study of late-life cognition and dementia in India collecting a wide range of demographic, health, cognitive, and economic data on a large national sample (N= 3,224) of Indian adults aged 60 or older.[9] LASI-DAD is a sub-study of the larger Longitudinal Aging Study in India (LASI)[10], and is one of ten studies in the Health

and Retirement Study (HRS) international network that is implementing the Harmonized Cognitive Assessment Protocol (HCAP) to collect comparable cognition and dementia data from low, middle, and high-income countries around the world.[11]

LASI-DAD used two-stage stratified random sampling and oversampled those at high-risk of cognitive impairment. First, the full LASI sample from the parent study was stratified based on respondents' state of residence and their risk of cognitive impairment, determined by their performance on cognitive measures in the baseline LASI. Second, participants were randomly drawn in roughly equal numbers from the high-risk and non-high-risk cognitive impairment strata. The LASI-DAD sample size for each state was set proportional to that used in the parent LASI.

The LASI-DAD respondent interview included demographics, cognitive testing, and physical measures. Each respondent was asked to provide the name of an informant to provide additional information about the respondent regarding medical diagnoses, cognitive function, and performance of activities of daily living (ADLs) and instrumental activities of daily living (IADLs). Additional information on economic and family measures was available from the parent LASI survey.

LASI-DAD interviews took place an average of seven months after the main LASI interview, from April 2017 through April 2019. The response rate was 82.9% and was similar among those who were (82.8%) and were not (82.9%) at high-risk for cognitive impairment based on their cognitive function in the main LASI interview. Interviews were

conducted at geriatric health centers in each of 14 states/Union Territories across India, or in the homes of some participants based on respondents' preference and their proximity to the hospital.[9] LASI-DAD included respondents from: Jammu & Kashmir, Haryana, Delhi, Rajasthan, Uttar Pradesh, Madhya Pradesh, West Bengal, Odisha, Assam, Karnataka, Kerala, Tamil Nadu, Telangana, and Maharashtra. Participants were from urban and rural areas and the sampling frame is intended to represent the country as a whole.[9] Interviews were conducted in 13 local languages.

Measures

Cognitive Function

Cognitive function was assessed using a summary cognition score comprised of 18 cognition measures administered in LASI-DAD (range from 0 to 360, with higher score indicating better cognitive function). The individual LASI-DAD cognitive tests are shown in Supplement Table 1, and more information is available in the published LASI-DAD protocol.[9] This summary cognition score was developed by the LASI-DAD study team to assess general cognitive function across multiple cognitive domains.[9] Regression results for the Hindi Mental State Exam (HMSE), one component of the summary cognition measure that has been used in prior studies in India, are shown in Supplemental Table 3.

Hypertension Classification

Three measurements of blood pressure were performed with the respondent seated, and we used the average systolic blood pressure (SBP) and diastolic blood pressure (DBP) of the second and third measurement as the indicator of measured blood pressure; hypertension was defined as an SBP ≥140 mm Hg or DBP ≥90 mm Hg. Respondents also reported if a doctor had ever told them they had hypertension, and whether they were taking medications for hypertension. This information was used to classify individuals into three mutually exclusive groups: 1) no hypertension (no physician-diagnosis of hypertension and normal measured BP); 2) undiagnosed hypertension (no physician-diagnosis and hypertension by measured BP); and 3) diagnosed hypertension (physician-diagnosis of hypertension, regardless of normal or hypertensive blood pressure measurement). We defined “total hypertension” as the sum of individuals with both diagnosed and undiagnosed hypertensions. We further stratified the diagnosed hypertension group into “uncontrolled” and “controlled” hypertension based on whether their measured BP was above or below the hypertension threshold. Only those respondents who self-reported a hypertension diagnosis were asked if they were taking medication.

Covariates

Sociodemographic factors relevant to both the risk for hypertension and cognitive function were assessed, including: age, urban/rural residence, caste, education (no schooling, less than secondary school, secondary school or higher), relationship status

(married, widowed, separated/divorced, never married), and per capita household consumption (in Rupees).

Caste designation was based on respondents' self-report of being a member of: a Scheduled Caste, a Scheduled Tribe, Other Backward Class (OBC), or "no caste or other caste". These categories have been used in prior population-based studies in India[12], including studies using LASI data[13]. While caste designation can be associated with SES, the strength of that association varies across geographic regions in India.

Per capita household consumption, rather than income or wealth, was used as a measure of economic status based on prior studies indicating it better captures economic status in low-income and rural settings.[13,14] Household consumption included self-reported expenses over the previous year for: food, household utilities, fees, durable goods, education, health care, discretionary spending, transit, and remittances. Total household consumption was converted to per capita consumption by dividing by the total number of household members.

Health characteristics included in our analyses included Body Mass Index (BMI) calculated with measured height and weight, self-report of physician-diagnosis of stroke, Alzheimer disease, arthritis, cancer, diabetes, high cholesterol, heart problem, and lung disease.

Six geographic regions were defined as: Center (Madhya Pradesh), North (Jammu & Kashmir, Haryana, Delhi, Rajasthan, Uttar Pradesh), South (Karnataka,

Kerala, Tamil Nadu, Telangana), East (West Bengal, Odisha), West (Maharashtra), and Northeast (Assam).

Data Analysis

We calculated descriptive statistics for sociodemographic and health characteristics, stratified by hypertension status. We estimated four linear regression models with different sets of covariates to examine the relationship of hypertension and other variables to the summary cognition score. Model 1 is the unadjusted relationship of undiagnosed and diagnosed hypertension to the summary cognition score. Model 2 adds age categories, sex, education, relationship status, residence, caste, and per capita consumption (quartiles in Rupees: ≤24,100; 24,100-36,920; 36,921-58,5580; and ≥58,581+). Model 3 adds health conditions, and Model 4 adds region of residence. We excluded 350 individuals (11%) from the analysis due to missing data for one or more covariates (n=294 were missing the BMI measure), leaving a final analytical sample of n=2,874. We also assessed the interaction between hypertension status and age categories and hypertension status and gender. We used a Wald test to compare models and a residuals plot to assess model fit. All analyses were performed using STATA software (release 15.1, Stata Corp). We used the LASI-DAD post-stratification sampling weight to adjust for non-response and the complex sampling design.[9]

RESULTS

Characteristics of the LASI-DAD sample, stratified by hypertension status, are shown in Table 1. Overall, hypertension (either diagnosed or undiagnosed) was more common among those who were older, women, lived in an urban residence, belonged to OBC or “no caste or other caste”, and were separated/divorced/never married. Undiagnosed hypertension was more common among those in a scheduled caste or scheduled tribe, and among those with less schooling. Diagnosed hypertension was most common among those in the top quartile of per capita consumption, while those in the lowest quartile had the lowest prevalence of total hypertension, but highest prevalence of no hypertension. The mean summary cognition score was highest among those with diagnosed hypertension ($p<0.01$). The distribution of summary cognition scores of the sample can be found in Supplemental Figure 1.

Figure 1 provides more detail on the overall prevalence of hypertension and hypertension control in the LASI-DAD. 36.9% of older adults had no hypertension, 21.6% had undiagnosed hypertension, and 41.5% had diagnosed hypertension. Among those with hypertension, 34.5% were undiagnosed, 34.2% were diagnosed and uncontrolled, and 31.3% were diagnosed and controlled; so more than two-thirds (68.7%) of hypertension was either not diagnosed or not controlled.

Results from the multivariable linear regression analysis of summary cognition score on sociodemographic and health variables are shown in Table 2. Without

adjustment (Model 1) and after adjustment for sociodemographic factors (Model 2), diagnosed hypertension was associated with slightly better cognitive function ($p<0.05$). Older age, female sex, less education, being widowed, rural residence, being in a Scheduled Caste or Scheduled Tribe, and being in the lowest consumption quartile were all independently associated with worse performance on the cognitive tests. With further adjustment for health characteristics (Model 3), diagnosed hypertension was no longer significantly related to cognitive function. Stroke and Alzheimer's/dementia diagnosis were associated with worse cognitive function. Those who were underweight had lower cognition scores while those who were overweight/obese had higher cognition scores. The addition of geographic region (Model 4) showed regional differences with the North and Central regions associated with worse cognition scores. The addition of region did not significantly change the coefficients from Model 3 with the exception of caste coefficients, which were larger after region was added to the model.

DISCUSSION

The total hypertension prevalence of 63.2% that we found among older Indians is higher than reported in prior studies that included younger adults[4-6,13,15,16], and also studies that assessed hypertension using only direct blood pressure measurement.[4-6] While we found a significant proportion of hypertension to be undiagnosed, it appears that there has been progress over the last decade in hypertension recognition and

treatment among older Indians.[17] An analysis of pilot data collected in 2010 for the parent LASI study found the same prevalence of directly measured hypertension using the same methodology and definitions (43%), but significantly lower rates of physician-diagnosed hypertension (17% compared to 41% in our study) and medication use (14% compared to 36%)[13]. Future studies using LASI-DAD data that focus more closely on predictors of hypertension diagnosis, treatment, and control will provide important information for potential improvements in health care access, appropriate treatment, and cardiovascular risk profiles among the growing population of older Indians.

We did not find an independent relationship between hypertension and cognitive function in this cross-sectional study, which is in line with prior cross-sectional studies, especially those that include adults aged 80 or older.[18] Growing evidence suggests that mid-life hypertension, and especially persistent elevation of blood pressure in mid-life[19], may have a more robust relationship to later-life cognitive impairment than hypertension at older ages[18]. The recent SPRINT MIND trial found that intensive blood pressure control in a sample of adults aged 50 and older (mean age of 68) was associated with a lower likelihood of the composite outcome of incident mild cognitive impairment or dementia.[20] Given the high prevalence of hypertension in middle-aged and older adults, it will be important for future longitudinal studies, including those using LASI-DAD data, to follow trajectories of blood pressure and cognition in mid- and later-life to identify the

blood pressure treatment targets that are most likely to preserve later-life cognitive function.

Cognitive function in this national sample of older Indian adults was independently associated with a number of characteristics that have been shown in prior studies in both high-income[21] and low and middle-income countries[22,23]. For instance, older age, less education, rural residence, being underweight, and a history of stroke were all significantly negatively associated with summary cognition score. Other factors negatively associated with summary cognition score included female sex, being widowed, residing in the North or Central regions, and being a member of a Scheduled Caste, Scheduled Tribe, or Other Backwards Class; each of these latter factors suggest the importance of economic and social opportunity as key contributors to cognitive health at older ages. Future research using longitudinal LASI data may help better identify the key drivers and pathways of the negative relationship between socioeconomic disadvantage and cognitive function, including the possibility that hypertension may, in part, mediate the relationship between socioeconomic disadvantage and worse cognitive function.

Women were more likely than men to report physician-diagnosed hypertension and to be taking medications for hypertension, suggesting potentially better access to the health care system, despite other disadvantages such as less education and less likely to be married or partnered (see Supplemental Table 2). Among those with

diagnosed hypertension, women were also more likely than men to have controlled hypertension. These findings are consistent with other research in 44 low and middle-income countries[24] and within India[25] that suggest women are more likely to receive hypertension diagnosis and care. Recent studies[24,25] report findings on the "hypertension care cascade", that is, how hypertension is identified, diagnosed, and treated. These studies found that despite high hypertension prevalence in young and middle-aged Indians (aged 15-49), most were not making it through the hypertension care cascade to receive a diagnosis or achieve control.[24,25] India performed especially poorly compared to 43 other low and middle-income countries regarding the share of those with hypertension who successfully make it through the care cascade.[24] Our findings suggest older adults in India face similar challenges, as more than two-thirds of older Indians with hypertension in our study did not make it through the hypertension care cascade to receive a diagnosis or achieve control of their hypertension. It will be especially important to identify ways to improve the hypertension care cascade for older Indians as the total hypertension prevalence of 63.2% in our study was significantly higher than recent national prevalence estimates among young and middle-aged Indian adults.[24,25]

Previous research among Indians who were aged 50 and older between 2007-2010 showed that more than one-third of older Indians identified cost as a barrier to getting healthcare, and less than 10% reported their last inpatient or outpatient

healthcare visit as free of cost.[17] The 2018 government healthcare reform, *Ayushman Bharat*, contains two mechanisms that may affect the hypertension care cascade for older Indians. The first is the *Pradhan Mantri Jan Arogya Yojana* (PM-JAY), which has the objective of expanding access and reducing healthcare costs for the most vulnerable Indians as an effort to reach universal health coverage.[26] The second component is the creation of *Health and Wellness Centers* (HWCs) that place additional emphasis on primary care, noncommunicable disease, and care for older adults. Future follow-up waves of LASI and LASI-DAD data collection will be useful for evaluating the impact of the *Ayushman Bharat* reforms on the diagnosis and treatment of hypertension and other chronic diseases among older adults in India.

There are a number of potential limitations of our study. We used the base-line LASI-DAD data, so our analyses are cross-sectional and we were not able to determine the direction of causality for the relationships we studied. Future data collection in LASI and LASI-DAD will be useful for better identifying longitudinal causal relationships. Self-report of health conditions, including physician-diagnosed hypertension, may be subject to mis-reporting, making the inclusion of direct measurement of blood pressure important. We did not have data on the onset of hypertension and blood pressure readings were taken concurrently with cognitive tests. Since mid-life hypertension[27] and chronicity of hypertension[18] likely have an important impact on the relationship of late-life hypertension to cognitive function, this may have limited our ability to identify a

relationship. Finally, we used a cognitive summary score to assess cognition in this study, and did not examine specific cognitive domains (e.g., memory, language, or executive function).

The strengths of our study include the use of recently-collected high quality data from LASI-DAD, a national study with comprehensive hypertension and cognitive measures in older Indians. The embedding of LASI-DAD in the larger LASI will provide valuable opportunities to use nationally-representative longitudinal data to better understand the risk factors and outcomes for cognitive decline in India. The use of both self-report of hypertension and directly measured blood pressure is a key strength of our study, and provided important new information on the rates of hypertension diagnosis, treatment, and control with the most recent data available for older Indian adults

In conclusion, we found that two-thirds of older Indians have hypertension, and the majority of those with hypertension are either undiagnosed or their blood pressure is not adequately controlled. Diagnosed and undiagnosed hypertension were not independently related to cognitive function in this cross-sectional analysis.

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Author Contributions: Ms. Farron, Mr. Kabeto, and Dr. Langa had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Study Concept and Design: Farron, Kabeto, Langa

Analysis and Interpretation of Data: Farron, Kabeto, Langa

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Statistical Analysis: Kabeto

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Figure 1 (Attached as pdf)

Title: Prevalence of Hypertension and Hypertension Control

Note: Small differences in percentages among figures is due to missing data.

Supplement (Attached document)

Title: Supplement to Hypertension and Cognitive Health Among Older Adults in India

Description: The supplement contains information on the tests and scores that comprise the summary cognition score; characteristics of the LASI-DAD sample by sex; multivariate linear regression analysis of Hindi Mini-Mental Score (HMSE) on sociodemographic characteristics, health characteristics, and region; and the distribution of the summary cognition scores for the LASI-DAD sample.

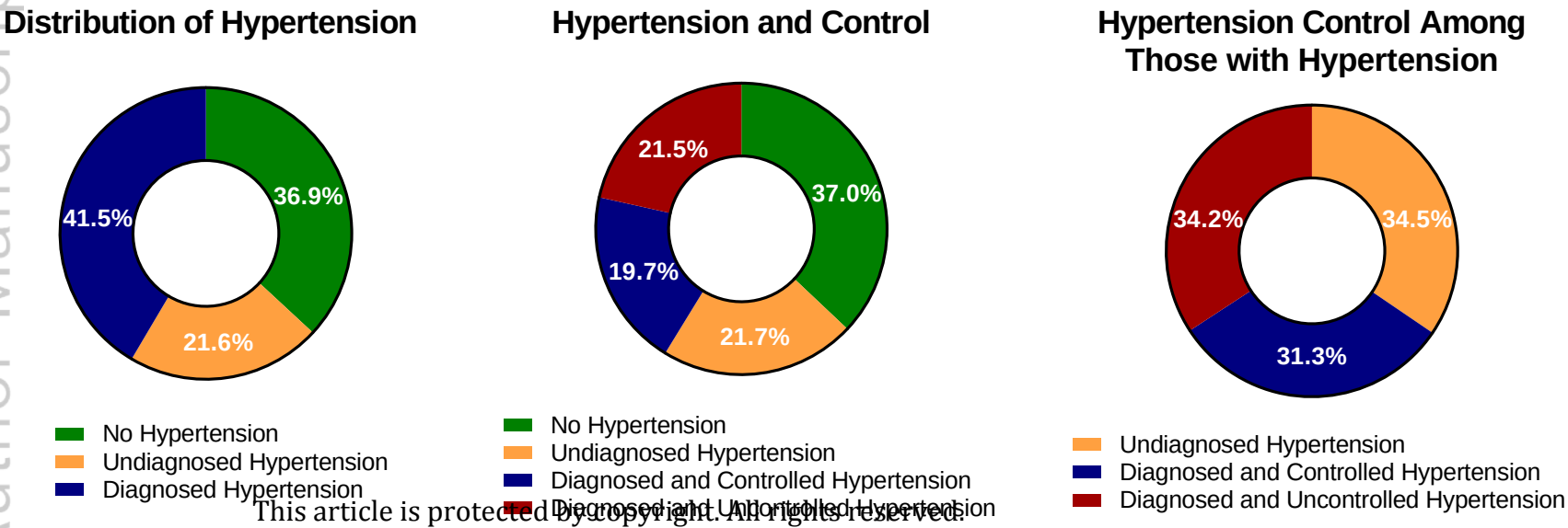

Table 1. Characteristics of the LASI-DAD sample by hypertension status, weighted (row %)

	No Hypertension[a] (n=1,090)	Diagnosed Hypertension[b] (n=1,182)	Undiagnosed Hypertension[c] (n=602)
Distribution of hypertension, %	36.9	41.5	21.6
Sociodemographic Characteristics			
Age, mean, years (SD)	67.9 (7.2)	69.2 (7.1)	68.7 (7.3)
Age categories, %			
60-69	39.2	39.2	21.6
70-79	32.3	46.2	21.5
80+	34.6	43.1	22.3
Sex, %			
Men	40.6	34.7	24.7
Women	33.2	48.0	18.7
Residence, %			
Rural	44.0	34.6	21.5
Urban	31.4	46.8	21.8
Caste, %			
Scheduled Caste	42.3	33.3	24.4
Scheduled Tribe	45.7	25.9	28.5
Other Backward Class	37.7	41.4	20.9
No Caste or Other Caste	32.0	47.8	20.3
Education categories, %			
No schooling	37.2	40.2	22.6
Less than secondary	35.9	44.7	19.4
Secondary or higher	36.4	47.0	16.7
Relationship Status, %			
Married / Partnered	39.4	38.9	21.7
Widowed	32.5	46.9	20.7
Separated / Divorced / Never Married	22.9	39.6	37.5
Per capita consumption in Rupees in quartiles, %			
≤24,100	42.0	34.1	23.9
24,101-36,920	38.2	39.8	22.0
36,921-58,580	32.9	45.7	21.4
58,581+	34.5	46.0	19.5
Health Characteristics			
BMI, %			
<18.5	52.0	25.6	22.4
18.5-24.9	37.8	38.7	23.6
25.0-29.9	26.8	53.2	20.1
30+	21.4	65.7	12.9
Stroke, %	20.1	64.2	15.74
Arthritis, %	30.2	48.3	21.5
Cancer, %	20.5	58.1	21.4
Diabetes, %	17.5	69.4	13.4
Ever had high cholesterol problem, %	17.3	74.9	7.8
Ever had heart problem, %	18.9	71.1	10.0

Ever had lung disease, %	34.6	50.3	15.1
Alzheimer's / dementia, %	12.2	67.2	20.6
Mean summary cognition score (SD)	130.0 (48.2)	136.0 (45.9)	130.4 (44.4)

[a]Normal blood pressure measurement (SBP <140 and DBP<90) and no self-report of physician-diagnosis

[b]Self-report of physician-diagnosis

[c]Hypertensive blood pressure measurement (SBP ≥140 or DBP ≥90) and no self-report of physician-diagnosis

Table 2. Multivariable linear regression analysis of summary cognition score on sociodemographic characteristics, health characteristics, and region

Variable	Model 1	Model 2	Model 3	Model 4
Hypertension (reference: no hypertension)				
Undiagnosed hypertension	0.5 (-4.5, 5.4)	1.2 (-2.7, 5.0)	0.1 (-3.7, 3.9)	0.3 (-3.3, 4.0)
Diagnosed hypertension	6.0 (1.8, 10.2)	3.2 (0.4, 6.4)	-0.1 (-3.3, 3.2)	0.5 (-2.7, 3.7)
Age (reference: 60-69)				
70-79		-12.6 (-15.8, -9.4)	-11.5 (-14.6, -8.3)	-11.4 (-14.4, -8.3)
80+		-30.4 (-35.4, -25.3)	-27.6 (-32.6, -22.6)	-27.2 (-32.0, -22.4)
Gender (reference: men)				
Women		-7.5 (-10.8, -4.3)	-8.5 (-11.7, -5.3)	-8.4 (-11.5, -5.3)
Education (reference: no schooling)				
Less than secondary schooling		45.2 (41.4, 49.0)	43.6 (39.9, 47.4)	41.8 (38.2, 45.5)
Secondary schooling or higher		61.8 (55.3, 68.3)	58.9 (52.5, 65.3)	58.0 (51.8, 64.2)
Relationship status (reference: married)				
Widowed		-5.6 (-9.0, -2.3)	-4.9 (-8.2, -1.6)	-6.5 (-9.7, -3.3)
Separated/Divorced/Never Married		-3.5 (-16.1, 9.2)	-0.3 (-12.3, 11.6)	-5.6 (-17.0, 5.8)
Residence (reference: urban)				
Rural		-16.6 (-19.5, -13.7)	-14.3 (-17.2, -11.3)	-12.9 (-15.8, -9.9)
Caste (reference: No Caste or Other Caste)				
Scheduled Caste		-6.0 (-10.3, -1.8)	-4.2 (-8.4, -0.1)	-6.3 (-10.6, -2.1)
Scheduled Tribe		-9.6 (-15.9, -3.2)	-6.2 (-12.5, 0.2)	-10.7 (-17.0, -4.4)
Other Backwards Class		0.6 (-2.7, 3.9)	1.2 (-2.0, 4.4)	-2.7 (-5.9, 0.6)
Per capita consumption (reference: <24,100 Rupees)				
24,100-36,920		4.2 (-.2, 8.2)	3.0 (-0.9, 6.9)	2.9 (-0.9, 6.7)
36,921-58,580		6.1 (2.2, 10.0)	4.3 (0.5, 8.2)	3.8 (0.1, 7.5)
58,581+		11.4 (7.2, 15.6)	8.7 (4.5, 12.8)	8.0 (4.0, 12. 0)
BMI (reference: 18.5-24.9)				
<18.5			-12.7 (-16.4, -8.9)	-12.3 (-15.9, -8.6)
25.0-29.9			4.3 (0.8, 7.9)	4.2 (-0.7, 7.7)

30+	8.2 (3.1, 13.3)	9.2 (4.2, 14.3)
Stroke	-7.5 (-13.0, -2.1)	-7.8 (-13.2, -2.3)
Alzheimer's/Dementia	-14.2 (-27.9, -0.4)	-13.6 (-26.8, -0.5)
Arthritis	0.8 (-2.4, 4.1)	-1.8 (-5.0, 1.5)
Cancer	3.7 (-8.3, 15.7)	1.2 (-11.9, 14.3)
Diabetes	3.9 (0.1, 7.6)	1.3 (-2.4, 5.0)
Heart problems	5.4 (-0.2, 10.9)	3.7 (-1.6, 9.1)
Lung problems	1.7 (-3.5, 6.9)	2.2 (-3.0, 7.4)
Region (reference: Central)		
North		-0.2 (-8.0, 7.5)
South		18.6 (10.9, 26.2)
East		13.0 (4.9, 21.0)
West		16.2 (7.2, 25.2)
Northeast		11.7 (1.9, 21.6)

Note: The summary cognition measure was obtained by adding 18 cognition measures (range 0 to 360). Values reported are the regression coefficients (points of the summary cognition measure) and 95% confidence intervals

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