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Subjective Age and Risk of Incident Dementia: Evidence from the National Health and Aging Trends Survey

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Abstract

The present study examines the association between subjective age and risk of incident dementia in a large longitudinal sample of older adults. Participants were adults aged 65 years and older from the National Health and Aging Trends Study (NHATS). Subjective age, covariates, and cognitive status were assessed in 2011 and cognitive status was again assessed in 2012, 2013, 2014 and 2015. Incident dementia was determined based on answers from self and proxy respondents. The analyses included 4,262 participants without dementia at baseline. Adjusting for demographic factors and baseline cognition, an older subjective age was related to higher likelihood of incident dementia. This association was partly accounted by depressive symptoms. Beyond the effect of chronological age, feeling older is associated with the risk of incident dementia.

1. Introduction

Dementia has extensive individual and societal consequences. It is a major cause of functional limitations, disability and mortality (Staekenborg et al., 2016), which generate substantial social and economic costs (Wimo et al., 2017). Given that its prevalence is expected to rise in the next few decades due to the ageing of the population (Alzheimer Association, 2017), the identification of factors associated with risk of incident dementia is a crucial public health issue.

Chronological age is the strongest risk factor for dementia and prevalence of dementia increases with age (Daviglus et al., 2010). There is, however, significant variation in the rate of aging across individuals, and a growing literature suggests an association between aging perceptions and changes in cognition and dementia-related outcomes (Levy et al., 2016; Stephan et al., 2017). Specifically, subjective age, that is how old or young people feel relative to their chronological age, captures individual differences in physiological and psychological aging (Kotter-Grühn et al., 2015) and may modulate risk of dementia. Recent research supports the hypothesis that feeling older than one's age is related to steeper memory decline (Stephan et al., 2016) and risk of cognitive impairment and dementia (Stephan et al., 2017). An older subjective age is also associated with a range of dementia-related risk factors that may explain its association with impaired cognition, including

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depressive symptoms (Choi & DiNitto, 2014), stress reactivity (Shrira et al., 2016), diabetes and hypertension (Demakakos et al., 2007), inflammation (Stephan et al., 2015a), and physical inactivity (Wienert et al., 2016). Subjective age may therefore be useful as a novel early marker for risk of dementia.

Only one study to date, however, has examined the association between subjective age and risk of dementia (Stephan et al., 2017). Thus, there is a need for more research to replicate and extend these findings in independent samples and using different methods and instruments. The work from Stephan and colleagues (2017) classified dementia exclusively on participants' performance on a brief cognitive test. Broader measures of dementia that include multiple criteria are needed, such as informant reports of cognition and diagnosis of dementia, in addition to participants own test performance.

The present study contributes to existing knowledge by further examining the association between subjective age and incident dementia in a large longitudinal sample of older adults with information from both self and proxy respondents to identify dementia. Consistent with past research, an older subjective age was expected to predict higher risk of incident dementia. In addition, we tested whether this association remained significant when mental (i.e. depressive symptoms), physical (hypertension and diabetes) and behavioral (physical activity and smoking) factors associated with both subjective age and dementia were included as covariates.

2. Method

2.1. Participants

Participants were part of the National Health and Aging Trends Study (NHATS). The NHATS is a prospective cohort study of Medicare enrollees aged 65 years and older (Grant number NIA U01AG032947) conducted by the Johns Hopkins Bloomberg School of Public Health. The NHATS protocol was approved by the Johns Hopkins University Institutional Review Board. Participants provided informed consent before participation in the study. Data from the 2011 to 2015 waves were analyzed. Subjective age and cognitive status were assessed at baseline and cognitive status was assessed again in 2012, 2013, 2014 and 2015. At baseline, 6,603 individuals provided complete data on cognition, subjective age, demographics, and mental, physical and behavioral factors. Based upon the criteria used in NHATS (see below), we excluded individuals with dementia at baseline, which resulted in a sample of 5,217 individuals. Of this sample, 4,324 participants had information on dementia status from at least one of the follow-up assessments, as emerged from respondents or a proxy interview. Because extreme values on subjective age may reflect misunderstanding of the question or uncooperativeness, participants with responses 3 SD above or below the mean subjective age were removed (Stephan et al., 2017). The final sample was thus composed of 4,262 participants (Mean Age= 76, SD= 7.2).

Attrition analysis using t-tests or chi-square revealed that participants in the longitudinal sample had better cognitive scores (d=.17), had higher education (d=.17), were more physically active (35% vs. 6%), and were less likely to be current smokers (6% vs 2%) than those without data at follow-up. There were no differences in chronological age, sex, race,

subjective age, depressive symptoms, hypertension or diabetes between those with and without data at follow-up ($p > .05$). The majority of participants in the group without longitudinal data refused to participate (74%) or died in the following waves (16%). Other reasons included participants being too ill to participate (4%), unable to locate (3%), and to a lesser extent being ineligible or not interviewed, unavailable during field period, and language barrier.

2.2. Subjective age

Subjective age was assessed by asking participants to specify how old they felt most of the time in years. We computed proportional discrepancy scores by subtracting chronological age from felt age and then dividing by chronological age (Rubin & Berntsen, 2006). A negative score indicates a younger subjective age, whereas a positive score indicates an older subjective age. Consistent with existing research (Stephan et al., 2017), we excluded outliers with responses 3 SD above or below the mean (n=62; <2% of respondents). Specifically, individuals who felt ≥ 71% younger and those who felt ≥ 37% older were excluded.

2.3. Dementia status

Information about dementia was obtained each year from 2011 to 2015. The NHATS classifies participants as having dementia if they presented any of the following (Davydow et al., 2014; Kasper et al., 2013). First, an NHATS participant or a proxy respondent reported that a doctor had diagnosed the participant with dementia or Alzheimer's disease. Second, a score of 2 or higher on the AD8 Dementia Screening Interview as reported by a proxy respondent that indicated likely dementia (Galvin et al., 2005). Third, a score on a cognitive test ≤1.5 SD below the mean on at least two out of three domains: memory (immediate and delayed word recall), orientation (date, month, year, day of the week, President and Vice President) and executive function (clock drawing) (Kasper et al., 2013). These criteria were used to screen participants both at baseline and follow-up.

2.4. Covariates

Demographic covariates included chronological age, sex, race, and education, assessed using a scale that ranged from 1 "No schooling completed" to 9 "Master's, professional or doctoral degree". Additional mental, clinical and behavioral covariates were controlled. Depressive symptoms were measured using the Patient Health Questionnaire-2 (Kroenke et al., 2003). Clinical factors included self-reported diagnosis of diabetes and hypertension (coded as 1 yes and 0 no). Behavioral factors included smoking and physical activity. History of smoking was coded as 1 for current smokers and 0 for never/former smokers. Baseline physical activity was assessed by asking participants to rate whether they ever spend time on vigorous activities that increased their heart rate and made them breathe harder in the last month, coded as yes (1) or no (0).

2.5. Data analysis

Cox proportional hazard models were used to test for the association between subjective age and incident dementia. The basic model controlled for baseline chronological age, sex, race, education, and cognition. In a follow-up analysis, mental (depressive symptoms), physical

(hypertension and diabetes), and behavioral (smoking and physical activity) factors were included as additional covariates. These analyses were repeated excluding participants who developed dementia in the first year after baseline to control for potential reverse causation.

3. Results

Descriptive statistics are presented in Table 1. Of the baseline participants, 9% (*N*= 376) developed dementia over a period ranging from 8 months to 4.5 years (Mean: 3.2; SD: 1.2) for a total of 13,715 person-years. The difference in baseline subjective age between individuals who developed dementia and those with normal cognitive functioning was d=.12 (Table 1). Controlling for demographic covariates and baseline cognition, an older subjective age was related to a higher likelihood of incident dementia (Table 2, Model 1). One standard deviation older subjective age (which corresponds roughly to feeling 12 years older) was related to 16% higher likelihood of incident dementia. This association remained significant when hypertension, diabetes, physical activity and smoking were included but was reduced from HR=1.16 to 1.11 and to non-significance when depressive symptoms were included in the model (Table 2, Model 2-Model 5). Additional analysis contrasted participants with an older subjective age (those who felt older than their chronological age, n= 236) with participants with younger subjective age (those who felt younger than their chronological age, n= 3205), excluding those feeling the same as their chronological age (n= 821). Controlling for the demographic factors and baseline cognition, the risk of incident dementia was about 60% higher among individuals with an older subjective age (HR=1.62, 95% CI=1.08-2.44; p<.05). In line with the previous analysis, this association remained significant when behavioral and clinical factors were included, but was non-significant when depressive symptoms were controlled.

We repeated the primary analysis by excluding dementia cases that occurred in the first year after the baseline assessment to reduce the potential influence of incident dementia on subjective age (reverse causation). Controlling for demographic factors and baseline cognition, an older subjective age remained a significant predictor of incident dementia (HR= 1.18, 95% CI=1.05-1.33; p<.01), even after accounting for depressive symptoms and other clinical and behavioral covariates (HR=1.12, 95% CI=1.00-1.26; p<.05).

4. Discussion

The present study indicates that feeling older than one’s chronological age is associated with a higher risk of incident dementia over a four-year period. This association was observed while controlling for demographic factors and baseline cognition. This study extends existing knowledge on the link between subjective age and cognitive impairment by using an expanded set of self and proxy markers to identify incident dementia. This finding adds to existing research on the role of individuals’ self-assessment of one’s health or one’s memory for the prediction of dementia-related outcomes (Montlahuc et al., 2011; Rönnlund et al., 2011) by providing new evidence on the predictive value of the subjective assessment of one’s age for dementia risk.

The present study showed that the association between subjective age and dementia was partially accounted for by depressive symptoms. This finding suggests that depressive symptoms may partly mediate the association between an older subjective age and higher likelihood of incident dementia. Indeed, feeling older is related to more depressive symptoms (Choi & DiNitto, 2014), which in turn are related to the risk of dementia (Mirza et al., 2014; Tolppanen et al., 2015). Other pathways may operate in the subjective age-dementia link. For example, an older subjective age is also associated with higher systemic inflammation (Stephan et al., 2015a), greater metabolic dysregulation and lower pulmonary function (Stephan et al., 2015b) that contribute to higher dementia risk (Heneka et al., 2015; Vidal et al., 2013; West et al., 2016). In addition, individuals who feel older are more vulnerable to stress (Shrira et al., 2016), which amplifies the likelihood of cognitive impairment and dementia (Mah et al., 2016).

This study has several strengths, including the use of a large longitudinal sample of older adults, several types of information from self- and proxy respondents to classify dementia, and the control of recognized covariates. However, there are also limitations. The NHATS did not perform clinical and neuropsychological evaluations for the diagnosis of dementia, a common limitation of large population surveys. In addition, the follow-up period was relatively short and there was considerable attrition. Additional research is needed to examine whether the association between subjective age and incident dementia-related outcomes could be observed over longer time frame. Furthermore, the association between subjective age and psychological and behavioral symptoms of dementia deserves attention. Finally, based upon recent evidence of the multidimensionality of subjective age (Kornadt et al., in press), future research could examine whether specific facets may be more predictive of cognitive impairment and dementia.

In sum, the present study found that the subjective evaluation of one's age is one marker of dementia risk that is independent of chronological age. The study replicates and extends previous studies and advances knowledge on the role of aging in dementia by considering the subjective evaluation of the rate of physiological and psychological aging. The assessment of subjective age may enrich existing prognostic models for the identification of individuals at risk of future cognitive impairment who may benefit from targeted by preventive programs.

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Table 1

Baseline Characteristics of the Sample

	Overall sample (N= 4,262)		Normal at Follow-up (N= 3,886)		Dementia at follow up (N= 376)	
Variables	***M/%***	***SD***	***M/%***	***SD***	***M/%***	***SD***
Age (Years)	76	7.2	75.5	7.0	81.1	7.7
Sex (% Men)	42%	–	42%	–	41%	–
Race (% White)	74%	–	75%	–	68%	–
Education	5.4	2.2	5.5	2.2	4.7	2.3
Baseline Cognition	0.1	2.1	0.2	2.0	−1.7	2.0
Depression	1.4	0.6	1.4	0.6	1.6	0.8
Diabetes	24%	–	23%	–	28%	–
High blood pressure	67%	–	67%	–	71%	–
Smoking	8%	–	8%	–	6%	–
Physical activity	42%	–	43%	–	30%	–
Subjective age	−0.16	0.16	−0.17	0.16	−0.14	0.16

Table 2

Relationship between Subjective Age and Incident Dementia (N= 4,262)

Predictor	Model 1	Model 2	Model 3	Model 4	Model 5
	Hazard Ratios (95% CI)	**Hazard Ratios (95% CI)**	**Hazard Ratios (95% CI)**	**Hazard Ratios (95% CI)**	**Hazard Ratios (95% CI)**
Age	1.07(1.05-1.08)***	1.07(1.05-1.08)***	1.07(1.06-1.09)***	1.07(1.06-1.09)***	1.07(1.06-1.09)***
Male	1.21(.98-1.50)	1.19(.96-1.47)	1.23(1.00-1.52)	1.27(1.03-1.57)	1.27(1.02-1.57)*
White	.90 (.72-1.14)	.92 (.73-1.16)	.91 (.72-1.15)	.91 (.72-1.14)	.93 (.73-1.17)
Education	.96 (.86-1.08)	.97(.87-1.09)	.97(.86-1.09)	.99(.88-1.11)	1.00(.89-1.13)
Baseline Cognition	.68 (.64-.72)***	.68 (.64-.72)***	.68 (.64-.72)***	.69 (.65-.73)***	.69 (.65-.73)***
Subjective Age	1.16 (1.04-1.29)**	1.16 (1.04-1.30)**	1.15 (1.03-1.29)*	1.11 (.99-1.23)	1.11 (.99-1.23)
Self-reported Diabetes		1.22(.97-1.54)	–	–	1.21 (.96-1.54)
Self-reported Hypertension		.93(.74-1.17)	–	–	.90 (.71-1.14)
Current Smoking			1.41 (.92-2.16)	–	1.35(.88-2.07)
Current Physical Activity			.93 (.73-1.17)	–	.93(.74-1.18)
Depressive symptoms				1.24(1.14-1.36)***	1.24(1.13-1.36)***

Note.

*$p<.05$,

**$p<.01$,

***$p<.001$;

Subjective age: Higher value represents an older subjective age (felt age-chronological age/chronological age: Range: −0.71-0.37); Education was assessed on a scale that ranged from 1 “No schooling completed” to 9 “Master’s, professional or doctoral degree”; Baseline cognition was the sum of standardized memory, orientation and executive function, with higher score indicating higher cognition (Range: −5.43-6.02); Depressive symptoms was the mean of two items, with higher mean indicating higher depressive symptoms (Range: 1–4).