



## Original Article

# Factors Associated with Subjective Aging Among Older Outpatients In Northern - India

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## Abstract

**Objectives:** The objective of the study was to investigate factors associated with subjective aging among older patients visiting a geriatric medicine outpatient department in Northern-India. **Methods:** The study is a cross-sectional study. Patients were categorized into three groups: whether they felt younger, equal, or older than their peers of same age. Factors such as fall, incontinence, anorexia, hand grip strength, cognition, depression, vision, hearing, cardiopulmonary function and immunization were assessed. Multinomial logistic regression was used to investigate the associated factors of subjective aging. **Results:** We assessed 184 older patients with a median age of 66.5 years (IQR 63.0 -78.8). Chronological age and hand grip strength were the significant factors associated with subjective aging. With one year increase in age, odds of feeling older than peers of same age decreased by 8.9% (OR, 0.911; 95% CI, 0.831–0.999, p = 0.047). With one kilogram increase in hand grip strength, odds of feeling younger than peers of same age increased by 7.3% (OR, 1.073; 95% CI, 1.01–1.14, p = 0.032). **Conclusion:** Chronological age and hand grip strength are the factors associated with subjective aging in Northern-Indian older adults. Further longitudinal multi-center studies are needed to confirm our findings.

**Keywords:** Biological age, Geriatrics, Geriatric syndromes, Subjective age, Subjective well-being

## Introduction

Subjective age is a person's self-perceived age, which may be less or more than their chronological age<sup>1</sup>. It may represent a person's perception of their age and the changes experienced during the aging process and includes measures such as optimism, self-efficacy and self-rated health<sup>2</sup>. It is reported that older adults tend to feel younger than they are (by about 15-20%) and this discrepancy between the subjective age and chronological age depends upon several factors, including but not limited to one's health<sup>3</sup>. In the current era driven by data and artificial intelligence, factors associated with subjective age can offer valuable insights into the multifaceted aspects of aging, encompassing not only physical and physiological dimensions but also psychosocial perceptions.

Recent research has increasingly focused on subjective age as a psychosocial determinant of overall health and well-being. Feeling younger was reported to be associated

with lower risk of major depressive episode or cognitive impairment<sup>4</sup>. Studies have revealed associations between subjective age and positive health outcomes, such as reduced cardiovascular events, lower risks of motor decline, and fewer instances of dementia<sup>5-7</sup>. Nevertheless, discrepancies in subjective age exist among high- and low-income countries, as per a study where older adults in low-income felt less younger than similar age groups in high income settings and had a poor quality of life<sup>8</sup>. However, aging data from low and

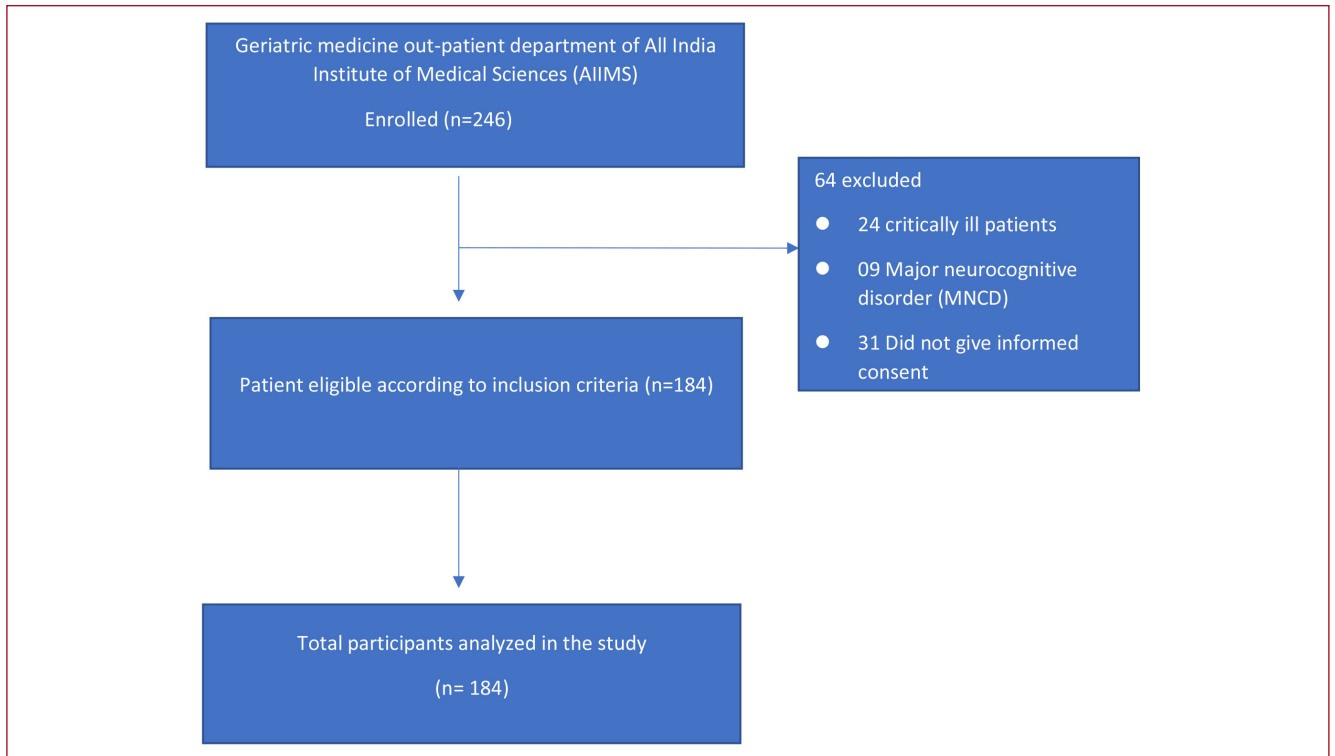
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**Figure 1.** Patient recruitment flow chart.

middle income countries (LMICs) are scarce. India houses a large portion of older adults worldwide and studies on various aspects of aging are crucial for the development of public health policies and intervention strategies for reducing the burden of population aging.

Given the significance of these concepts, the primary objective of this study was to assess subjective aging among patients visiting an out-patient geriatric medicine department at a tertiary care center in north-India. Based on findings from previous studies and a geriatrician's perspective we hypothesized that presence of various geriatric conditions tend to make an older adult feel older than their calendar age. There have been many studies on subjective well-being in the past but studies on subjective age and its associated factors in LMICs are lacking. Our paper aims to fill this gap regarding subjective perception of age, and its associated factors in relation to geriatric syndromes and multimorbidity.

## Methods and Materials

### Study setting

The study has a cross-sectional design. It was conducted between January 2019 and October 2020 at the geriatric medicine out-patient department (OPD) of All India Institute of Medical Sciences (AIIMS), New Delhi, a tertiary care referral center. Ambulatory patients without Major Neurocognitive

Disorder (MNCD) visiting the OPD, with written informed consent were included in the study. Critically ill patients (those requiring hospitalization), those with MNCD, and those patients who did not give consent were excluded from the study as shown in Figure 1. Patient recruitment and assessment for eligibility was done in-person based on convenience. The out-patient setting of a geriatric medicine department usually receives referral patients from rural peripheral hospitals and from inter-departmental geriatric specialist referrals.

Sample size calculation: From a study by Sirohi et al. with prevalence of fall of 36%, sample size calculated to be 182 using 95 percent confidence interval.

### Initial assessment

Any patient visiting the geriatric medicine outpatient department and fulfilling the inclusion criteria were assessed. Patients with major neurocognitive disorder (MNCD) were excluded using Saint Louis University Mental Status (SLUMS) score<sup>9</sup>. A score of 19 or less (for high school education) and a score 14 or less (for lower than high school education) was used as a cut off for MNCD. Basic demographic details including socioeconomic details (modified Kuppaswamy scale) were surveyed for all participants. Charlson's Co-morbidity Index (CCI) was used to evaluate the burden of

multiple co-morbidities among the participants in the form of quantitative variable.

### **Assessment of subjective aging**

For assessment of subjective aging, patients were asked: Whether they felt younger/older/ equal than their peers of the same chronological age. Based on the answers patients were divided into three groups: 1): Those feeling younger age than the peers of the same chronological age; 2): Those feeling older age than peers of the same chronological age; 3): Those feeling equal age to their peers of same chronological age.

### **Assessment of Geriatric conditions**

#### Physical domain and vitality

Grip strength was measured using a handheld Jamar electronic dynamometer<sup>10</sup>. Three readings from each hand were taken, alternately. The maximum/best of the six readings was recorded as an optimum grip strength of the individual.

Patients were also asked whether they experience persistent loss of appetite in the past six months.

#### Sensory domain

By using Snellen's chart and visual acuity equivalence chart, visual efficiency score was derived<sup>11</sup>. Hearing was assessed using whisper test. Any degree of hearing impairment in either of the ears was taken as presence of hearing impairment<sup>12</sup>.

#### Cognitive domain

Participant's memory function was assessed using PGI memory scale (PGIMS) and total memory score was obtained<sup>13</sup>. Peg Board Test was used for assessing dexterity or fine motor function test<sup>14</sup>. The test was conducted with the dominant arm. One practice trial was provided prior to timing the test for 60 seconds. The total number of pegs placed in the hole at the end of 60 seconds was recorded irrespective of the color of the peg or the direction of placing of pegs. A total of three trials were recorded and the highest recording was used for analysis.

#### Aerobic (locomotory) and cardiopulmonary fitness

Two- minute step test (2MST) was used in the study as an indicator of cardiopulmonary fitness and locomotive capacity<sup>15</sup>. By having the patient stand next to a wall, the height of the iliac crest and patella was marked. Then half of the distance between the two was marked. Patient raises each knee to the mark on the wall, for as many times as possible in two-minutes. The number of times the right knee reached the required height was counted. Patients with impaired balance could use the back of a chair as a touch-hold for stability.

All participants were asked whether they have persistent joint pain in the past six months or not.

#### Psychological domain

Depression was screened using 2 depressive symptoms screening questionnaire. The two questions were: "Over the past two weeks have you felt down, depressed, or hopeless?" and "Over the past two weeks, have you felt little interest or pleasure in doing things?" Answer of "yes" to any one of the questions was taken as positive in the screening for depression<sup>16</sup>.

#### Other geriatric conditions

For evaluation of polypharmacy, the total number of drugs consumed daily was calculated from the number of active components, irrespective of the number of pills. History of persistent leakage of urine in the past six months and history of unexplained fall within the last one year was taken as positive for having urinary incontinence and falls respectively.

As per the Centers for disease control and prevention (CDC) definition of "smoker", patients who had smoked 100 cigarettes in their lifetime were taken as positive for a history of smoking. All participants were enquired whether they had been immunized with at least one of the pneumococcal or influenza vaccine in the past or not.

### **Statistical analyses**

Categorical variables were summarized by proportions. Continuous variables following normal distribution were summarized by mean, median, standard deviation and inter-quartile range.

Multinomial logistic regression was performed to investigate the associated factors of subjective aging. The independent variables used in the regression analyses included chronological age, gender, education, socioeconomic status, co-morbidity, prescribed number of drugs, cognition, grip strength, cardiopulmonary fitness, visual efficiency, hearing impairment, depression, smoking, alcohol consumption, joints pain, dietary habit, anorexia, immunization status, history of falls and urinary incontinence. The dependent variable was subjective aging and between group comparison was performed (for the 3 subjective aging groups) according to various independent variables.

Deviance chi square goodness of fit model was used for model fitting information and Nagelkerke R-square was calculated. We also checked for validation of predicted model. Likelihood of risk was based on odds ratios with 95% confidence intervals, P-values (<0.05). Data was analyzed using SPSS version 26.

### **Results**

#### **Results of descriptive statistics**

The median chronological age of the geriatric outpatients was 66.5 years (IQR 63.0 -78.8 years). Most of them belonged to the age group of 60-65 years. 62% of them were male. Substance abuse (smoking,

Variables	Measures	Variables	Measures
Sample size (N)	184	<b>Geriatric Syndromes, N (%)</b>	
<b>Chronological Age (years),</b>		Falls	33 (18.0)
Median (IQR)	66.5 (63.0-78.8)	Anorexia	54 (29.4)
60-65	81 (44.0)	Urinary Incontinence	27 (15.0)
66-70	57 (31.0)	Immunization history, N (%)	21 (11.4)
71-75	21 (11.4)	Joint Pain, N (%)	89 (48.4)
> 75	25 (13.6)	<b>Sensory Function, N (%)</b>	
<b>Sex, N (%)</b>		Hearing Impairment	44 (24.3)
Male	115 (62.5)	Vision Impairment	110 (60.4)
Female	69 (37.5)	<b>Screening for Depression, N (%)</b>	
<b>Marital Status, N (%)</b>		Yes	62 (33.7)
Married	184 (100.0)	No	122 (66.3)
Unmarried	0 (0.0)	<b>Highest Grip Strength, Median (IQR)</b>	
<b>Personal History, N (%)</b>		25.05 (18.92-32.0)	
Smoking	30 (16.3)	<b>Peg Board Test Score, Median (IQR)</b>	
Alcohol	18 (9.8)	32.0 (28.0-36.0)	
Tobacco	16 (8.7)	<b>Visual Efficiency Score, Median (IQR)</b>	
<b>Dietary Habit, N (%)</b>		90.0 (85.0-100.0)	
Non -Vegetarian Diet	70 (38.0)	<b>Two-minutes Step Test Score, Median (IQR)</b>	
Vegetarian Diet	114 (62.0)	65 (44.5-87.0)	
<b>Kuppuswamy socioeconomic status, Median (IQR)</b>		<b>Number of prescribed drug formulations, Median (IQR)</b>	
11 (6.0-15.8)		4.0 (2.0-7.0)	
<b>Charlson comorbidity index, Median (IQR)</b>		<b>Total memory score by PGIMS, Median (IQR)</b>	
3.0 (2.0-4.0)		67.0 (53.0-79.0)	
<b>Subjective Aging groups, N (%)</b>			
Younger	49 (26.6)		
Equal	94 (51.1)		
Older	41 (22.28)		

**Table 1.** Descriptive statistics of study population (n=184).

alcohol or tobacco use) was found in up to 16.3% of the geriatric out-patients. Majority of the patients consumed a vegetarian diet. The geriatric patients had a median Kuppuswamy score of 11 belonging to lower middle class with IQR between 6.0 and 15.8. The median Charlson’s comorbidity index (CCI) was 3.0 with an IQR between 2.0 and 4.0 (Table 1).

Assessment of subjective aging revealed that almost half of the patients (51.1%) said they felt equal to the age of their peers of same chronological age, whereas 26.6% felt younger and 28.28% felt older than their peers of same chronological age.

18% of the patients visiting the geriatric medicine OPD had at least one fall in the previous year and 48.4 % suffered from joint pain and 29.4% of the geriatric outpatients had

anorexia. Among the sensory function, 60.4% had vision impairment and 24.3% had hearing impairment. 15% of the patients had history of persistent leakage of urine in the past 6 months and 33.7% of them were screened positive for depression.

The median grip strength was 25.05 kgs (IQR 18.92-32.0), median peg board test score was 32.0 pegs (IQR 28.0-36.0) and the median visual efficiency score was 90.0 (IQR 85.0 - 100.0).

On assessment of cardiopulmonary fitness, the median 2-minute step test score for the older adults was 65 steps (IQR 44.5 - 87.0). The median number of prescribed drug formulations was 4 (IQR 2.0 -7.0). On assessment of cognitive function, the median total memory score by PGIMS was 67.0 (IQR 53.0- 79.0) (Table 1).

**Table 2.** Multivariate analysis to identify the associated factors of various degree of subjective aging.

Explanatory Variables* Subjective age comparison	Multinomial logistic regression (n= 1 84)				
	Coeff	SE	OR	CI	P value
<b>Chronological age</b>					
Younger	0.058	0.041	1.060	0.978-1.149	0.154
Older {ref. Equal}	-0.093	0.047	0.911	0.831-0.999	0.047
<b>Socioeconomic scale</b>					
Younger	0.077	0.043	1.080	0.993-1.175	0.074
Older {ref. Equal}	0.080	0.058	1.083	0.967-1.214	0.168
<b>Charlson comorbidity index</b>					
Younger	0.355	0.286	1.426	0.814-2.496	0.215
Older {ref. Equal}	0.493	0.306	1.637	0.899-2.981	0.107
<b>Number of prescribed drugs</b>					
Younger	-0.109	0.087	1.897	0.756-1.064	0.212
Older {ref. Equal}	0.098	0.109	1.103	0.890-1.366	0.370
<b>Total memory score</b>					
Younger	-0.011	0.021	0.989	0.950-1.029	0.584
Older {ref. Equal}	-0.036	0.023	0.965	0.921-1.010	0.125
<b>Hand grip strength</b>					
Younger	0.070	0.033	1.073	1.01-1.14	0.032
Older {ref. Equal}	0.059	0.040	1.061	0.982-1.147	0.136
<b>Gender {ref. Male}</b>					
Younger	0.895	0.611	2.448	0.739-8.104	0.143
Older {ref. Equal}	1.284	0.749	3.612	0.832-15.683	0.087
<b>Depression {ref. Positive screening}</b>					
Younger	0.397	0.591	1.487	0.467-4.738	0.502
Older {ref. Equal}	-0.945	0.575	0.389	0.126-1.199	0.100
<b>Two minutes step test</b>					
Younger	0.006	0.011	1.006	0.984-1.029	0.577
Older {ref. Equal}	-0.019	0.013	0.981	0.956-1.007	0.147
<b>Peg board test</b>					
Younger	0.041	0.047	1.042	0.950-1.143	0.381
Older {ref. Equal}	-0.053	0.054	0.949	0.853-1.055	0.333
<b>Visual efficiency score</b>					
Younger	-0.003	0.020	0.997	0.959-1.037	0.883
Older {ref. Equal}	-0.042	0.024	0.958	0.914-1.006	0.083
<b>Smoking {ref. Presence}</b>					
Younger	0.217	0.634	1.242	0.358-4.304	0.733
Older {ref. Equal}	0.211	0.805	1.235	0.255-5.984	0.793

**Table 2.** (Cont. from previous page).

Explanatory Variables* Subjective age comparison	Multinomial logistic regression (n=184)				
	Coeff	SE	OR	CI	P value
<b>Alcohol consumption</b> {ref. Presence}					
Younger	-0.152	-0.152	0.859	0.186-3.966	0.845
Older	-1.692	-1.692	0.184	0.028-1.225	0.080
{ref. Equal}					
<b>Anorexia</b> {ref. Presence}					
Younger	0.730	0.583	2.076	0.662-6.507	0.210
Older	-0.700	0.522	0.496	0.178-1.381	0.180
{ref. Equal}					
<b>Joint pain</b> {ref. Presence}					
Younger	-0.388	0.447	0.678	0.283-1.628	0.385
Older	-0.623	0.539	0.536	0.186-1.543	0.248
{ref. Equal}					
<b>Dietary habit</b> {ref. Non vegetarian}					
Younger	0.759	0.467	2.136	0.855-5.334	0.104
Older	-0.211	0.566	0.810	0.267-2.455	0.710
{ref. Equal}					
<b>Immunization</b> {ref. History of immunization}					
Younger	-0.398	0.676	0.672	0.179-2.526	0.556
Older	-0.160	<b>0.787</b>	0.852	0.182-3.984	0.839
{ref. Equal}					
<b>Fall</b> {ref. Presence}					
Younger	0.208	0.663	1.232	0.336-4.520	0.753
Older	-0.549	0.591	0.578	0.181-1.838	0.353
{ref. Equal}					
<b>Urinary incontinence</b> {ref. Presence}					
Younger	-0.983	0.663	0.374	0.102-1.372	0.138
Older	-1.046	0.670	0.351	0.094-1.306	0.118
{ref. Equal}					
<b>Hearing impairment</b> {ref. Presence}					
Younger	-0.019	0.508	0.981	0.363-2.656	0.363-2.656
Older	0.931	0.623	2.536	0.748-8.595	0.748-8.595
{ref. Equal}					
<b>Nagelkerke R<sup>2</sup></b>			<b>0.490</b>		

**Results of regression analysis**

By multivariate logistic regression analysis (Table 2) using multinomial regression analysis, the significant associated factors of subjective aging were found to be chronological age and hand grip strength.

Higher hand grip strength was a significantly associated

factor (OR, 1.073; 95%CI, 1.01-1.14, P = 0.032) for subjective aging group 0 (i.e., younger) compared to group 1 (i.e., equal), however no association was observed for group 2 (i.e. older). Chronological age was a significantly associated factor (OR, 0.911; 95%CI, 0.831-0.999, P = 0.047) for subjective aging group 2 (i.e., older) compared to

Model	Likelihood Ratio Tests			
	-2 Log Likelihood	Chi-Square	df	Sig.
Null model	373.338			
Final model	272.300	101.038	40	.000

**Table 3.** Overall model evaluation using likelihood ratio test.

Observed subjective aging	Predicted subjective aging			
	Younger	Equal	Older	Percent Correct (%)
Younger	22	24	3	44.9
Equal	15	71	6	77.2
Older	1	15	24	60.0
Overall Percentage (%)	21.0	60.	18.2%	64.6

**Table 4.** Classification table of model with predictor variables.

group 1 (i.e., equal), however no association was observed for group 0 (i.e. younger).

With one year increase in chronological age, odds of feeling older than peers decreases by 8.9 percent as compared to those who feel equal to their peers (OR, 0.911; 95% CI, 0.831–0.099,  $p = 0.047$ ).

With one kilogram increase in hand grip strength, odds of feeling younger than peers increases by 7.3 percent, as compared to those who feel equal to their peers (OR, 1.073; 95%CI, 1.01–1.14,  $p = 0.032$ ).

### Model fitting information

The result presented in Table 2 and 3 showed a likelihood ratio test statistics  $G^2 = 272.30$  which was distributed as chi-square with 40° of freedom as shown in Table 4. Overall measure of the model given by the model fitting criteria was  $\chi^2 = 101.038$ ,  $df = 40$ ,  $p$ -value =  $<0.001$ . The significant  $p$ -value suggests that our final model was significantly better than the null model.

Deviance chi square goodness of fit model showed  $\chi^2 = 272.3$ ,  $df = 320$ ,  $p$ -value = 0.975. This non-significant  $p$ -value indicates that the model fits the data well. The Nagelkerke R-square was 0.49. This suggests that our predictors explain only 49% of the variation in subjective aging.

### Validation of predicted probabilities

According to the classification presented in Table 4, prediction for those with subjective age younger than peers of same chronological age, equal to peers of same chronological age and older than peers of same chronological

age was 44.9%, 77.2% and 60.0% respectively. So, the model prediction was better for those with subjective age of older than peers of same chronological age as compared to those with subjective age younger than their peers.

## Discussion

Our study was conducted to explore subjective aging among older adults visiting the hospital out-patient geriatric department in northern India, and to identify the associated factors of subjective aging in those individuals. Subjective aging assesses how people feel in relation to their chronological age. Subjective age is directly related to physical health status or biological age of the individual and vice versa. Self-perception has been an established powerful indicator for predicting the health status of an individual. Through our study, we have investigated the possible relationship between subjective aging and common geriatric conditions including falls, urinary incontinence, multimorbidity and common aging indicators including hand grip strength, cognition, depression, vision and hearing impairment, cardiopulmonary fitness, immunization status etc.

Previous literature shows multiple possible predictors of subjective aging. Older adults with multiple-comorbidities or those with depression were found to have poor higher subjective age<sup>17</sup>. A longitudinal study done by Yannick et al. showed how multimorbidity, functional limitation, and perceived discrimination based on their age impacted a person's subjective age<sup>18,19</sup>. The studies done by Yannick et al. excluded depression as an influence on subjective age, however, a systematic analysis by Debreczeni et al.

concludes that older subjective age is associated with increased incidence of depression<sup>20</sup>. Debrezzeni et al. also suggested that the association of subjective age and depression is multifactorial and may vary according to cultural contexts. Similarly, a qualitative study done by Sabatini et al. has correlated subjective age with gender where females equated their age with positive and negative physical, emotional, and social experiences of life whereas the male participants equated their age with their ability to perform daily activities<sup>21,22</sup>. Previous larger study in community dwelling older adults from Korea revealed factors including less severe depression, having better perceived health, having no visual impairment, having higher handgrip strength, and living in a metropolitan area were associated with younger subjective age<sup>22</sup>.

A previous study showed older adults tend to feel 7.8% younger than their actual age, on average<sup>18</sup>. This is similar to our study where we found that with one year increase in chronological age, odds of feeling older than peers decreases by 8.9 percent as compared to those who feel equal to their peers. Another study reported that older adults tend to feel younger than they are by about 15-20%<sup>2</sup>. The phenomenon of feeling younger than one's chronological age has been noted in older age groups who usually try to dissociate from the thought of feeling old than they actually are<sup>23-25</sup>.

Having higher handgrip strength was found to be associated with feeling younger in our study. This is similar to previous studies which reported correlation between handgrip strength and subjective age<sup>18,23</sup>. But it is in contrast to a study from Norway which found that grip strength was not related to subjective age<sup>26</sup>. Handgrip strength is a strong measure of one's physical and mental capacity, hence incorporated in the measurement of frailty and serves as an outcome measure for studies involving older population. A previous study showed subjective aging also identifies individuals at greater risk of falls<sup>27</sup>, however, we did not find any significant correlation of falls with subjective aging in our study population.

Our study has several strengths. This study is the first to include multiple factors for identifying the association with subjective aging including cognitive, physical, sensory, cardiorespiratory, multiple geriatric syndromes, immunization history, socioeconomic factors and substance abuse in Indian population. World Health Organization (WHO) has described six key domains of Intrinsic Capacity (IC) which includes vitality, visual capacity, hearing capacity, cognitive capacity, psychological capacity, and locomotor capacity<sup>26</sup>. In this study, we have used these domains to examine the association with subjective aging. Also, data on subjective aging from low- and middle-income countries (LMICs) are scarce. Although there have been studies on subjective well-being or subjective health, data on subjective aging is lacking from India, a country which houses a rapidly increasing large proportion of older adults. Our study has its limitations. Firstly, it has a cross-sectional study design without follow-

up. Secondly, the sample size is small which limits the derivation for many possible factors of subjective aging. It was a single-center study from one region of India. Thirdly, the participants were recruited from Geriatric medicine OPD with selection bias and thus may not be representative of the community at large.

In conclusion, our study shows a significant association of subjective aging with chronological age and hand grip strength in geriatric out-patients from north India. Further longitudinal studies are needed to determine more factors affecting subjective age, as it is crucial to look for ways to support a sense of feeling younger for better health outcomes.

#### *Ethics approval*

*Ethical approval was received from the Institutional Ethics Committee (IEC), (Ref. No. IECPG-25/23.01.2019) of All India Institute of Medical Sciences (AIIMS), New Delhi.*

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