



The difference between self-perceived and chronological age in the elderly may correlate with general health, personality and the practice of good health behavior: A cross-sectional study

Katsuhiko Takatori^{a,d,*}, Daisuke Matsumoto^{a,d}, Makoto Miyazaki^b, Naomi Yamasaki^c, Jong-Seong Moon^{c,d}

^a Department of Physical Therapy, Faculty of Health Science, Kio University, 4-2-2 Koryo, Kitakatsuragi-gun, Nara, Japan

^b Center for Teaching, Learning and Technology, Kio University, 4-2-2 Koryo, Kitakatsuragi-gun, Nara, Japan

^c Department of Nurse, Faculty of Health Science, Kio University, 4-2-2 Koryo, Kitakatsuragi-gun, Nara, Japan

^d Health Promotion Center, Kio University, 4-2-2 Koryo, Kitakatsuragi-gun, Nara, Japan

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ABSTRACT

Background and objective: For the elderly, maintaining a young self-perceived age has a positive impact on physical and mental health. The purpose of this study was to investigate the impact of the discrepancy between self-perceived age and chronological age in regards to physical activity, instrumental activities of daily living, functional capacity, personality, general self-efficacy, depressive symptoms, and disease burden.

Methods: Participants were 3094 older adults from 2015 baseline data of the Keeping Active across Generations Uniting the Youth and the Aged study. The questionnaire was mailed to 8004 elderly people aged 65 years or older. Of the 3871 people who returned the questionnaire (collection rate, 48.3%), 3094 subjects were analyzed in this study (female, 52%). The questionnaire included aspects of physical activity, instrumental activity of daily living, functional capacity, personality traits, general self-efficacy, depressive symptoms, history of falls, fear of falling, communication with young people, medical history, and self-perceived age, as well as basic characteristics such as age, sex, living alone or not, and educational history.

Results: Regression analysis showed that the presence of high self-rated health, personality traits of extraversion and openness to experience, higher general self-efficacy, and the presence of fear of falling were positively associated with a younger self-perceived age.

Conclusions: The results identified personality and psychological factors related to self-perceived age in community-dwelling elderly people. Therefore, changes in personality traits and subjective health accompanying aging affect the self-perceived age, which may also affect the extension of healthy life expectancy.

1. Introduction

Japan has a rapidly aging society, and health promotion and preventative care for the elderly are important issues. The relationship between changes in physical and mental functions due to aging and requiring long-term care relies generally on physical and cognitive function. However, social cognition and psychological research has indicated that changes in psychological function and personality characteristics associated with aging affect future health conditions. In particular, elderly individuals with a positive self-perception for aging show an increased longevity and other positive health outcomes (Levy

et al., 2002a; Levy, Slade, & Kasl, 2002b).

A previous evaluation of the self-perceptions of aging by elderly people used the total score of 5 items of the Philadelphia Geriatric Center Morale Scale (PGCMS; Lawton, 1975) or the subjective age felt by the elderly themselves. In recent years, various terms have been used in research to define the age that elderly people perceive themselves, including self-perceived age, subjective age (Stephan, Sutin, & Terracciano, 2015b; Stephan, Sutin, & Terracciano, 2015c; Stephan, Caudroit, & Chalabaev, 2011; Stephan, Demulier, & Terracciano, 2012; Stephan, Chalabaev, Kotter-Grühn, & Jaconelli, 2013; Stephan, Caudroit, Jaconelli, & Terracciano, 2014; Stephan, Sutin, Bayard, &

Abbreviations: IADL, instrumental activity of daily living; TMIG-IC, Tokyo Metropolitan Institute of Gerontology Index of Competence; JST-IC, Japan Science and Technology Agency Index of Competence; GSES, general self-efficacy scale; GDS, Geriatric Depression Scale; GDS-5, five-item geriatric depression scale

* Corresponding author at: Department of Physical Therapy, Faculty of Health Science, Kio University, 4-2-2 Koryo, Kitakatsuragi-gun, Nara, 6350832, Japan.

E-mail addresses: k.takatori@kio.ac.jp (K. Takatori), d.matsumoto@kio.ac.jp (D. Matsumoto), m.miyazaki@kio.ac.jp (M. Miyazaki).

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Terracciano, 2017), felt age (Choi, DiNitto, & Kim, 2014), and cognitive age (Ihira et al., 2015). Many prior studies have reported that differences between ages defined using these terms and chronological age (actual age) affect various health-related outcomes. For example, people with a younger self-perceived age have better physical function (physical activity, walking speed, grip strength, standing balance) (Ihira et al., 2015; Stephan, Sutin, & Terracciano, 2015a, 2014), better cognitive function (memory function, executive function) (Ihira et al., 2015; Stephan et al., 2014), greater well-being (Infurna, Gerstorf, Robertson, Berg, & Zarit, 2010), fewer depressive symptoms (Keyes & Westerhof, 2012), greater life satisfaction (Stephan et al., 2011), and less systemic inflammation (Stephan et al., 2015c).

On the other hand, an older self-perceived age has been reported to be related negatively with health outcomes such as cognitive decline and sedentary lifestyle (Stephan et al., 2014). A longitudinal study investigating the relationship between self-perceived age and risk of death has reported that individuals with an older self-perceived age have a greater mortality rate than those with a younger self-perceived age (Rippon & Steptoe, 2015).

As mentioned above, many studies have reported that self-perceived age is a surrogate index that can help evaluate an individual's health condition, as well as self-rated health. In addition, some studies have investigated factors affecting self-perceived age. High physical activity (Caudroit, Stephan, Chalabaev, & Le Scannff, 2012), low psychological distress (Shrira, Bodner, & Palgi, 2014), good self-rated health, extraversion and openness traits (Stephan et al., 2012), good mental health, and high personal mastery (Bergland, Nicolaisen, & Thorsen, 2014) have been demonstrated to be related to a younger self-perceived age. The only study that has investigated factors that increase or decrease the self-perceived age prospectively reported that a decrease in loneliness results in a younger self-perceived age and an increase in depressive symptoms increases the self-perceived age (Ayalon, Palgi, Avidor, & Bodner, 2016).

However, surveys on self-perceived age have been conducted rarely in Japan, and relationships with health-related outcomes, psychological factors, and personality characteristics that affect self-perceived age have not been investigated sufficiently. International comparative research among Japan, the United States, Germany, and Sweden have indicated that psychological factors related to health, such as self-rated health, vary from country to country, and the proportion of subjective unhealthy people among the Japanese elderly is the second largest after Germany (Eighth International Comparative Survey on the Life and Consciousness of Elderly People, Cabinet office, Government of Japan, 2016). Therefore, it is necessary to identify preventive measures for mental/psychological frailty in Japanese elderly people.

Currently, we are investigating the relationship between healthy life expectancy and the self-perceived age of the elderly in a large prospective cohort study. Here, we report the results of a cross-sectional study that examined the relationship between self-perceived age and health-related outcomes using the results of the Keeping Active across Generations Uniting the Youth and the Aged (KAGUYA) survey. The purpose of this study was to investigate the correlation between the amount of the discrepancy between self-perceived age and chronological age in regards to physical activity, instrumental activities of daily living (IADL), functional capacity, personality traits, general self-efficacy, depressive symptoms, and disease burden in Japanese elderly people.

2. Materials and methods

2.1. Participants

Participants were drawn from the KAGUYA study, a nationally representative 5-year longitudinal study supported by the Ministry of Education as a Private University Strategic Research-Based Support Project and conducted to clarify the elongation effect of healthy life

span through a survey for all elderly residents living in Koryo, Nara Prefecture and through specific health promotion interventions (development of care prevention class, dementia cafe). Participants signed a consent form approved by the Institutional Review Board at the Kio University in Japan (approval number, H27-34). The questionnaire was mailed to all elderly people (N = 8004) aged 65 years or older. Of the 3871 people who returned the questionnaire (collection rate, 48.3%), 3094 subjects, excluding those who certified for eligibility for nursing care under long-term care insurance, were analyzed in this study. The average age of participants was 72.9 years (female, 52%; SD = 6.2 years; range, 65–98 years). The questionnaire included aspects of physical activity, IADL, functional capacity, personality traits, general self-efficacy, depressive symptoms, history of falls, fear of falling, communication with young people, medical history, and self-perceived age, as well as basic characteristics such as age, sex, living alone or not, and educational history.

2.2. Measures

2.2.1. Self-perceived age

In this study, we use the term "self-perceived age" as the term denoting the age that elderly perceive themselves (Rippon & Steptoe, 2015). According to a previous study (Stephan et al., 2013), self-perceived age can be assessed by asking participants to specify, in years, how old they feel. In another study (Stephan, Sutin, Luchetti, & Terracciano, 2016), subtracting the chronological age from the self-perceived age and dividing the result by the chronological age was defined as the discrepancy score. A lower value of the discrepancy score indicates a younger self-perceived age, while a higher value indicates an older self-perceived age. In this analysis, we excluded 20 participants who provided extreme responses (two standard deviations above or below the mean) as outliers.

2.2.2. Physical activity

Physical activity was evaluated by the presence or absence of exercise habits. According to the definition used in the National Health and Nutrition Survey (Ministry of Health, L. a. W., 2003), we defined exercise habits as continued exercise of more than 30 min twice a week for more than one year. This excluded activities of daily living such as walking while shopping.

2.2.3. IADL and functional capacity

We used the Tokyo Metropolitan Institute of Gerontology Index of Competence (TMIG-IC) (Koyano, Shibata, & Nakazato, 1987) for assessment of IADL level and functional capacity. Regarding functional capacity, the hierarchical model of competence by Lawton (Lawton, 1972) defines the following seven conceptual levels: (1) Life Maintenance, (2) Functional Health, (3) Perception-Cognition, (4) Physical Self-Maintenance, (5) Instrumental Self-Maintenance, (6) Effectance (Intellectual activity), and (7) Social Role. The TMIG-IC is a widely-used standard in Japan, and its reliability and validity have been confirmed (Koyano, Shibata, Nakazato, Haga, & Suyama, 1991). The TMIG-IC is a multidimensional 13-item index. Items 1–5 are classified as IADL, items 6–9 are classified as intellectual activity, and items 10–13 are classified as social role. The response to each item was designed simply as 'yes' (able to do) or 'no' (unable) and scored as 1 for each 'yes' and 0 for each 'no'. In addition to the TMIG-IC, we used the Japan Science and Technology Agency Index of Competence (JST-IC) (Iwasa et al., 2015) for the evaluation of high-level functional capacity. The JST-IC expands on the concept of the three TMIG-IC categories, to respond to changes in the living environment of older people in recent years (Iwasa et al., 2015, 2017). The JST-IC measures a higher level of daily function that includes newly added components, such as social participation and life management. The JST-IC can measure the "competences required for older individuals living alone to become independent and lead an active daily life" within the living environment of the modern active older

citizen, and it has properties that require higher functioning to execute compared with the ADL and IADL (Koyano et al., 1987, 1991).

2.2.4. Self-rated health

Self-rated health was assessed using a single item that asked participants to report whether their health was excellent, very good, good, fair, or poor. We reversed the original scale so that excellent health received the highest score (5 points) and poor health received the lowest score (1 point).

2.2.5. Personality

In order to score participants personality traits based on Big Five theory of personality traits, five representative character evaluation terms representing each personality character were used with reference to the adjective check list (Gough & Heilbrun, 1983). These include: 1) "I have a sociable personality" (Extraversion), 2) "I do not worry about the details" (Neuroticism), 3) "I'm definitely going to work hard" (Conscientiousness), 4) "I like to work with people and accomplish things" (Agreeableness), and 5) "I actively acquire new knowledge" (Openness to experience). These items are short, easy-to-understand phrases that assess five personality traits. Each item was rated on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree).

2.2.6. General self-efficacy

We used the Japanese version of the General Self-Efficacy Scale (GSES) (Schwarzer et al., 1997). This scale is a 10-item psychometric scale designed to assess optimistic self-beliefs to cope with a variety of difficult demands in life. The scale was developed in German by Matthias Jerusalem and Ralf Schwarzer and has been used in many studies (Schwarzer et al., 1997).

2.2.7. Depression symptoms

The Geriatric Depression Scale (GDS) is a 30-item self-report assessment designed specifically to identify depression in the elderly. We used the five-item geriatric depression scale (GDS-5) (Hoyl et al., 1999; Rinaldi et al., 2003) validated with the original scale. Participants responded with either 'Yes' or 'No' to each question and scored 1 for each "Yes", 0 for each "No". Depressive symptoms were suggested at a score of 2 or more out of 5.

2.2.8. Disease burden

The sum of diagnosed conditions, such as hypertension, diabetes, heart disease, osteoporosis, dyslipidemia, stroke, or arthritis was computed to obtain the measure of disease burden.

2.2.9. History of falls and fear of falling

The history of falls was evaluated for the experience of falling over the past year (coded as 1 for presence of fall history and 0 for no fall). Fear of falling was evaluated by the presence or absence of anxiety about a future fall (coded as 1 for presence of fear of falling and 0 for no fear).

2.2.10. Communication with young people

Except for families, we investigated the frequency of talking with young people on a daily basis. Frequency is classified into 6 scores of "none", "about once a year", "about once every six months", "about once a month", "about twice a month", and "at least once a week" (1–6 points).

2.2.11. Covariates

Age (in years), sex (coded as 1 for men and 0 for women), living alone or not (coded as 1 for living alone and 0 for not alone), and educational history (in years) were included as covariates.

Table 1
Participant characteristics (N = 3074).

| Variables | Mean/% | SD |
|--------------------------------|--------|------|
| Age (65–98) | 72.9 | 6.2 |
| Sex (% female) | 52% | – |
| living alone | 0.1 | – |
| Educational history | – | – |
| < 6 Years | 0.6% | – |
| 6 ≤ 9 Years | 22.8% | – |
| 10 ≤ 12 Years | 46.2% | – |
| ≥ 13 Years | 29.9% | – |
| Disease burden | 1.2 | 0.9 |
| Felt age | 66.7 | 7.5 |
| Discrepancy score ^a | –0.1 | 0.08 |
| Personality | – | – |
| Extraversion | 3.6 | 0.8 |
| Neuroticism | 3.4 | 0.9 |
| Openness to experience | 3.5 | 0.9 |
| Agreeableness | 3.5 | 0.9 |
| Conscientiousness | 3.7 | 0.9 |
| Interaction with young people | 3.0 | 2.0 |
| Physical activity | 40.3% | – |
| TMIG-IC | 11.3 | 1.9 |
| JST-IC | 10.2 | 3.4 |
| GSES | 32.4 | 7.0 |
| GDS-5 | 1.6 | 1.0 |

Notes: TMIG-IC: Tokyo Metropolitan Institute of Gerontology Index of Competence; JST-IC: Japan Science and Technology Agency Index of Competence; GSE: General Self Efficacy Scale; GDS-5: the five-item geriatric depression scale. ^a Discrepancy score = (Felt age – chronological age) / Chronological age. Negative value represent feeling younger from chronological age.

Twenty participants who were outliers on subjective age were excluded from the analysis.

2.3. Data analysis

In the data analysis, a correlation matrix for all variables was created, and the Pearson's correlation coefficient and significance between each variable were calculated. We performed a multiple regression analysis with discrepancy score as the dependent variable and a variable showing significant correlation with the discrepancy score by the correlation analysis as the independent variable. Subjects were divided into two groups based on whether the self-perceived age was higher than the chronological age, and the self-rated health score and the GSE score adopted as significant variables in the multiple regression analysis were compared between the groups. Student's *t*-test was used for comparison among the groups. All statistical analyses were conducted using SPSS version 21.0 (IBM, Chicago, IL, USA). The level of significance was set at $p < 0.05$.

3. Results

Table 1 shows the characteristics of the participants. The average self-perceived age and discrepancy score were 66.7 years (SD = 7.5 years, range, 48–91 years) and -0.1 years (SD = 0.08 years), respectively. There were no differences due in regards to gender in the self-perceived age. The self-perceived age was significantly younger than chronological age ($p < 0.01$). There was no difference in the discrepancy score in the classification by ages (young-old people and old-old people).

Table 2 shows the correlation matrix of each variable. Age, educational history, self-rated health, physical activity, five personality traits, communication with young people, fear of falling, TMIG score, JST-IC score, GSE score, and disease burden showed a significant correlation with discrepancy score.

As a result of multiple regression analysis with discrepancy score as a dependent variable, self-rated health ($\beta = -0.083$, $p < 0.01$),

Table 2
Correlation matrix of each variables.

| | Discrepancy score | Age | Sex | Living alone | Educational history | Self-rated health | Physical activity | Extraversion | Neuroticism |
|---------------------------------|-------------------|---------|---------|--------------|---------------------|-------------------|-------------------|--------------|-------------|
| Age | .081** | | | | | | | | |
| Sex | .024 | .012 | | | | | | | |
| Living alone | .034 | -.056** | -.097** | | | | | | |
| Educational history | -.104** | -.310** | -.095** | .032 | | | | | |
| Self-rated health | -.206** | -.119** | .028 | .018 | .163** | | | | |
| Physical activity | -.080** | -.002 | -.074** | .010 | .092** | .192** | | | |
| Extraversion | -.242** | -.056** | .136** | .015 | .049** | .220** | .086** | | |
| Neuroticism | -.125** | -.005 | .029 | -.005 | .061** | .141** | .021 | .343** | |
| Conscientiousness | -.136** | .000 | .006 | -.009 | .050** | .169** | .083** | .319** | .234** |
| Agreeableness | -.175** | -.052** | .018 | -.007 | .092** | .217** | .083** | .425** | .230** |
| Openness to experience | -.245** | -.083** | -.009 | -.002 | .238** | .238** | .125** | .413** | .222** |
| Communication with young people | -.116** | -.100** | .058** | -.008 | .054** | .155** | .056** | .226** | .074** |
| Fall history | -.035 | -.138** | -.063** | .043 | .081** | .104** | .032 | -.011 | .009 |
| Fear of falling | -.134** | -.268** | -.195** | .066** | .153** | .232** | .127** | .057** | .028 |
| TMIG-IC | -.179** | -.229** | .175** | -.003 | .243** | .245** | .121** | .316** | .139** |
| JST-IC | -.224** | -.400** | -.018 | .087** | .356** | .288** | .188** | .285** | .132** |
| GDS5 | .170** | .174** | .065** | -.044 | -.144** | -.241** | -.122** | -.246** | -.116** |
| GSE | -.231** | -.055** | -.118** | .008 | .164** | .230** | .128** | .383** | .252** |
| Disease burden | .037 | .101** | -.027 | -.009 | -.055** | -.225** | -.025 | -.013 | -.008 |

| | Conscientiousness | Agreeableness | Openness to experience | Communication with young people | Fall history | Fear of falling | TMIG-IC | JST-IC | GDS5 | GSE |
|---------------------------------|-------------------|---------------|------------------------|---------------------------------|--------------|-----------------|---------|---------|---------|-------|
| Age | | | | | | | | | | |
| Sex | | | | | | | | | | |
| Living alone | | | | | | | | | | |
| Educational history | | | | | | | | | | |
| Self-rated health | | | | | | | | | | |
| Physical activity | | | | | | | | | | |
| Extraversion | | | | | | | | | | |
| Neuroticism | | | | | | | | | | |
| Conscientiousness | .498** | | | | | | | | | |
| Agreeableness | .461** | .573** | | | | | | | | |
| Openness to experience | .151** | .257** | .231** | | | | | | | |
| Communication with young people | .041* | .014 | .033 | .014 | | | | | | |
| Fall history | .056** | .088** | .135** | .040* | .232** | | | | | |
| Fear of falling | .240** | .369** | .422** | .265** | .080** | .107** | | | | |
| TMIG-IC | .265** | .398** | .491** | .258** | .092** | .224** | .645** | | | |
| JST-IC | -.219** | -.271** | -.318** | -.184** | -.084** | -.193** | -.339** | -.385** | | |
| GDS5 | .416** | .449** | .545** | .232** | .030 | .158** | .337** | .425** | -.277** | |
| GSE | -.021 | -.030 | -.011 | -.061** | -.089** | -.149** | -.043** | -.054** | .053** | -.011 |
| Disease burden | | | | | | | | | | |

Notes: Values mean correlation of coefficient; TMIG-IC: Tokyo Metropolitan Institute of Gerontology Index of Competence; JST-IC: Japan Science and Technology Agency Index of Competence; GSE: General Self Efficacy Scale; GDS-5: the five-item geriatric depression scale.
*p < 0.05, **p < 0.01.

Table 3
Results of multiple regression analysis with discrepancy score as dependent variable.

| Variables | B (SE) β | P |
|---------------------------------|--------------------|------|
| Age(65-98) | .000 (.000) .022 | .341 |
| Educational history | -.000 (.003) -.012 | .577 |
| Self-rated health | -.007 (.002) -.083 | .000 |
| Physical activity | -.001 (.004) -.007 | .720 |
| Extraversion | -.013 (.002) -.129 | .000 |
| Neuroticism | -.002 (.002) -.025 | .249 |
| Conscientiousness | .001 (.002) .008 | .727 |
| Agreeableness | .004 (.002) .039 | .139 |
| Openness to experience | -.008 (.003) -.084 | .003 |
| Communication with young people | -.001 (.001) -.033 | .120 |
| Fear of falling | -.007 (.004) -.043 | .047 |
| TMIG-IC | -.001 (.001) -.022 | .408 |
| JST-IC | -.001 (.001) -.028 | .347 |
| GDS5 | .003 (.002) .034 | .126 |
| GSE | -.001 (.000) -.093 | .000 |
| Disease burden | -.001 (.002) -.012 | .551 |
| Adjusted R ² = 0.11 | | |

Notes: TMIG-IC: Tokyo Metropolitan Institute of Gerontology Index of Competence; JST-IC: Japan Science and Technology Agency Index of Competence; GSE: General Self Efficacy Scale; GDS-5: the five-item geriatric depression scale; B: unstandardized regression coefficient; SE: standard error; β : standardized regression coefficient.

extraversion ($\beta = -0.129, p < 0.01$), openness to experience ($\beta = -0.084, p = 0.003$), fear of falling ($\beta = -0.043, p = 0.047$), and GSE score ($\beta = -0.093, p < 0.01$) were adopted as significant variables. Multi-co-linearity between independent variables was not observed (Table 3).

Participants were classified according to whether the subjective age was older than the chronological age, and, as a result of sub-analysis in which the variables adopted as significant factors in the multiple regression analysis were compared, elderly people who feel that their age is younger than their actual age have better subjective self-rated health (feel younger, 3.55 ± 0.98 ; feel older, 2.57 ± 1.05 ; $p < 0.01$) and GSE score (feel younger, 32.6 ± 8.22 ; feel older, 26.43 ± 8.22 ; $p < 0.01$) (Fig. 1).

4. Discussion

In this study, we scored the discrepancy between self-perceived age and chronological age and investigated the relationship of this discrepancy with various background factors such as level of IADL, functional capacity, personality aspect, physical activity, psychological aspect, and disease burden. As for the discrepancy between the self-perceived age and the chronological age, the self-perceived age was significantly younger than the chronological age, and mean discrepancy score was -0.10 ± 0.08 . Our results are consistent with those reported previously (Stephan et al., 2015a, 2015c, 2013; Stephan et al., 2016).

In regards to the personality aspect, extraversion and openness to experience were related to younger subjective age in the multiple regression analysis model, consistent with results from previous studies (Canada, Stephan, Caudroit, & Jaconelli, 2013; Stephan et al., 2012). The strength of these characteristics can be regarded as a psychologically positive state, which may indicate that there is an interaction between positive thinking and younger self-perceived age.

Regarding the relationship between psychological aspects and self-perceived age, self-rated health, fear of falling, and GSE scores were adopted as significant relevant factors. Correlation between self-rated health and self-perceived age have been clarified in previous studies (Bergland et al., 2014; Infurna et al., 2010), and similar results were obtained in the present study. As for GSE scores, which are considered to be associated with health behavior theory, the practice of good health behavior and the quantity of self-efficacy in which a positive

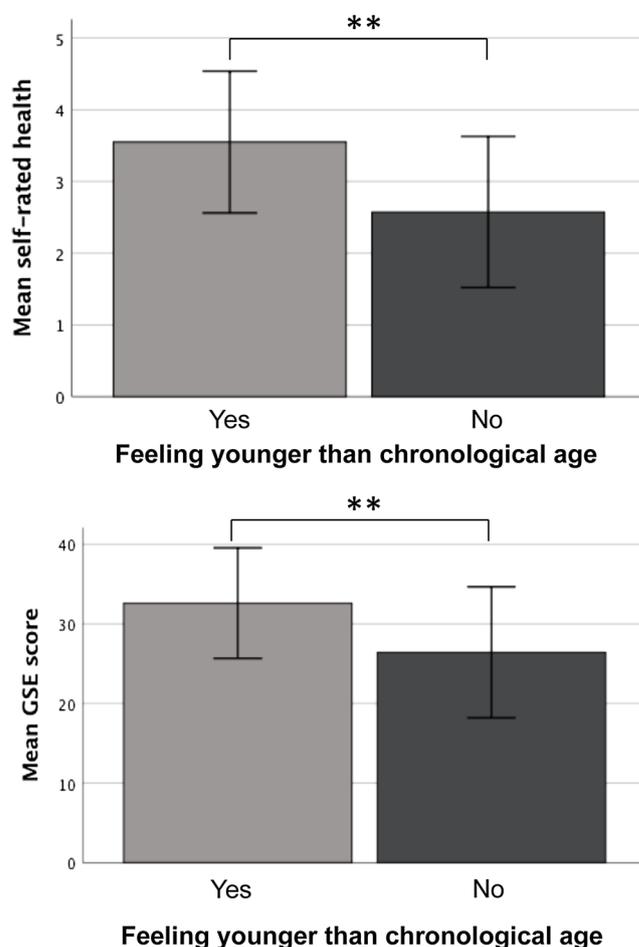


Fig. 1. Comparison between subjective age and self-rated health and SSE score. Note: **P < 0.01, error bar: standard deviation.

correlation is observed has been demonstrated in many previous studies (Garcia et al., 1995; Sallis et al., 1986; Sallis, Hovell, Hofstetter, & Barrington, 1992; Steptoe, Rink, & Kerry, 2000). Taken together these results suggest that evaluating self-perceived age is a surrogate indicator of the health condition of the elderly and may be relevant to the degree of adherence to future exercise habits as a behavior change approach to health.

On the other hand, a negative relationship was observed between the fear of falling and self-perceived age, and there was no significant correlation with the existence of an actual falling experience. In general, the existence of a falling fear as a post-fall syndrome may lead to a risk of falling (Alarcón, González-Montalvo, & Otero Puime, 2009). Our results were contrary to our expectation. However, the fear of falling has been reported to exist even in elderly people who have not experienced falls (Friedman, Munoz, West, Rubin, & Fried, 2002). As the participants in this study are elderly people who are independent in their daily living activities, older people with a younger self-perceived age are more active, with high interest in their own health and a fear of trauma and fractures caused by falls. Our results suggest that this fear has increased. The GDS-5 score, a contrasting index to the height of self-efficacy, was not related to the self-perceived age, likely because the number of participants in the depression state exceeding the cut-off value was small.

We divided participants into two groups based on whether the self-perceived age was higher than the chronological age and compared the self-rated health and the GSE score, which were significantly related to the self-perceived age in the multiple regression analysis. As a result, the self-rated health and the GSE score were significantly higher in the

self-perceived young group compared to the self-perceived elderly group. As described above, this is considered to show more clearly the relationship between self-perceived age, health condition, and ease of practicing health behavior. In the theory of health behavior, it is advocated that positive emotion promotes adherence of health behavior and the establishment of health behavior increases positive thinking (Garcia, Archer, Moradi, & Andersson-Arntén, 2012; Kim, Kubzansky, Soo, & Boehm, 2017). Therefore, it is considered important to encourage the elderly to keep their feelings young.

From a social psychological point of view, the influence of age on the self-perception of aging has been studied extensively. Researchers within the area of social cognition have identified factors that may exacerbate the naturally occurring decline in self-perceived age due to aging (Stephan, Sutin, & Terracciano, 2015d). Among such factors, widespread ageist attitudes, age discrimination (Pascoe & Smart, 2009), and stereotypes (Cuddy & Fiske, 2002; Cuddy, Norton, & Fiske, 2005; Kite, Stockdale, Whitley, & Johnson, 2005; Nelson, 2005; Pinquart, 2002) may play an important role. Levy and coworkers focused on the long-term effects of negative stereotypes of older people that are prevalent in society and that contribute to a self-image of aging when one becomes old (Levy, 2009). Thus, when a negative stereotype is internalized in the course of life, it becomes a self-stereotype and affects the perception of one's own aging. At the same time, this also affects cognition and physical function. These authors demonstrate the effect of positive self-perception on longevity and health (Levy et al., 2002b; Levy, Slade, Kunkel, & Kasl, 2002b; Levy, 2003). Associating the results of our research with the above stereotype internalization theory suggests that participants with a young self-perceived age are positive self-stereotypes with respect to aging, and this may be related to the formation of better self-rated health and general self-efficacy. Conversely, participants with a subjective age older than the chronological age may be affected by the stereotype threat attributed to ageism (fear of stereotypes).

There are several limitations to this study. First, since the research design is a cross-sectional study, it is impossible to clarify the causal relation between self-perceived age and each related variable. Second, the information concerning diseases is self-reported, and medical diagnoses were not confirmed. Third, in this research, we have not investigated the impact of the social psychological factors mentioned above. Finally, the effective response rate of this survey data is somewhat low and respondents may be limited to elderly people who are relatively interested in health.

The KAGUYA project is a five-year prospective study, and we plan to clarify the causal relationship between self-perceived age and influential factors from various aspects by the scheduled 2nd wave survey.

5. Conclusions

The discrepancy score calculated from self-perceived age and chronological age was significantly related to self-rated health, general self-efficacy, extraversion trait, and openness to experience. From these results, the evaluation of the discrepancy score for elderly patients may be a simple surrogate index reflecting general health and the ease of practicing good health behavior. In addition, elderly people who have a tendency to extraversion and openness to experience maintain a young self-perceived age, which may have a positive impact on prevention of psychological/mental frailty and a future healthy life.

Institutional review board

Each participant signed a consent form approved by the Institutional Review Board at the Kio University in Japan (approval number, H27-34).

Author contributions

Conceived and designed the experiments: KT DM JM YN. Performed experiments: KT JM. Analyzed data: KT DM MM. Wrote the manuscript: KT DM.

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Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to research, authorship, and/or publication of this article.

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