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Received 13 August 2004; accepted in revised form 9 March 2005

Age and Ageing 2005; **34:** 368–372
doi:10.1093/ageing/afi091
Published electronically 17 May 2005

Perceived age as a predictor of old age mortality: a 13-year prospective study

VIRPI UOTINEN[1], TAINA RANTANEN[2], TIMO SUUTAMA[3]

[1]Open University, PO Box 35, University of Jyväskylä, Finland, FIN-40014
[2]The Finnish Centre for Interdisciplinary Gerontology, University of Jyväskylä, PO Box 35, Viveca, Finland, FIN-40014
[3]Department of Psychology, University of Jyväskylä, PO Box 35, MaC, Finland, FIN-40014

Address correspondence to: V. Uotinen. Fax: (+358) 14 260 4343. Email: virpi.uotinen@sport.jyu.fi

Abstract

Objectives: to examine whether in older people perceived age is associated with risk of total mortality independent of chronological age.
Design: prospective population-based study (Evergreen project) with mortality surveillance for 13 years after the baseline.
Setting: face-to-face interview among community-dwelling residents of the city of Jyväskylä, Finland.
Subjects: 395 men and 770 women aged 65–84 years at baseline.
Measures: perceived physical age and perceived mental age were rated either as younger, the same or older in comparison with subject's chronological age. Death dates were received from the official register of the province of Central Finland. Confounders used were chronological age, education in years, number of long-term illnesses, self-rated health, depression score (Beck's 13-item depression scale), and cognitive status.
Results: mortality rates per 1,000 person-years from the older to younger perceived physical age category were 99, 65 and 59 in men, and 81, 54 and 36 in women. In the perceived mental age categories, correspondingly, mortality rates were 139, 63 and 64 in men, and 82, 55 and 44 in women. The fully adjusted relative risk (RR) of death over 13 years with the perceived younger physical age category as referent was 1.42 (95% CI 1.00–2.02) in the older category and 1.28 (1.03–1.60) in the same age category (P=0.049). The crude RR of mortality for perceived mental age categories was 1.56 (1.09–2.23) in the older and 1.10 (0.92–1.31) in the same age as compared with the younger category (P=0.046). Adding cognitive status into the model diminished the predictive value of the model (P=0.545).

Conclusions: perceived age predicted worsening of health as described as mortality. Perceived age may indicate general well-being and faith in the future, potentially reflecting changes in health.

Keywords: *perceived age, subjective age, mortality, ageing, elderly*

Introduction

Perceived age, also known as subjective age, reflects personal evaluation of age and consists of factors such as recognition of chronological age, role involvement, health and physical limitations as well as awareness of societal age norms [1]. A number of studies suggest that people with a lower perceived age are healthier, have higher morale and evaluate their mental and physical status more favourably than their counterparts with a higher perceived age [2–8]. Perceived age of leaving middle age has been found to be potentially associated with future health outcomes in middle-aged people [9]. In a 4-year follow-up, conducted with 460 people aged 60 years and over, Markides and Pappas [10] noted that perceived age was a better predictor of survival than life expectancy, even after controlling for health status. Although the potential association of perceived age with mortality may be strongly explained by various indicators of health [3], one could speculate whether this self-assessment of subjective rate of ageing still captures such aspects of personal well-being that remain uncaptured when using traditional health measures.

Positive psychological factors, such as emotional vitality and morale, have been found to protect from adverse health outcomes even after controlling for socio-demographic characteristics and health indicators [10–13]. Penninx *et al.* [13] noted that emotional vitality in older disabled women reduced the risk of subsequent new disability and mortality. The results were not simply caused by the absence of depression since protective health effects remained when emotionally vital women were compared with women who were neither emotionally vital nor depressed. It was suggested that people with emotional vigour probably had healthier lifestyles and a better adherence to treatment regimens. These people may also show a higher resilience when facing stress and deploy more effective coping strategies. Better ability to cope with environmental or physical stressors may, in turn, reduce their damaging effects [13].

Although perceived age might embrace a variety of factors that indicate health and well-being, as far as we know, the potential link between perceived age and future changes in health is still rather unexplored. In the light of these observations the aim of this study was to examine perceived physical and mental ages as potential predictors of mortality in a large and heterogeneous sample of non-institutionalised people aged 65–84 years. Chronological age, gender, educational status, number of chronic illnesses, self-rated health, depression score and cognitive status were included in the models as covariates.

Methods

This investigation is a part of the Evergreen project, a prospective study among 65- to 84-year-old residents of the city of Jyväskylä, in Central Finland, focusing on their functional capacity [14]. The study was based on in-home interviews on living conditions, and mental and physical functioning. The sample comprised 800 non-institutionalised people born in 1904–1913 and 800 people born in 1914–1923. About 80% (n=1224) of them were interviewed in 1988 in their homes. This study utilises data on the 1,165 individuals, 395 men and 770 women, who answered both the questions on perceived age. Mortality among this sample was followed up for 13 years. Death dates were received from the official register of the province of Central Finland.

Indicators of perceived age were mental and physical age. Perceived mental age was elicited by the following question: 'Do you feel mentally younger, the same, or older than your real age?'. The question concerning perceived physical age was: 'Do you feel physically younger, the same, or older than your real age?'.

Baseline variables that were studied as potential confounders included chronological age, education, number of illnesses, self-rated health, depression score and cognitive status. Education was described in years of formal education (range 0–23 years). Health status was indicated by the number of diagnosed long-term illnesses (range 0–10) and based on the participant's self-report. Self-rated health was elicited by a question: 'How would you rate your health at the moment?' (1=very good, 2=good, 3=average, 4=bad, 5=very bad). Mood was indicated as depressive symptoms that were studied by the modified version of Beck's 13-item depression scale (BDI) [15]. The scale consists of 13 items, each of which is rated from 0 to 3. Ascending scores indicated a greater severity of depressive symptoms (no symptoms, 0–4 points; mild symptoms, 5–7 points; moderate symptoms, 8–15 points; and severe symptoms, 16 or more points). The modified version differed from the original instrument with respect to two questions: feelings of guilt was changed to self-accusations and working difficulty to disturbed sleep. Cognitive status was indicated by the Mini-D, a test constructed for dementia screening purposes [16]. The test consisted of 35 items (range 0–43 points) measuring cognitive functioning in six areas: orientation, memory, learning, visual perception, numerical ability and reasoning. A sum score of 25 points or less denoted likelihood of a serious cognitive decline. The test has shown high reliability in a previous study [17].

Statistical methods

Participants were divided into three groups according to their baseline perceived age and separate analyses were performed for perceived mental and physical age. χ^2 tests were used to analyse the similarity of the patterns of mental age and physical age. The linear-by-linear association test was used to analyse the presence of trends between perceived

Table 1. Characteristics of the three perceived age groups

Perceived physical age	All ($n=1165$) Mean	SD	Younger (1) ($n=438$) Mean	SD	Same (2) ($n=602$) Mean	SD	Older (3) ($n=125$) Mean	SD	F-test *P*-value[a]	Groups[b]
Chronological age (years)	72.8	5.4	72.8	5.5	72.6	5.3	73.9	5.7	0.050	–
Education (years)	6.6	3.4	7.0	3.5	6.6	3.3	5.3	3.1	0.001	1,3 ($P<0.001$)
Number of illnesses	2.0	1.5	1.5	1.3	2.2	1.6	2.7	1.5	0.001	1,2 ($P<0.001$) 1,3 ($P<0.001$)
Self-rated health	2.9	0.9	2.5	0.8	3.0	0.8	3.7	0.8	0.001	1,2 ($P<0.001$) 1,3 ($P<0.001$)
Cognitive status score	36.5	5.1	36.8	5.0	36.7	4.9	34.6	5.9	0.001	1,3 ($P<0.001$)
Depression score	2.8	3.2	1.8	2.2	3.1	3.1	5.3	5.1	0.001	1,2 ($P<0.001$) 1,3 ($P<0.001$)
Perceived mental age	All ($n=1165$) Mean	SD	Younger (1) ($n=664$) Mean	SD	Same (2) ($n=449$) Mean	SD	Older (3) ($n=52$) Mean	SD	F-test *P*-value[a]	Groups[b]
Chronological age (years)	72.8	5.4	72.7	5.5	72.8	5.4	74.6	5.3	0.060	–
Education (years)	6.6	3.4	6.9	3.5	6.3	3.2	5.0	3.2	0.001	1,2 ($P=0.007$) 1,3 ($P<0.001$)
Number of illnesses	2.0	1.5	1.9	1.5	2.0	1.5	2.6	1.9	0.013	1,3 ($P=0.039$)
Self-rated health	2.9	0.9	2.8	0.9	3.0	0.9	3.4	0.9	0.001	1,2 ($P<0.001$) 1,3 ($P<0.001$)
Cognitive status score	36.5	5.1	36.9	4.9	36.4	4.9	31.8	6.6	0.001	1,3 ($P=0.001$)
Depression score	2.8	3.2	2.5	2.6	3.0	3.2	6.9	6.7	0.001	1,2 ($P=0.027$) 1,3 ($P=0.002$)

[a]Brown-Forsythe's test for variables with non-homogeneous variances.
[b]Paired comparisons with Scheffe's test for homogeneous and Tamhane's test for non-homogeneous variances.

age variables. Respective procedure was used to analyse the association between perceived age variables and self-rated health. Two-way variance analysis was used to ascertain that there were no significant sex differences in perceived age variables among the subjects or interaction with mortality status. One-way analysis of variance was used to compare age, education, number of diseases, self-rated health, cognitive status and depression scores between the three categories of perceived age. Cox proportional hazard regression models with adjustments for potential confounders were used to estimate the relative risks of mortality in the perceived age categories. Data analyses were executed using SPSS for Windows Release 11.01 (15 November 2001).

Results

In perceived physical age, 37% ($n=438$) of subjects felt younger, 52% ($n=602$) the same, and 11% ($n=125$) older than their chronological age. Some 57% ($n=664$) of the participants reported feeling mentally younger, 38% ($n=449$) the same, and 5% ($n=52$) older than their chronological age. Gender was not associated with perceptions of perceived physical age or mental age. A strong positive linear association between the two perceived age variables was observed with 66% ($n=768$) of the participants choosing a corresponding response alternative in both indicators of perceived age ($\chi^2=434.7$, $P<0.001$). There was also a strong linear association between self-rated health and perceived physical age ($\chi^2=226.9$, $P<0.001$) and perceived mental age ($\chi^2=47.8$, $P<0.001$).

Overall, the participants with physical or mental perceived age older than their chronological age were somewhat older, less educated, had more illnesses, more negative perceptions of their health, lower cognitive status, and a higher depression score than those in the other perceived age categories (Table 1).

During the 13-year follow-up, 60% ($n=235$) of men and 48% ($n=371$) of women died. The unadjusted mortality rates per 1,000 person-years from the older to younger perceived physical age categories were 99, 65 and 59 in men, and 81, 54 and 36 in women. In the perceived mental age categories, mortality rates were 139, 63 and 64 in men, and 82, 55 and 44 in women (Figure 1). In both sexes, there were higher mortality rates in the 'older' category than in the two other perceived age categories. Prior to including men and women in the same multivariate models we confirmed by two-way variance analysis that there were no significant sex differences among the subjects (main effect for perceived physical age, $P=0.362$, and for perceived mental

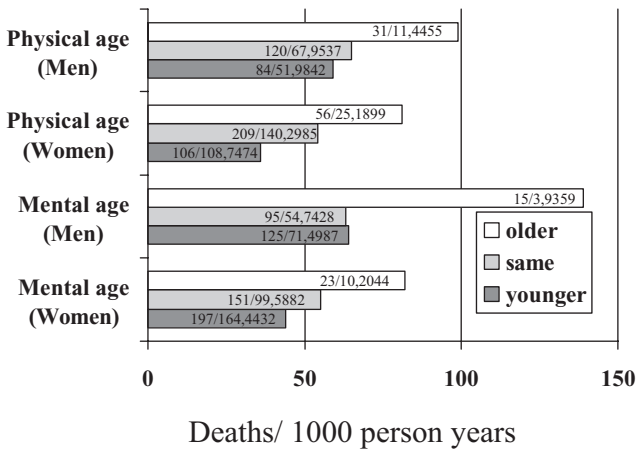

Figure 1. Mortality rates per 1,000 person-years in groups based on perceived age.

Table 2. Relative risk of mortality according to subjective age at baseline with youthful group as the reference group (n=1,165)

	Physical age aroups					Mental age groups				
Mortality	Older versus youthful		Same versus youthful			Older versus youthful		Same versus youthful		
Covariates	RR	95% CI	RR	95% CI	Overall *P*	RR	95% CI	RR	95% CI	Overall *P*
Unadjusted	2.07	1.61–2.67	1.35	1.13–1.61	0.001	2.05	1.47–2.87	1.17	0.99–1.38	0.001
Age + gender + education	1.86	1.43–2.42	1.41	1.17–1.69	0.001	1.80	1.28–2.54	1.14	0.97–1.36	0.003
Age + gender + education + diseases + self-rated health	1.66	1.26–2.18	1.29	1.07–1.56	0.001	1.56	1.09–2.23	1.10	0.92–1.31	0.046
Age + gender + education + diseases + self-rated health + cognitive status	1.40	1.04–1.88	1.27	1.04–1.54	0.026	1.19	0.80–1.76	1.09	0.91–1.30	0.545
Age + gender + education + diseases + self-rated health + cognitive status + mood	1.42	1.00–2.02	1.28	1.03–1.60	0.049	1.19	0.74–1.92	1.16	0.94–1.42	0.360

RR, relative risk; CI, confidence interval.

age, P=0.631) or interaction with mortality status (P=0.169 for perceived physical age and P=0.649 for mental age, respectively).

In perceived physical age, the unadjusted relative risks of death over 13 years were 2.07 (95% CI 1.61–2.67) among the 'older' and 1.35 (1.13–1.61) among the 'same' category (P< 0.001). In mental age, the unadjusted relative risks of death were 2.05 (95% CI 1.47–2.87) in the 'older' category and 1.17 (0.99–1.38) in the 'same' category with the 'younger' as referent (P< 0.001) (Table 2). First, a set of demographic variables (age, gender and education) were included into the models for perceived age. Second, health indicators (diseases and self-rated health) were added. Finally, first cognitive status and then also mood were added into the model as potential predictors of perceived age. Perceived physical age remained a significant predictor of mortality even after controlling potential confounders. The fully adjusted (age, gender, educational and cognitive status, number of diseases, self-rated health and depressive symptoms) relative risks of death over 13 years were 1.42 (95% CI 1.00–2.02) in the 'older' and 1.28 (1.03–1.60) in the 'same' perceived physical age category with the 'younger' as the reference group (P=0.049). Perceived mental age was a significant predictor of mortality after controlling age, gender, education, diseases and self-rated health. Relative risks of death were 1.56 (95% CI 0.92–1.31) in the 'older' and 1.10 (0.92–1.31) in the 'same' perceived mental age category with the 'younger' as the reference group (P=0.046). However, after adding cognitive status (P=0.545) or both cognitive status and mood (P=0.360) as covariates, the relationship between perceived mental age and mortality was no longer significant.

Discussion

Results of this study suggest that older perceived age may be an early indicator of worsening health in older people. The main result was that describing oneself as older than one's chronological age increased the risk of mortality even after adjusting for demographic factors (age, gender, educational status) and health variables (diseases, self-rated health). Of the two perceived age variables, physical age was a stronger predictor of mortality than mental age. It predicted mortality even after adding cognitive status and mood as covariates besides demographic and health variables.

There may be several potential explanations why the simple indicator of perceived age predicts mortality in older people. Subjective age may reflect a person's general well-being and as such the faith he or she has on the future. The present data support this idea, as those participants who reported feeling 'older than their age' indeed had more diseases, a poorer self-rated health, a lower cognitive status score, and a higher depression score compared with people in the other perceived age categories. Because adjusting for confounders decreased but did not eliminate its effect on mortality, perceived age may also include more aspects than just being an indicator of global well-being. As a concept, perceived age, perceived physical age more so, probably encompasses information not only about perceived health and well-being but also about other factors, such as developmental expectations and cultural age norms [1]. One could ponder whether an awareness of the subjective rate of ageing is especially captured by perceived physical age, because ageing in western culture is, by and large, associated with physical deterioration. This observation may reflect the common cultural conception that body and mind represent separate entities, where the body is seen to age while the mind is less prone to age changes [18]. Indeed, feeling physically older than one's chronological age was more common than feeling mentally older. Future research should provide more information about the conceptual and empirical overlap and dissimilarity between different indicators of perceived age and their association with well-being.

The power of perceived mental age to predict mortality disappeared after adding cognitive status as a covariate. This suggests that the potential association between perceived mental age and mortality is explained by an increased risk of dementia among the older mental age group.

Unfortunately we did not have data available which would have allowed us to capture the severity of diseases. Instead, we expressed co-morbidity as a sum of self-reported physician-diagnosed long-term illnesses, which allows for the possibility that some residual confounding remained in the models. However, we do not believe that this would fully

explain our results as self-rated health, at least partly, may be viewed as a surrogate measure of disease severity, although further testing would be required to support this view.

The present study is based on a representative sample of community-dwelling people with a relatively long mortality follow-up. As age identification research has often been carried out among small samples [19, 20] this is a clear advantage of our study. Our results contribute to existing knowledge about ageing as a personal experience by showing that perceived age was associated with mortality in a sample of community-dwelling older people even after controlling for multiple potential confounders. The findings suggest that the study on personal perceptions of age has clinical relevance and emphasise the need to understand better the processes underlying perceived aging.

Key points

- Perceived age is related to the risk of mortality in older people.
- The risk of mortality was not entirely explained by the effects of baseline chronological age, educational status, or health indicators.
- Indicators of perceived age may provide useful information when trying to identify persons at an increased risk of deterioration in their health.

Acknowledgements

The Evergreen project has been funded by the Academy of Finland, the Ministry of Education, the Ministry of Social Affairs and Health, the City of Jyväskylä, and the University of Jyväskylä.

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Received 16 August 2004; accepted in revised form 9 March 2005