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Do levels of perceived stress increase with increasing age after age 65? A population-based study

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Abstract

Background: psychological and health-related stressors often occur in advanced ages, but little is known about perceived stress in adults aged 65 and over. This study aimed to test the hypothesis that levels of perceived stress increase with increasing age and to detect factors that may account for the association.

Methods: a dementia-free cohort of 1,656 adults aged 66–97 years living at home or in institutions, participating in the Swedish National Aging and Care study, Kungsholmen (SNAC-K) was assessed for levels of perceived stress using the 10-item perceived stress scale (PSS).

Results: prevalence of high stress according to the top tertile of the population (PSS score 20+) was 7.8% in adults aged 81+ years, 7.5% in adults aged 72–78 and 6.2% in adults aged 66 years ($P = 0.020$). More women than men reported high stress, 8.3 versus 5.4% ($P = 0.001$). Levels of stress increased with increasing age ($P = 0.001$) in the linear regression model. This association remained after adjustment for demographic and psychosocial factors, but no longer was present after adjusting for health-related factors.

Conclusion: health-related stress is highly prevalent in older adults and seems to play an important role in the association between levels of perceived stress and age in older adults.

Keywords: stress and health, perceived stress scale, older adults and stress, older people

Introduction

Psychological stress has frequently been associated with a broad spectrum of negative health outcomes [1, 2]. Although life after the retirement age is generally considered to be a peaceful period of life, many psychological challenges, such as loneliness, bereavement, caring for a family member and deterioration of own health, may occur, all of which can lead to increased levels of stress [3]. Due to prolonged life expectancy, more and more adults are reaching very old age, increasing the possibility to face health-related stressors [4], consequently leading to higher levels of perceived stress. However, evidence on prevalence of perceived stress in the general population of older adults over the age of 65, particularly those aged 80 and over, is limited. Further, data concerning whether levels of perceived stress are associated with age are scarce [5–7].

Few studies have explored the perception of stress in older adults and the results have been inconsistent. Some studies have found decrease of perceived stress with increasing age [8–11]; others showed no differences between younger and older adults [3, 7]. The majority of previous studies lack adequate representation of the general population, as most studies included community-dwelling volunteers and excluded persons with mental and physical limitations, leaving highly selected healthy samples of older adults [6, 7, 12]. In addition, factors frequently associated with stress in late life such as depression, cognitive impairment and health status [13] were not taken into account in most of the studies. Compiled literature indicates that health-related stressors increase with age. While healthy older adults may have better coping strategies than younger adults [14], those with suboptimal physical health status can experience high levels of perceived stress [15, 16]. Therefore, it is reasonable that a study including participants with multiple health problems would show an increase of perceived stress with increasing age [12]. Moreover, due to the vast variation of stressors in advanced age [12], without exploring the effect of these age-related factors, such as ill-health and financial difficulties [17], the true association between burden of stress and age may be masked in advanced age. Finally,

methodologies differed greatly between the studies as well. While some studies measured perception of stress through face-to-face interview followed by self-administered questionnaires or diaries [7, 9, 10, 12], others examined stress levels through telephone interviews [8]. Telephone interviews, though efficient and able to accommodate more individuals, have been shown to have very low response rates among older participants [18].

Based on a representative sample of older adults from the general population living at home or in institutions, using the cross-culturally validated Perceived Stress Scale (PSS), this study aims to estimate the prevalence of high levels of perceived stress in men and women aged 66–97 years, and to explore whether perceived stress increases with age, while taking into account potential confounders, such as psychological and physical health.

Method

Study population

The study population is derived from the Swedish National Aging and Care study in Kungsholmen/Essingeöarna (SNAC-K) initiated 2001, which is an on-going population-based longitudinal study aimed to identify risk factors for diseases and functional decline in old age. In 2007–10, 2,252 older adults aged 66–97 participated in the third phase of the study (more detailed design of data in Supplementary data, Appendix 1, available in *Age and Ageing* online). To avoid unreliable measures of stress [19], we excluded 251 participants who were diagnosed with probable or possible dementia or cognitive impairment (Mini Mental State Examination (MMSE) score < 24). We excluded another 339 individuals with missing information in five or more items on the PSS and 6 individuals who had severe sleep problems. The remaining 1,656 subjects (mean age 74.6 ± 7.0) were included in the present study.

Data collection

At each assessment in SNAC-K, participants met a physician for extensive medical examination, including medical history,

cognitive performance and assessment of current health, a registered nurse for outline of lifestyle, demographics and blood sampling and a neuropsychologist for neuropsychological examination.

The 10-item PSS was used to assess global perception of stress [20]. The PSS has been validated in numerous studies, including cross-cultural validation, and has persistently shown high internal validity (Cronbach's alpha > 0.70) and good test-retest reliability (Rho > 0.70) [21, 22]. The psychometric properties of the Swedish version of the PSS-10 have a good internal reliability (Cronbach's alpha 0.85 for age range 18–79 years and 0.80 for 55–79 years), and construct validity with anxiety ($r = 0.68$), depression ($r = 0.57$) and mental/physical exhaustion ($r = 0.71$) [10]. Demographic factors such as age, gender and education were obtained during an interview with a project nurse. Information on living arrangement was gathered by asking whether the participant lived alone, with someone or living in institutions ($n = 23$). Financial problems were considered present if a negative answer was given to any of the two questions concerning personal economy, (i) 'can you afford to pay your monthly bills' and (ii) 'can you afford to pay an unexpected bill of 14,000 Swedish crowns (equivalent to about 2,147 US Dollars)'.

Global cognitive function was assessed with the MMSE by a physician. Dementia diagnosis was made according to the Diagnostic and Statistical Manual of Mental Disorders fourth edition (DSM-IV) by two separate physicians. In the case of discrepancies, a third experienced neurologist was asked to make a final diagnosis. Depressive symptoms were rated by a physician according to the Montgomery-Åsberg Depression Rating Scale (MADRS) [23], and the MADRS score was categorised into five different groups: 0, 1–2, 3–6, 7–9 and 10+. The 10+ category has been used as a promising cut-off for the presence of clinically relevant depression [24]. Multimorbidity was assessed through the 13-item cumulative illness rating scale (CIRS) [25]. Physical disability was measured through Instrumental Activities of Daily Living (IADL) scale [26]. Activities of Daily Living (ADL) measurements were not utilised in the present study due to very few participants with any ADL disability ($n = 26$).

Statistical analyses

Missing data on five or less items on the PSS (7.4% of the sample) were replaced with maximization estimation method (E.M.) [27]. Cronbach's alpha coefficients were computed to measure internal consistency of the PSS-10, and Spearman correlation coefficients between the PSS score and the MADRS depression scale were computed to measure construct validity. Pearson's χ^2 or ANOVA were used to assess differences in characteristics of participants. Pearson's correlation coefficient was calculated to examine the correlation between depression and the other health-related factors. PSS was categorised into low (scores 0–10), moderate (11–20) and high (21–30) stress according to the tertile distribution to estimate the prevalence of categorical stress levels in the population. The 10 age groups were

reduced to three groups: (i) 66 years, (ii) 72–78 years and (iii) 81+ years.

A weighted variable was created and used in all analyses, because the youngest and the oldest age groups were over-sampled. Standard coefficient (β) in multivariate linear regression was used to quantify the association of perceived stress with the independent variables. Because demographic, psychosocial and health factors are related to both age and perception of stress [15], they may act as confounders when studying the age–stress association. To examine the possible mediating effects of these potential confounders, subsequent regression models were performed with inclusion of each independent variable, one by one. We started with only introducing age groups into the model (Table 2, Model 1), and followed by introducing all demographic variables, that is age, gender and education (Model 2). Alongside the demographic variables, we additionally added psychosocial factors, that is financial problems and living arrangement (Model 3). We continued the analyses based on Model 2 adding health-related factors, that is cognition, multimorbidity and physical impairment (Model 4). Finally, based on Model 4, we further added depression (Model 5). All risk factors were finally added in a model fully adjusting for all potential confounders (Supplementary data, Appendix 1, available in *Age and Ageing* online).

Results

Compared with the participants who lacked five or more items on the stress questionnaire ($n = 339$), participants with complete information were significantly younger, had a lower physical disability, were more often living with someone, had less financial problems, higher education, better cognitive function, less multimorbidity and fewer depressive symptoms ($P < 0.05$). No gender difference was present between the two groups. The internal reliability Cronbach's alpha was 0.7 and construct validity with depression was 0.41 in the current study.

The prevalence of high stress (the top tertile, PSS 21+) was 6.2% (95% CI, 4.3–8.6%) among the young old, 7.5% (95% CI, 5.5–9.8%) for old adults and 7.8% (95% CI, 5.6–10.5%) for the oldest old (81+) ($P = 0.02$) (Figure 1). Women had higher prevalence of high stress at the top tertile (8.3%, 95% CI, 6.7–10.2%) than men (5.4%; 95% CI, 3.7–7.4%) $P = 0.001$ (Figure 1). Higher mean levels of perceived stress were associated with advanced age, female gender, low education, financial problems, living alone, weaker cognitive function, multimorbidity, physical disability and higher depressive symptoms ($P < 0.05$) (Table 1).

Levels of perceived stress were significantly higher in advanced age ($\beta = 1.16$, $P < 0.01$) in the univariate regression model. The association was attenuated but remained significant in the 81+-year-old group ($\beta = 0.90$, $P < 0.05$) after adjusting for gender, education, financial problems and living arrangements (Table 2, Model 1–3). The association was no longer present ($\beta = -0.35$, $P = 0.35$) after introducing

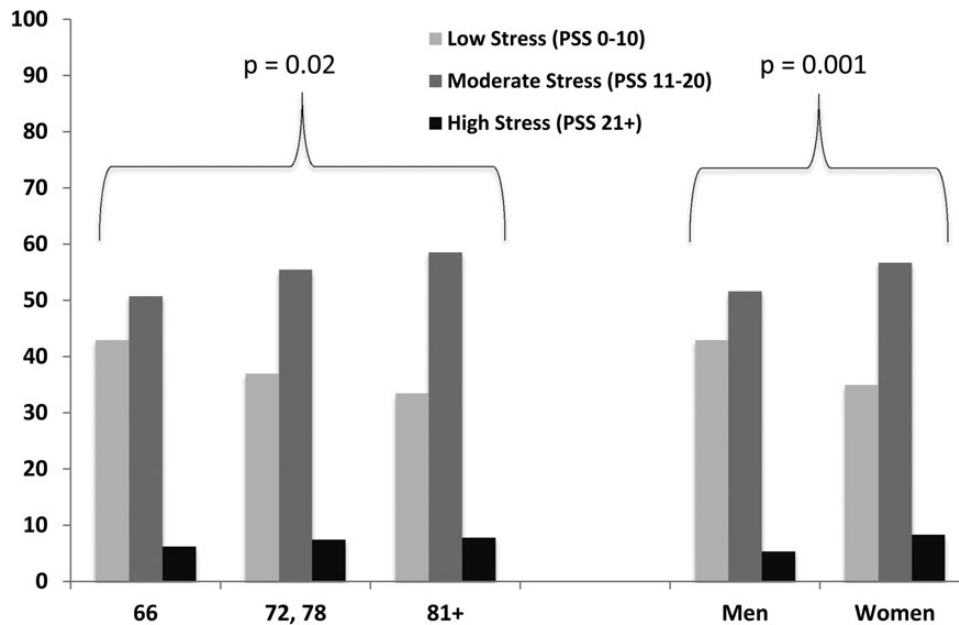


Figure 1. Prevalence (per 100) of perceived stress levels according to tertile distribution of the PSS-10 score by age and gender.

cognitive function, multimorbidity, physical disability and depressive symptoms, one by one or simultaneously, into the gender- and education-adjusted model (Table 2, Model 4–5).

Table 1. Characteristics of study population and levels of perceived stress (PSS)

	Participants n (%)	PSS score Mean ± SD	P value
Age			0.003
66	529 (31.9)	11.8 ± 5.2	
72–78	629 (38)	12.4 ± 5.6	
81+	498 (30.1)	13.0 ± 5.4	
Gender			0.000
Men	634 (38.3)	11.8 ± 5.2	
Women	1,022 (61.7)	12.8 ± 5.6	
Finance			0.000
No problems	1,566 (95.5)	12.2 ± 5.4	
Problems	74 (4.5)	14.8 ± 6.0	
Living alone			0.006
No	824 (50.3)	12.0 ± 5.4	
Yes	815 (49.7)	12.7 ± 5.5	
IADL (physical function)			0.000
0	1,369 (82.8)	12.0 ± 5.3	
1+	283 (17.2)	14.4 ± 5.6	
MADRS (depressive symptoms)			0.000
0	896 (54.1)	11.0 ± 4.8	
1–2	393 (23.7)	12.5 ± 5.2	
3–6	267 (16.2)	15.0 ± 5.5	
7–9	55 (3.3)	17.9 ± 6.8	
10+	45 (2.7)	19.7 ± 5.4	
	Mean ± SD		
Education ^a	12.9 ± 3.9		
CIRS (multimorbidity) ^b	7.0 ± 3.8		
MMSE (cognitive function) ^c	28.4 ± 1.4		

^aEducation: range in study population (2–23 years).

^bCumulative illness rating scale: range in study population (0–22).

^cMini mental state examination: range in study population (24–30).

Further, higher levels of stress were independently related to female gender ($\beta = 0.83, P = 0.004$), low education ($\beta = 0.11, P = 0.002$), financial problems ($\beta = 1.33, P = 0.065$), living with someone ($\beta = 0.60, P = 0.013$), weaker cognitive function ($\beta = 0.20, P = 0.050$), and depression ($\beta = 6.80, P < 0.001$) in the fully adjusted model (Supplementary data, Appendix 2, available in *Age and Ageing* online). In addition, introducing depressive symptoms into the model vanished the significant independent associations of the other health-related factors with perceived stress. Indeed, depression was significantly correlated with all other health-related factors ($r = -0.117$ – $0.266, P < 0.05$ for all).

Results were unchanged in additional analyses in participants with complete information on all items, non-weighted data, as well as in population including those six individuals who were excluded due to severe sleep problems.

Discussion

In the present study, we showed that levels of perceived stress increase with increasing age among men and women aged 66–97 living at home and in institutions. The association was robust and independent of gender, education, economic status and living arrangements. However, the association was no longer present after controlling for cognitive function, multimorbidity, physical disability and depressive symptoms.

To our knowledge, this is the first population-based study on perceived stress in male and female adults aged 66–97 living at home or in institutions. Due to the lack of guidelines for categorisation of high levels of stress using the PSS, we used the top tertile of the score (21+, PSS score range 0–30) in the current study population as cut-off to define high levels of stress. The mean levels of stress observed in our

Table 2. Association of perceived stress with age, health and psychosocial factors

	Model 1 β (SE)	Model 2 β (SE)	Model 3 β (SE)	Model 4 β (SE)	Model 5 β (SE)
Age					
66	Ref	Ref	Ref	Ref	Ref
72–78	0.56 (0.32)	0.41 (0.32)	0.39 (0.32)	–0.34 (0.35)	–0.31 (0.33)
81+	1.16 (0.33)**	0.82 (0.35)*	0.90 (0.36)*	–0.67 (0.44)	–0.36 (0.43)
Women		0.84 (0.27)**	0.74 (0.29)**	0.78 (0.30)**	0.76 (0.30)*
Education		–0.13 (0.04)**	–0.11 (0.04)**	–0.10 (0.03)**	–0.11 (0.04)**
Financial difficulties			2.63 (0.71)**		0.97 (0.67)
Living alone			0.04 (0.30)		–0.54 (0.30)
Low cognitive function (MMSE)				0.28 (0.11)**	0.22 (0.10)*
Multimorbidity (CIRS)				0.14 (0.04)**	0.05 (0.04)
Physical impairment (IADL)				1.85 (0.43)**	0.83 (0.42)*
Depressive symptoms (MADRS)					
0					Ref
1–2					1.23 (0.34)**
3–6					3.71 (0.40)**
7–9					5.72 (0.76)**
10+					7.41 (0.86)**

* $P < 0.05$.

** $P < 0.01$.

study were higher in comparison to other studies with equivalent age groups [8, 10, 28], but the differences in study designs hamper the comparison. One of the studies was based on non-institutionalised volunteers who were enrolled in a telephone interview survey [8], and the other two were based on community dwellers, whereas our study included both community- and institutionalised dwellers.

In line with a previous study, we found that female gender, low education and financial problems were independent predictors of high levels of perceived stress [8, 10], and none of these factors changed the association between stress and age. We found that levels of perceived stress were not associated with age after controlling for health-related factors. These findings are in line with a previous study using the same stress measurement in a sample of community dwellers aged 54–91 and controlled for a number of potential confounders including health status [3].

In contrast, our findings were inconsistent with the reports of a decreased level of stress with increasing age [8–11]. Two of the studies included populations younger than 65: community-dwelling adults [8] and women with physical disability or victims of violence [9]. The third study was based on randomly selected adults aged 18–85, but the participation rate was only 30%, perceived stress was assessed with a single question via telephone interview and no health-related covariates were controlled for in the analyses [11]. The fourth study included adults aged 18–79; however, they categorised older adults as 55+ [10], and furthermore only 40% of the sample participated in the study, which may have excluded older adults with less optimal health.

Our study highlights the importance of health status in old age [29], because all health-related factors were associated with perceived stress especially in the absence of depressive symptoms. Our finding that cognitive function was related to

stress is in agreement with other reports that early signs of cognitive impairment may enhance feelings of stress for older adults. It is known that cognitive function declines with age; thus, increased stress levels with advanced age might be due to declined cognitive function [30]. Another factor that was shown to significantly influence the association between stress and age is multimorbidity, which is highly prevalent in the older population [4]. It has been shown that perceived stress is higher in subjects with more severe multimorbidity [31] and, conversely, that higher levels of stress predict future incidence of several chronic diseases. Our finding of physical disability as another influential factor for the age–stress association is in agreement with other reports that individuals with physical disabilities may be more vulnerable to stress, have less resources to cope with stress, therefore experiencing higher stress levels [9]. Moreover, mid-life stress has been suggested to be a predictor for physical disability in old age, and prevalence of physical disability has been shown to increase with increasing age [32]. However, disability was overall low in our sample, only 1.5% (25/1656) participants with ADL disability; this may be a result of excluding those with dementia and low cognitive function (MMSE < 24). Finally, in line with other studies [29, 33, 34], depression emerged as the strongest health-related factor, which could explain the increased stress with age. These results are reasonable, because perceived stress has frequently been associated with depressive symptoms, which have been shown to increase with increasing age [35]. However, the moderate correlation between the PSS and MADRS may indicate an overlap, and it is debatable to what extent psychological scales such as the PSS are also capturing components of other psychiatric co-morbidities. In addition, depressive symptoms were correlated to all other health-related factors examined in the current study, indicating the importance of the role of depressive symptoms in stress perception.

The current study has several strengths. The results are based on a large sample of older male and female adults from general population with a high participation rate [36]. Perceived stress was measured with a well-validated cross-cultural scale that is frequently utilised in both younger and older age groups [8, 20]. A number of potential mediators including health-related factors were included in the model analysing the association between perceived stress and age. To minimise age bias due to chosen sampling method, a weighted variable was created and used in all analyses. The study is further strengthened by the similar results derived from additional analyses that excluded participants with imputed data, using unweighted data, and including people with severe sleep problems. The present study is however not without limitations. Selection bias may be present, because the participants who completed the questionnaire and were included in the analyses were overall healthier; more educated and had fewer financial difficulties than those who did not complete the PSS form, although with similar distribution in gender. Because there is no standard cut-off score of PSS to define high stress levels, our choice of using the highest tertile (21+) of the PSS score range detected in the current study population (0–30) may have under- or overestimated the prevalence of high stress. Due to the cross-sectional nature of this study, it is not possible to determine the direction of the relationship between health and stress. Stress may have negative effects on health, and vice versa, worse health conditions, with or without depression, can increase the risk of stress, which in turn may worsen already existing co-morbidities. Further longitudinal studies are needed to examine the relationship between perceived stress and health in older populations.

In conclusion, levels of perceived stress increased with increasing age and were the highest among the oldest old. However, the increased levels of perceived stress in advanced age can be explained by health-related factors such cognitive decline, multimorbidity and physical disability especially when occurring with depressive symptoms. This emphasises the importance of health status for the well-being of older adults.

Key points

- Stress increases with age.
- High stress is more common in very old adults and women.
- Association between age and stress is modified by health status.

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Conflicts of interest

None declared.

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Supplementary data

Supplementary data mentioned in the text are available to subscribers in *Age and Ageing* online.

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