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# Poorer self-rated health is associated with elevated inflammatory markers among older adults

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## KEYWORDS

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## Summary

**Objective:** Self-rated health is a strong independent predictor of mortality after accounting for objective health status, behavioral risk factors, and sociodemographic characteristics. However, mechanisms underlying this association are largely unexplained. Inflammation has been associated with increased risk of morbidity and mortality in the elderly. The current study aimed to: (1) examine associations between self-rated health and serum inflammatory markers in older adults; (2) examine the relative strength of these associations for self-rated health versus self-rated change in recent health; (3) examine components of self-rated health that may underlie the association between inflammation and global self-rated health.

**Methods:** Self-rated health, as measured by the RAND health survey, and serum interleukin (IL)-6 and C-reactive protein (CRP) were assessed among 250 generally healthy older adults (185 women, 65 men; average age =  $63.8 \pm 13.7$  years).

**Results:** A series of linear regression analyses demonstrated that poorer self-rated health was significantly associated with higher IL-6 and CRP. These relationships remained after controlling

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for age, body mass index, gender, and objective health conditions. These associations also remained after controlling for depressive symptoms, neuroticism, perceived change in health over the past year, and health behaviors (smoking, sleep quality, and physical activity). Analyses of RAND component measures demonstrated that poorer physical functioning was significantly associated with IL-6; the relationship between global self-rated health and both IL-6 and CRP remained after accounting for perceived physical functioning.

*Conclusions:* Poorer self-rated health is associated with elevated serum inflammatory markers among generally healthy older adults. The relationship of self-rated health with inflammatory markers is not secondary to depressive symptoms, neuroticism, or recent changes in perceived health. Subjective ratings of health provide important clinical information regarding inflammatory status, beyond traditional objective risk factors, even among generally healthy individuals.  
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Self-rated health is a strong independent predictor of mortality after accounting for objective health status, behavioral risk factors, and sociodemographic characteristics. Single-item measures of self-rated health have predicted mortality among individuals with chronic diseases including diabetes (Dasbach et al., 1994) and cardiovascular disease (Bosworth et al., 1999) as well as dialysis patients (Thong et al., 2008) after controlling for objective indicators of disease severity. In addition, over two dozen studies across different countries have found associations between self-rated health and subsequent mortality in the general population (for review see Idler and Benyamini, 1997; Benyamini and Idler, 1999). Although differential effects based on gender, socioeconomic status, and race have been reported in some studies (Benyamini et al., 2003; Franks et al., 2003; Singh-Manoux et al., 2007; Yao and Robert, 2008), overall the predictive value of self-rated health across diverse samples is surprisingly robust. Thus, single-item measures of self-rated health provide clinically relevant information regarding health status, above and beyond traditional objective indicators of health.

Mechanisms underlying the association between self-rated health and mortality are largely unexplained. A highly plausible pathway is inflammatory processes. Chronic elevations in serum proinflammatory cytokines contribute to the development of a number of serious health conditions including cardiovascular diseases, arthritis, diabetes, inflammatory bowel disease, periodontal disease, certain cancers, and age-related functional decline (Hamerman et al., 1999; Ershler and Keller, 2000; Pedersen et al., 2000; Bruunsgaard et al., 2001; Black, 2002; Ishihara and Hirano, 2002). Moreover, elevated levels of circulating inflammatory markers predict increased risk of morbidity and mortality in the elderly (Harris et al., 1999; Bruunsgaard et al., 2003; Cappola et al., 2003; Roubenoff et al., 2003; Maggio et al., 2006). Notably, inflammation is well-known to induce symptoms of sickness behavior, including lethargy, decreased appetite, and behavioral withdrawal (Dantzer and Kelley, 2007). Such symptoms may in turn affect subjective appraisals of health, even among generally healthy adults. In this manner, inflammation may be a common factor contributing to both reduced self-rated health and increased mortality risk.

Few studies have examined associations between self-rated health and inflammation. In a community sample of 1727 elderly adults, a graded association between a single-item measure of self-rated health and IL-6 was reported; this association was much stronger than the association of IL-6

with any specific health diagnosis (Cohen et al., 1997). Among 265 primary health care patients, poorer self-rated health was associated with higher levels of inflammatory markers (IL-1 $\beta$ , IL-1ra, and TNF- $\alpha$ ) among women, but not men (Lekander et al., 2004). Further, self-rated health was more strongly associated with inflammation than was physician-rated patient health. Subsequent research by the same group demonstrated that age moderated this relationship; among 174 primary health care patients, poorer self-rated health was associated with higher TNF- $\alpha$  among all age groups, while associations between self-rated health with IL-1 $\beta$  and IL-1ra were significant only among the oldest participants (Unden et al., 2007). Inflammatory markers (IL-6 and CRP) have also been associated with self-rated health among women with coronary heart disease after controlling for various health confounds (Janszky et al., 2005). Thus, available data indicate that self-rated health is associated with elevated serum proinflammatory proteins and that this relationship is more robust than and remains after controlling for objective indicators of health.

It has been argued that the predictive value of self-rated health for mortality may be a function of an individual's perception of recent declines in health. However, evidence regarding the relative predictive value of self-rated health versus self-rated change in health in predicting mortality is limited and mixed. In a study of elderly adults, inclusion of perceived changes in health in the past 24 months weakened but did not fully account for the association between current self-rated health and mortality (Thomas et al., 1992). In contrast, among a sample of older adult men, when changes in self-rated health over two years were included in the model, current self-rated health was no longer a significant predictor of mortality (Wolinsky et al., 1993). To our knowledge, no studies have examined whether current perceptions of health versus perceptions of recent changes in health are more strongly associated with serum inflammatory markers. Moreover, although global perceived health is undoubtedly influenced by multiple factors including perceived mental health, bodily pain, fatigue, and physical functioning, no studies have examined the extent to which such aspects of self-rated health may drive the link between global health perceptions and inflammation.

The current study sought to replicate and extend upon previous findings to: (1) examine associations between a single-item measure of global self-rated health and serum inflammatory markers in older adults; (2) examine the relative strength of association of global self-rated health versus self-

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