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Negative perceptions of aging modify the association between frailty and cognitive function in older adults☆

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ABSTRACT

Introduction: Older adults who are physically frail have poorer cognition compared to their robust peers. The mechanisms behind this association have yet to be established. Recent research has suggested that self-perceptions of aging are important predictors of physical and cognitive function in later life. This paper investigated whether self-perceptions of aging modify the relationship between frailty and cognitive function.
Methods: 4135 participants from the Irish Longitudinal Study on Aging (TILDA) completed the Brief Aging Perceptions Questionnaire (B-APQ), a cognitive battery, and frailty measures.
Results: Frailty was associated with poorer cognition in participants with negative perceptions of aging but not in those without. There was a significant interaction between negative perceptions of aging and frailty in predicting global cognition ($B = -0.11$, $SE = .04$) executive function ($B = -0.09$, $SE = .04$) and attention ($B = 0.13$, $SE = .04$) but not memory ($B = -0.03$, $SE = .04$).
Conclusion: Negative perceptions of aging may modify the association between frailty and frontal cognitive domains in older adults.

1. Introduction

Older adults who are frail are more likely to be cognitively impaired. This association has been demonstrated consistently in longitudinal studies of aging (Robertson, Savva, & Kenny, 2013). Yet while the association appears to be well-established the mechanisms underpinning the relationship have yet to be explained.

Frailty is an age-related syndrome characterised by a collection of symptoms including slow walking speed, weakness, sedentariness, unintentional weight loss and exhaustion (Fried et al., 2001). It is associated with adverse outcomes including disability and mortality. In gerontological research frailty is considered to be a physiological syndrome and thus the relationship between frailty and cognition is thought to be bound by a common physiological mediator (Fried et al., 2001). A number of physiological factors are common to both cognitive impairment and frailty yet the current empirical evidence for these as mechanisms remains relatively weak (e.g. Robertson et al., 2013).

As frailty is a cluster of symptoms it is probable that no single biomarker will perfectly predict the syndrome. Instead, a combination of factors likely contributes to frailty. Indeed, some suggest that a definition of frailty should include nutrition, physical ability, senses, mood, coping, social relations and social support (Gobbens, Luijkx, Wijnen-Sponselee, & Schols, 2010; Rodriguez-Manas et al., 2013). Yet the latter four are rarely, if ever, included despite increasing evidence to suggest that psychological factors such as depression play a role in the development and maintenance of the syndrome (e.g. Paulson & Lichtenberg, 2012). As psychological factors such as depression are also associated with cognitive decline (Ownby, Crocco, Acevedo, John, & Loewenstein, 2006) there may be a common psychological mechanism which underpins frailty and cognitive impairment.

Recent research has identified another psychological factor which predicts physical and cognitive function more strongly than, and independent of, depression. Older adults' self-perceptions of aging predict declines in cognition and walking speed – a key component of frailty – over two years independent of health changes and depression (Robertson, King-Kallimanis, & Kenny, 2015a; Robertson, Savva, King-Kallimanis, & Kenny, 2015b). Perceptions of aging encompass beliefs about aging including expectations, feelings of control and emotional responses to getting older. When perceptions are negative they cause declines in self-esteem, life satisfaction, self-rated health and objective cognitive and physical function (Robertson et al., 2015a; Weiss & Lang, 2012; Wurm & Benyamini, 2014; Wurm, Warner, Ziegelmann, Wolff, & Schuz, 2013). Physiological pathways including increased cardiovascular reactivity and risk of cardiovascular disease are also affected (Levy, Hausdorff, Hencke, & Wei, 2000; Levy, Zonderman, Slade, & Ferrucci, 2009).

One theory has touched on perceptions as a contributory factor in the development of frailty. Lang, Michel, and Zekry (2009) suggest that frailty is a cycle of decline in which physiological changes interact

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with psychological responses to these changes. They suggest that when some older adults experience a change – e.g. normal decline in muscle mass – they have a resultant increase in their perception of the effort involved in being physically active. This perception of effort leads to a decline in physical activity which puts them at risk of further muscle mass depletion and thus frailty. This theory could be expanded to include cognitive function as physical activity is also associated with risk of cognitive decline through both the harmful effects of sedentariness itself and a potential resulting decrease in social engagement (Robertson et al., 2013). Adults with negative perceptions of aging may therefore respond to age-related changes by withdrawing from activities which would otherwise protect against greater physical and cognitive decline.

Following from these theories we propose that older adults with negative perceptions of aging will be more likely to enter a cycle of frailty and cognitive impairment. Data from The Irish Longitudinal Study on Aging (TILDA) has previously shown that frailty is associated with poorer global cognition, executive function, memory and attention (Robertson, Savva, Coen, & Kenny, 2014). We thus sought to re-examine this relationship with the hypothesis that the association between frailty and cognitive function will only exist in adults with negative perceptions of aging.

2. Methods

2.1. Population

Data was taken from Wave 1 of TILDA, a prospective, population representative sample of community-dwelling adults aged 50+. Ethical approval was obtained and all participants provided written informed consent. Participants with a doctor's diagnosis of dementia or who were unable to personally consent to participation due to cognitive impairment were not included in the study. The study has been described in detail elsewhere (Kearney et al., 2011) but in brief 8175 participants aged 50+ were interviewed in their own homes followed by a nurse-administered health assessment.

2.2. Frailty

We used the Fried definition of frailty which is composed of five criteria: weakness, slowness, sedentariness, unintentional weight loss and exhaustion (Fried et al., 2001). Dominant hand grip strength was assessed using a dynamometer. Weak grip strength was defined as any score below the age, gender and BMI adjusted 20th percentile. Gait speed was measured as time taken to complete the Timed Up and Go task. Participants rose from a chair (seat height 46 cm), walked 3 m at a normal pace, turned, walked back to the chair and sat down (Podsiadlo & Richardson, 1991). Participants below the gender and height adjusted 20th percentile were considered to have slow gait. Physical activity was measured using the short form of the International Physical Activity Questionnaire (Hagstromer, Oja, & Sjostrom, 2006). Unintentional weight loss was assessed by the question 'In the past year have you lost 10 lb (4.5 kg) or more in weight when you were not trying to?' Exhaustion was assessed using 2 questions from the 20-item Centre for Epidemiological Studies Depression (CES-D) scale: "I could not get going" and "I felt that everything I did was an effort". A response of 'sometimes' or 'often' to either question was classified as exhaustion (Orme, Reis, & Herz, 1986). Participants with ≥3 indicators were defined as frail, ≥1 as pre-frail and 0 as robust (Fried et al., 2001).

2.3. Cognitive function

The cognitive battery included tests of global cognition, executive function, memory and attention.

Global cognition was assessed using the Mini Mental State Examination (MMSE) and Montreal Cognitive Assessment (MoCA) (Folstein, Folstein, & McHugh, 1975; Nasreddine et al., 2005). MMSE and MoCA are 30-point tests of global cognition. The MMSE includes questions assessing orientation, language, attention and memory. The MoCA has an additional assessment of executive function. There are ongoing debates about the strength of each (e.g. Aggarwal & Kean, 2010) and thus we included both.

Executive function was assessed using the visual reasoning subtest of the CAMDEX, Color Trails Test 2 and verbal fluency. For the visual reasoning test participants are asked to identify which of six objects would complete a pattern of three similar objects. In the verbal fluency test participants have 1 min to name as many words beginning with F as they can. The Color Trails Test part 1 requires participants to draw a line connecting circles numbered 1–25 in consecutive order. Part 2 requires participants to complete the same task while alternating between pink and yellow circles. Part 1 assesses visual scanning and attention while the mental flexibility and switching of part 2 involves executive function (D'Elia, 1996; Nasreddine et al., 2005; Roth et al., 1986).

Memory was assessed through the Picture Recognition and Recall subtests of the CAMDEX. Participants are shown 6 consecutive pictures of everyday objects (e.g. a lamp) and then asked to recall them. They are then shown a second series of pictures in which they have to pick the picture they previously saw from a series of similar objects (e.g. 3 different lamps). Participants were also given a list of 10 words and asked to repeat them back immediately and then five minutes later. This provided a measure of immediate and delayed memory (Roth et al., 1986; Wallace & Herzog, 1995).

Attention was assessed through the Color Trails Test 1 and the Sustained Attention to Response Task (SART) (D'Elia, 1996; Robertson, Manly, Andrade, Baddeley, & Yiend, 1997). In the fixed SART task participants were shown a computer screen which repeated a sequence of numbers from 1 to 9 for 4 min. Numbers appeared every 300 ms and participants were asked to click in response to each number except 3.

Composite scores for each domain were calculated by obtaining z-scores and combining them to create total scores for global cognition, executive function, memory and attention.

2.4. Perceptions of aging

The Brief Aging Perceptions Questionnaire (B-APQ) measure comprises Likert-scaled statements about participants' perceptions of aging (Sexton, King-Kallimanis, Morgan, & McGee, 2014). The full questionnaire has five subscales but previous work suggests that one – the *negative control and consequences* subscale – is associated with both physical and cognitive function (Robertson et al., 2015a). Participants rated their agreement with 5 statements such as 'As I get older I do not cope as well with problems that arise.' Each statement is scored on a scale of 1 to 5. The mean score across all five statements was calculated for each participant to give a total perceptions score. Higher scores indicated more negative perceptions of aging. Cronbach's alpha in this sample showed good internal reliability ($\alpha = .79$).

2.5. Covariates

Age, gender and education were self-reported with education categorized as primary, secondary or third level. Chronic conditions were ascertained by self-report of a doctor's diagnosis and were included as number of conditions. These included: joint problems, cataracts, glaucoma, age-related macular degeneration, lung disease, asthma, arthritis, osteoporosis, cancer, ulcers, liver disease, alcohol or substance abuse and chronic pain. Participants were asked to record all medications taken on a regular basis. Self-rated health was assessed with the question: "Compared to other people your age, would you say your health is…excellent, very good, good, fair or poor?" Higher scores were indicative of worse self-rated health. Depressed mood was assessed using 18 items from the 20-item CES-D scale excluding the 2