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Original article

Explaining the association between educational level and frailty in older adults: results from a 13-year longitudinal study in the Netherlands

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ABSTRACT

Purpose: The aim of this study was to examine the longitudinal association between educational level and frailty prevalence in older adults and to investigate the role of material, biomedical, behavioral, social, and mental factors in explaining this association.
Methods: Data over a period of 13 years were used from the Longitudinal Aging Study Amsterdam. The study sample consisted of older adults aged 65 years and above at baseline ($n = 1205$). Frailty was assessed using Fried's frailty criteria. A relative index of inequality was calculated for the level of education. Longitudinal logistic regression analyses based on multilevel modeling were performed.
Results: Older adults with a low educational level had higher odds of being frail compared with those with a high educational level (relative index of inequality odds ratio, 2.94; 95% confidence interval, 1.84–4.71). These differences persisted during 13 years of follow-up. Adjustment for all explanatory factors reduced the effect of educational level on frailty by 76%. Income, self-efficacy, cognitive impairment, obesity, and number of chronic diseases had the largest individual contribution in reducing the effect. Social factors had no substantial contribution.
Conclusions: Our findings highlight the need for a multidimensional approach in developing interventions aimed at reducing frailty, especially in lower educated groups.

Introduction

Frailty in older adults is defined as a state of increased vulnerability toward adverse health outcomes, resulting from the loss of reserve capacity in multiple physiological systems [1,2]. In aging societies, the growing number of frail older adults is seen as a major challenge for health care systems [3]. However, it is known that frailty affects some groups in the older population more than others. Recently, the role of socioeconomic position (SEP) in the distribution of frailty has received increased attention. Several studies have shown that older adults with low SEP are more often frail than those with high SEP [4–9].

An important indicator of SEP in older adults is educational level. It is the only indicator that is stable after young adulthood and is causally before other socioeconomic indicators such as occupational status and income [10]. So far, the relationship between educational level and frailty has not been studied extensively during later life. Most studies on the association between SEP and frailty that included educational level were based on cross-sectional data [7–9]. Therefore, it remains unknown how frailty changes over time in groups with different educational levels. In addition, little attention has been devoted to the factors that may account for educational differences in frailty. To study and explain the association between educational level and frailty throughout later life, longitudinal data on frailty and its multidimensional determinants are needed. The Longitudinal Aging Study Amsterdam (LASA) [11] is among the few cohort studies that includes such data.

Explanations for educational differences in frailty may be sought in factors that accelerate the physical aging process, and which are known to play a role in the relationship between educational level

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and other health characteristics, such as material, biomedical, behavioral, and psychosocial factors [12–14]. Material disadvantage (e.g., low income) is more common among the lower educated and may have effects on health, for example, through lack of access to healthy food and living in deprived neighborhoods [6,15–17]. In addition, several studies have shown that biomedical factors, including chronic diseases and biomarkers, varied according to both educational level and frailty status [2,18–21]. Behavioral factors may also be important in explaining the link between educational level and frailty, because people with low educational level generally have less healthy lifestyles, resulting, for example, in higher obesity prevalence rates [12,22,23]. Finally, psychosocial factors have been shown to be linked to both educational level and various health outcomes [14,24,25]. Psychosocial factors consist of mental factors, for instance depression and control beliefs, and social factors, such as personal network characteristics. People with low educational level are more often exposed to environmental stressors, but generally have fewer psychosocial resources available [26]. These potentially mediating factors are likely to be associated with one another in causal pathways that link educational level, on the upstream end, to frailty on the downstream end of the causal chain. Therefore, thorough investigation of explanations for educational differences in frailty should incorporate as much information on these factors as possible to account for these interrelationships.

Using data covering a period of 13 years from the LASA study, we examined the longitudinal association between educational level and frailty prevalence in older adults. Furthermore, we investigated to what extent material, biomedical, behavioral, social, and mental factors account for educational differences in frailty.

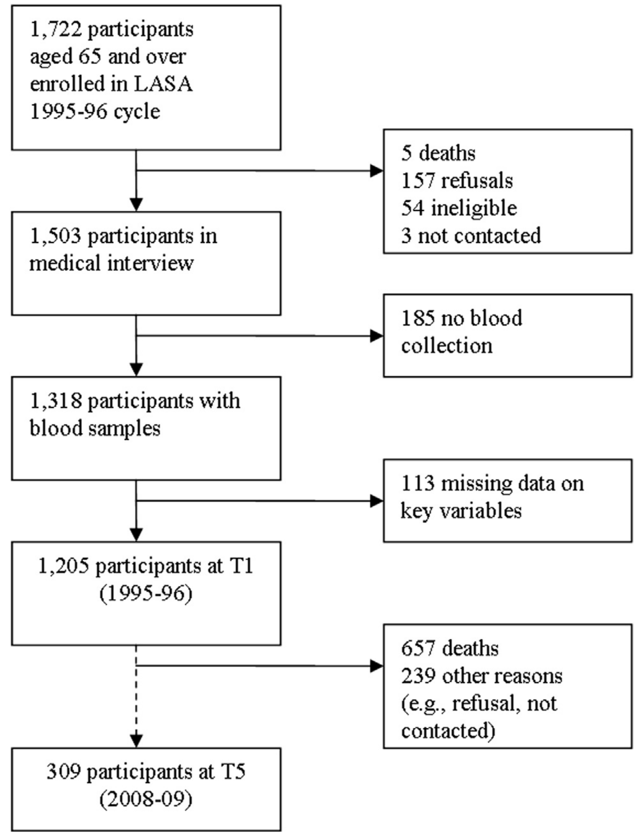

Fig. 1. Flowchart of the study population.

Methods

Study population

We used data from LASA, an ongoing study on physical, emotional, cognitive, and social functioning of older adults in the Netherlands. Details on the sampling and data collection of LASA have been described elsewhere [11]. In summary, a nationally representative survey was conducted in 1992–1993 among 3107 respondents between the age of 55 and 85 years. Follow-up measurements are collected approximately every 3 years. Data are collected in a face-to-face main interview and in a separate medical interview (including clinical tests) in the respondent's home by trained interviewers. In 1995–1996, the medical interview was followed by the collection of blood samples. The study received approval by the medical ethics committee of the VU University medical center. Signed informed consent was obtained from all study participants.

For the present study, we used data from five consecutive measurement waves over a period of 13 years (T1 = 1995–1996; T2 = 1998–1999; T3 = 2001–2002; T4 = 2005–2006; and T5 = 2008–2009). The sample consisted of respondents aged 65 years and older who participated in the main interview of T1 and completed a medical interview (Fig. 1). Of 1722 respondents who were invited for the medical interview, 1503 participated (87.3%). Blood samples were available for 1318 respondents (87.7%). Participants were included in the analyses if data on educational level (no missings), frailty (70 missings), and explanatory factors (43 missings) on at least the baseline measurement were available. This resulted in a final dataset of 1205 respondents, who provided 3515 observations ($n = 1205$ at T1; $n = 909$ at T2; $n = 659$ at T3; $n = 433$ at T4; and $n = 309$ at T5). Nonresponders at T1 were older, were more often women, had a lower educational level and had more chronic diseases (Appendix 1). Respondents for whom no follow-up data were available ($n = 273$) were older, more often men, more often frail, had a lower educational level and had more chronic diseases (Appendix 2).

Measures

At baseline, respondents were asked to state their highest level of education on a nine-category scale (see Statistical analysis section).

Frailty was assessed with the criteria based on the frailty phenotype [2], which include weight loss, weak grip strength, exhaustion, slow gait, and low physical activity. Our measures and cut-offs were identical or similar to those of Fried et al. [2]. If measures were not identical, the lowest quintile approach was used [27], as described in the following. Weight loss was present if a participant lost 5% or more body weight over 3-year follow-up [20]. Body weight was measured without clothes and shoes using a calibrated bathroom scale. Grip strength was assessed with a handheld dynamometer (the sum of the highest values of two measurements on each hand). Original cut-off points stratified by sex and body mass index were applied to indicate weak grip strength [2]. Exhaustion was measured using two items of the Center for Epidemiologic Studies Depression Scale (CES-D) [2,28]. Gait speed was assessed by recording the time taken (in seconds) to walk 3 meter, turn around, and walk 3 meter back as quickly as possible [29]. Slow gait was defined by the lowest quintile, stratified by sex and height. Finally, physical activity was assessed using the LASA Physical Activity Questionnaire [30]. Low physical activity was defined by the lowest quintile of average time spent on physical activities per day during 2 weeks before the interview. Cut-off points derived from data at T1 were used across all waves.