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The impact of multidimensional frailty on dependency in activities of daily living and the moderating effects of protective factors



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ABSTRACT

Background: Dependency in activities of daily living (ADL) might be caused by multidimensional frailty. Prevention is important as ADL dependency might threaten the ability to age in place. Therefore, this study aimed to assess whether protective factors, derived from a systematic literature review, moderate the relationship between multidimensional frailty and ADL dependency, and whether this differs across age groups. **Methods:** A longitudinal study with a follow-up after 24 months was conducted among 1027 community-dwelling people aged ≥ 65 years. Multidimensional frailty was measured with the Tilburg Frailty Indicator, and ADL dependency with the ADL subscale from the Groningen Activity Restriction Scale. Other measures included socio-demographic characteristics and seven protective factors against ADL dependency, such as physical activity and non-smoking. Logistic regression analyses with interaction terms were conducted.

Results: Frail older people had a twofold risk of developing ADL dependency after 24 months in comparison to non-frail older people (OR = 2.12, 95% CI = 1.45–3.00). The selected protective factors against ADL dependency did not significantly moderate this relationship. Nonetheless, higher levels of physical activity decreased the risk of becoming ADL dependent (OR = 0.67, 95% CI = 0.46–0.98), as well as having sufficient financial resources (OR = 0.49, 95% CI = 0.35–0.71).

Conclusion: Multidimensional frail older people have a higher risk of developing ADL dependency. The studied protective factors against ADL dependency did not significantly moderate this relationship.

1. Introduction

With the aging population, frailty has become an increasingly relevant construct. However, consensus about the definition is lacking. It is defined as a merely physical construct (Fried et al., 2001), and a multidimensional construct, including physical, psychological, social, and environmental aspects (Gobbens et al., 2010; De Witte et al., 2013; Rockwood & Mitnitski, 2007). Prevalence rates vary accordingly (Collard et al., 2012). Nonetheless, it is well-known that frailty is associated with adverse outcomes, of which one is disability in activities of daily living (ADL) (Coelho et al., 2015). Most older people desire to age in place (De Witte et al., 2012). However, “the ability to perform functions related to daily living” is needed to remain independently living in the community (WHO, 2001), and thus is ADL disability likely

to diminish the ability to age in place. Indeed, negative consequences of ADL disability may be hospitalization (Gill et al., 1998), mortality (Stineman et al., 2012), and lower levels of quality of life (Unsar et al., 2015), amongst others. Therefore, it is important to prevent (frail) older people from becoming disabled in ADL.

Although multiple studies on physical frailty in relation to ADL disability have been performed (Vermeulen et al., 2011; for an overview), literature on multidimensional frailty and ADL disability is relatively sparse. Nonetheless, recently it has been reported that social frailty is associated with an increased risk of ADL disability, irrespective of physical frailty (Teo et al., 2017). In addition, Mulasso, Roppolo, Giannotta, and Rabaglietti (2016) showed that both physical frailty and psychosocial factors influence the level of ADL disability. Given these findings, it seems important to investigate ADL disability as an adverse

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outcome in multidimensional frailty. However, instead of merely focusing on the risk of ADL disability, it is also of value to identify protective factors. In this way, interventions can concentrate on factors that may prevent frail older people from becoming disabled in ADL, which makes it possible to intervene in a more positive way, as preferred by older people (Lette et al., 2015).

In their recent systematic review, van der Vorst et al. (2016) identified several protective factors against ADL disability in community-dwelling people aged ≥ 75 . With regards to intervening factors, strong evidence was found for higher levels of physical activity as a protective factor against developing ADL disability (Avlund, Damsgaard, et al., 2002; Avlund, Due et al., 2002; Landi et al., 2007; Shah, Buchman, Leurgans, Boyle, & Bennet, 2012; Stessman et al., 2009; Sun et al., 2009). In addition, not smoking was found to be protective in one study (Sun et al., 2009). Regarding protective factors that could serve detection purposes only, being married was found to be a protective factor in multiple studies (Black & Rush, 2002; Gu & Yi, 2004; Jiang et al., 2002). In addition, being from a minor ethnicity (Black & Rush, 2002; Freedman et al., 2008; Gu & Yi, 2004; Moody-Ayers et al., 2005), living in a rural area (Sun et al., 2009), and having sufficient financial resources (Gu & Yi, 2004) were found to be potential protective factors. Lastly, and perhaps surprisingly, the review by van der Vorst et al. (2016) identified hypertension as a potential protective factor. This was reported in one of the included studies, conducted in people aged ≥ 85 years (Sabayan et al., 2012).

However, it is unclear whether these factors are still protective in community-dwelling older people with multidimensional frailty. For clinical practice, it is particularly important to know which factors moderate the effect of frailty on ADL disability, and which frail older people have a reduced risk of developing ADL disability. Herewith, it is necessary to take into account the possible differences across age groups, as van der Vorst et al. (2016) mentioned that predictive factors for developing ADL disability were likely to differ across age groups. While some studies focus on increasing levels of ADL disability as an adverse outcome, this study focuses on ADL dependency (i.e. whether or not people could independently perform ADL) – as this seems the biggest threat to remaining living independently at home (WHO, 2001). We aimed to investigate the following: (i) the main effect of multidimensional frailty on ADL dependency (arrow a, Fig. 1); (ii) whether this relationship is moderated by the aforementioned protective factors (arrow b, Fig. 1); (iii) the main effects of the selected protective factors on ADL dependency (arrow c, Fig. 1); and (iv) if there are differences across age groups (for all relationships). It is hypothesized that (i) multidimensional frailty is associated with an increased risk of ADL dependency; and (ii) older people with protective factors against ADL dependency are less likely to become dependent on others, even when they suffer from multidimensional frailty.

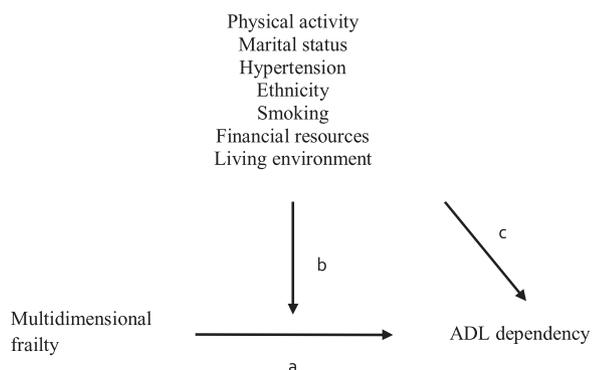


Fig. 1. Hypothesized model with seven protective factors as moderators.

2. Materials and methods

2.1. Study design and participants

Data used in this study was from a longitudinal study conducted by the Community Health Services Limburg in collaboration with Zuyd University of Applied Sciences (Heerlen, the Netherlands). The study was conducted in 2420 community-dwelling people aged ≥ 65 years. All participants were pre-frail or frail, according to Fried's criteria (Fried et al., 2001), and lived in the southern part of the Netherlands. The medical ethic committee of Zuyderland and Zuyd University of Applied Sciences approved the study (METC Z, 12-N-129), and informed consent was obtained from all participants. A more extensive description of the study has been published elsewhere (Op het Veld et al., 2017; Terstege et al., 2012).

For the current study, participants were included when they completed both the frailty and ADL measure at baseline, and reported no dependency in ADL at baseline (i.e. they were not dependent on others for 11 selected ADL from the Groningen Activity Restriction Scale (GARS; Kempen et al., 1996; Suurmeijer et al., 1994), which is described in more detail in Measurements section 2.2.1.2, below). This resulted in a sample of 1027 participants.

2.2. Measurements

2.2.1. Independent and outcome measure

2.2.1.1. Frailty. Frailty, as an independent measure, was assessed at baseline with the Tilburg Frailty Indicator (TFI; Gobbens et al., 2010). This 15-item questionnaire includes physical (8 items: physical health, weight loss, walking difficulties, balance, hearing, vision, strength in hands, and physical tiredness), social (3 items: living alone, miss having people around, and receiving support from others), and psychological frailty (4 items: cognition, depression, anxiety, and coping) (Gobbens et al., 2010). The total score ranges from 0 to 15, with higher scores indicating a higher level of frailty. A cut-off ≥ 5 is used to distinguish frail from non-frail respondents (Gobbens et al., 2010).

2.2.1.2. Dependency in activities of daily living. ADL dependency, as the outcome measure, was assessed after 24 months with the ADL subscale from the GARS (Kempen et al., 1996; Suurmeijer et al., 1994), which is a valid and reliable instrument (Suurmeijer et al., 1994). The ADL subscale includes 11 items measuring, amongst others, bathing and transferring (e.g. 'Can you, fully independently, wash and dry your whole body?', and 'Can you, fully independently, get around in the house (if necessary with a cane)?'). The answer options are measured on the following 4-point scale: 1 = 'Yes, I can do it fully independently without any difficulty', 2 = 'Yes, I can do it fully independently but with some difficulty', 3 = 'Yes, I can do it fully independently but with great difficulty', and 4 = 'No, I cannot do it fully independently; I can only do it with someone's help'. For the current study, scores on the ADL subscale from the GARS were dichotomized into two groups (1 = yes; 0 = no). Those needing help with one or more of the 11 ADL activities were defined as ADL dependent (i.e. those who scored answer option 4 on ≥ 1 ADL received a score of 1 on dependency). Those who were able to conduct all ADL activities independently were defined as non-dependent (i.e. without needing to rely on someone else; answer option 1–3 on all items and score 0 on dependency) (Kempen et al., 2012). People who were not dependent on others for performing all ADL at baseline (i.e. answer option 1–3 on all items) were included.

2.2.2. Protective factors

2.2.2.1. Physical activity. For physical activity, three main categories were assessed at baseline: vigorous household activities (e.g. mopping the floor), leisure activities (e.g. walking and riding a bike), and sport activities (e.g. running and fitness). For each activity, participants had to report how many days per week they performed the activity, and for

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