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

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.
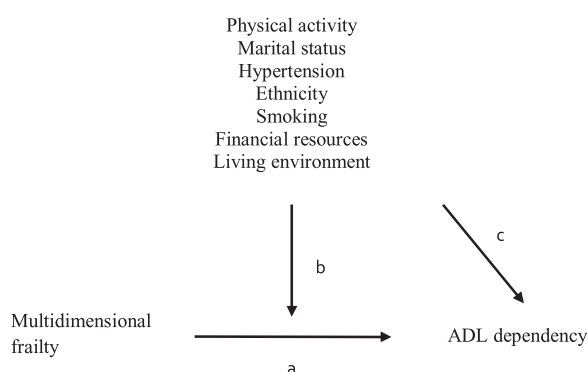

Fig. 1. Hypothesized model with seven protective factors as moderators.

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; Terstegge 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

how many hours per day. People who were involved in these activities for at least 30 minutes per day on 5 or more days per week were categorized as physically active (Broekhuizen et al., 2016).

2.2.2.2. Marital status.
At baseline, participants were asked to define their relationship status in one of the following terms: currently married, in a registered partnership, cohabiting, never married, divorced, or widowed. Answers were dichotomized into currently married (includes having a registered partnership) versus not married.

2.2.2.3. Hypertension.
Self-reported overall blood pressure was measured at baseline with the following question: 'Did you have a high blood pressure in the past 12 months?', which was answered with yes or no.

2.2.2.4. Ethnicity.
As participants from minor ethnicity groups were sparse (n = 5; 0.5%), people who were not born in the Netherlands were compared to people who were born in the Netherlands.

2.2.2.5. Smoking behavior.
At baseline, participants were asked whether they currently smoked or if they had ever smoked. Answers were divided in those who currently smoked compared to those who did not.

2.2.2.6. Financial resources.
Respondents were asked, 'Did you have any trouble making ends meet with your income in the last 12 months?' to which they could answer on a 4-point scale ranging from 'no, no difficulties at all' to 'yes, great difficulties'. Answers were separated into those with no difficulties at all versus people with at least some difficulties, including having to take care of expenses.

2.2.2.7. Living environment.
Statistics Netherlands (CBS) labels each municipality in the Netherlands with one of the following categories: (a) very strongly urbanized; (b) highly urbanized; (c) moderately urbanized; (d) not having a particularly urban character; or (e) not urbanized at all (CBS, 2015). These categories were dichotomized into urban (categories a–c) and rural (categories d–e).

2.2.3. Sample characteristics
The following sociodemographic characteristics were assessed at baseline: age, gender, education level, marital status, and living situation. In addition, the level of ADL disability was measured by means of the ADL subscale from the GARS (Kempen et al., 1996; Suurmeijer et al., 1994) at baseline. As we excluded people with ADL dependency at baseline (i.e. GARS answer option 4 on ≥1 item), baseline scores theoretically ranged from 11 to 33 (rather than 11–44), with higher scores indicating higher levels of disability.

2.3. Statistical analysis

Firstly, to assess selection bias due to loss to follow up, people who did and did not complete the ADL subscale after 24 months were compared using Mann-Whitney and Chi-Square tests. Secondly, descriptive statistics were calculated to describe the study sample regarding socio-demographic characteristics, frailty level, ADL disability level, and the presence of protective factors. Thirdly, people aged 65–74 and ≥75 were compared for each characteristic using Mann-Whitney and Chi-Square tests, as well as participants who did and did not develop ADL dependency after 24 months. Fourthly, logistic regression analyses were performed to investigate the following: (i) the main effect of multidimensional frailty at baseline on ADL dependency after 24 months; (ii) if this association can be influenced by each protective factor, by adding interaction terms; (iii) the main effect of each protective factor on ADL dependency; and (iv) if associations were influenced by age, by adding interaction terms. Regression analyses were adjusted for age and gender, and were conducted separately for those aged 65–74 and ≥75. In the case of significant interaction effects, regression analyses were conducted separately to be able to assess differences in odds ratio (OR) per group. Analyses were performed in SPSS Statistics for Windows, version 24.0 (Armonk, NY: IBM Corp). Statistical significance was set at $p < 0.05$.

3. Results

Out of 1027 participants, 859 completed the ADL measure after 24 months. Those who completed the measure differed significantly at baseline from those who did not (*n* = 168), in terms of age (mean age 73.9 (SD = 5.9) compared to 75.6 (SD = 6.8); p = .003), and level of ADL disability (mean score 13.3 (SD = 3.0) compared to 14.6 (SD = 4.3); p ≤ .001). In addition, those who completed the measure were less likely to be frail (50.1% versus 64.9%; p ≤ .001), more likely to have sufficient financial resources (45.8% versus 38.7%; p = .015), and more likely to be physically active at baseline (39.3% versus 27.9%; p = .008) (findings not tabulated).

Table 1
Baseline sample characteristics for the entire population, as well as separately for age groups and ADL outcome.

	Total group (n = 1027)	By age at baseline(T0) (n = 1027)			By ADL outcome after 24 months (T24) (n = 859)		
		65–74 (*n* = 515)	**≥75** (*n* = 512)	p-value	**Non–dependent** (*n* = 673)	**Dependent** (*n* = 186)	p-value
General							
Mean age (SD)	74.2 (6.1)	69.1 (2.9)	79.3 (3.8)	≤.001	73.3 (5.6)	76.0 (6.3)	.002
Female gender (%)	55.1	60.4	49.8	≤.001	55.0	60.2	.203
Frailty and level of ADL disability at baseline							
Frail (%)	52.5	45.4	59.6	≤.001	45.5	66.7	≤.001
Level of ADL disability (mean; SD)	13.5 (3.3)	13.0 (2.9)	14.1 (3.5)	≤.001	12.8 (2.6)	25.3 (3.6)	≤.001
Protective factors (%)							
Physically active	37.6	44.4	30.3	≤.001	42.1	29.3	.002
Being married	65,5	73.9	57.0	≤.001	69.6	55.7	≤.001
Hypertension	43.6	41.9	45.3	.285	42.3	47.7	.198
Minor ethnicity	20.7	20.4	21.1	.780	19.8	20.4	.840
Non–smoking	85.6	81,3	89.9	≤.001	86.5	85.7	.794
Sufficient financial resources	44.6	41.4	47.9	.036	49.3	33.0	≤.001
Rural living environment	54.5	53.8	55.3	.632	55.9	54.3	.703

Note. ADL = activities of daily living. Mean scores for level of ADL disability are reported (theoretical range 11–33; higher scores indicate more severe levels of ADL disability).

Table 2

Association between frailty and ADL dependency, and interaction terms with each protective factor for the total sample and per age group.

	ADL dependency	ADL dependency in those aged 65–74	ADL dependency in those aged ≥75
OR of frailty on ADL dependency (95% CI)			
Frailty (frail versus non-frail)	**2.12 (1.50–3.00)**	1.62 (0.98–2.68)	**2.70 (1.64–4.42)**
Interaction terms between frailty and each protective factor (p–values)			
Physical activity	.139	.331	.505
Marital status	.974	.942	.757
Hypertension	.459	.948	.270
Being from a minor ethnicity	.849	.901	.952
Non–smoking	.563	.402	.998
Sufficient financial resources	.802	.540	.551
Rural living environment	.912	.842	.769

Note. ADL = activities of daily living. Models were adjusted for age and gender.

3.1. Sample characteristics

Socio-demographic characteristics of the participants are shown in Table 1. Their mean age was 74.2 years (range = 65–93). 55.1% were female, 52.5% suffered from multidimensional frailty, and 21.7% (n = 186) of the older people who completed the follow-up measure (n = 859) developed ADL dependency after 24 months.

People aged 65–74 were less likely to be frail at baseline, had lower levels of ADL disability at baseline, and were more likely to be physically active, married, and have sufficient financial resources compared to people aged ≥75. The same applied to people who did not develop ADL dependency after 24 months compared to those who did. In addition, people aged 65–74 were mostly female and less likely to smoke, compared to people aged ≥75. Lastly, people who did not develop ADL dependency after 24 months were younger compared to those who did.

3.2. Frailty and protective factors in relation to ADL dependency

Table 2 shows the results of the logistic regression analyses. Frail older people had a twofold increased risk of ADL dependency compared to non-frail older people (OR = 2.12, 95% CI = 1.50–3.00). This risk seemed slightly higher in those aged ≥75 (OR = 2.70, 95% CI = 1.64–4.42) compared to those aged 65–74 (OR = 1.62, 95% CI = 0.98–2.68). However, this observed difference was not statistically significant (p-value interaction term = .151, not tabulated). Interaction terms between frailty and the protective factors were not statistically significant in the entire sample, or in the two age groups.

When assessing the main effects of each protective factor, it was found that higher levels of physical activity (OR = 0.67, 95% CI = 0.46–0.98), and having sufficient financial resources (OR = 0.49, 95% CI = 0.35–0.71) were protective against developing ADL dependency (Table 3). The impact of physical activity on ADL dependency did not differ significantly between the two age groups, although the impact of physical activity on ADL dependency only remained statistically significant in those aged ≥75 (OR = 0.48, 95% CI = 0.27–0.85). Having sufficient financial resources only remained a significant protective factor in those aged 65–74 years (OR = 0.31, 95% CI = 0.17–0.56), although there was only found a trend while comparing the age groups (p-value interaction term = .059). Lastly, there was a significant interaction effect regarding marital status. Nonetheless, findings were not statistically significant in both age groups: OR = 1.18 (95% CI = 0.66–2.14) in those aged 65–74, compared to OR = 0.62 (95% CI = 0.38–1.01) in those aged ≥75.

4. Discussion

The aim of this longitudinal study was to assess whether factors that have been found to be protective against ADL disability in previous studies (van der Vorst et al., 2016, for an overview), moderate the relationship between multidimensional frailty and ADL dependency. This study shows that older people who suffer from multidimensional frailty have an increased risk of developing ADL dependency, which is in line with previous research (Coelho et al., 2015). However, no moderating effects were found for the seven factors that have previously been shown to decrease the risk of developing ADL disability in community-dwelling people aged ≥75. Nonetheless, higher levels of physical activity were protective against future ADL dependency, as well as having sufficient financial resources.

Although all the factors included in this study were found to be protective against ADL disability in one or more previous studies (van der Vorst et al., 2016), these factors were not yet studied as moderating factors in the relationship between multidimensional frailty and ADL dependency. Nonetheless, income has been found to moderate the effect of physical frailty on ADL disability (Op het Veld et al., 2017). However, while we found that people with sufficient financial resources were less likely to become dependent in ADL after 24 months, the previous study showed that physically frail older people with higher levels of income were more likely to develop ADL disability compared to physically frail older people with lower income levels (Op het Veld et al., 2017). Our findings seem contradictory; however, while Op het Veld et al. (2017) assessed the disposable income, we assessed whether people had sufficient financial resources, which differs on a conceptual level (i.e. we asked if they are able to make ends meet). In addition, Op het Veld et al. (2017) only took physical frailty into account, while we followed a multidimensional approach.

Although we have not found physical activity to have an interaction effect, we found a main effect of physical activity on ADL dependency, irrespective of the fact that all participants were at least pre-frail, according to Fried's criteria (Fried et al., 2001). This might seem surprising, as presumably all participants were physically limited to some extent (Fried et al., 2001). However, it could be hypothesized that physical activity is more influential than physical frailty with regards to ADL dependency. In this study, the protective effect of physical activity does not significantly differ across age groups, which is comparable with previous research (Landi et al., 2007).

Regarding marital status, no main effect was found. However, there was a significant interaction effect of age, and there was found a trend for being married as a protective factor against future ADL dependency in those aged ≥75.Thus, marital status seems to have a stronger effect in older age, which is in line with the findings of the systematic literature review by van der Vorst et al. (2016). This might also be partially related to physical activity, as it is known that women who lose their spouse often become less active, as they do not feel obliged to perform certain activities any longer (Avlund, Damsgaard, et al., 2002; Avlund, Due et al., 2002; Due, 1993). Therefore, older people who are married may be more active, i.e. to take care of each other.

Nonetheless, there was no interaction or main effect for having hypertension, being from a minor ethnicity, non-smoking and living in a rural area. This might be due to the specific sample, i.e. physically (pre)frail older people. In addition, while we only included people without ADL dependency at baseline, most of the studies investigating the aforementioned factors did include people with ADL dependency. Moreover, we included people aged ≥65, while all the studies upon which the protective were selected were conducted with participants aged ≥75. However, other factors may have also influenced our findings. We did not found an effect of hypertension. While Sabayan et al. (2012) conducted their study in the oldest old (i.e. people aged ≥85), used an objective measure, and specified different blood pressure types; we measured it with only one question, which seems less reliable. In addition, the previous studies (Black & Rush, 2002; Freedman et al.,

Table 3

Main effects of each protective factor on ADL dependency for the total sample and per age group, and interaction terms between each protective factor and the age groups.

	ADL dependency	ADL dependency in those aged 65–74	ADL dependency in those aged ≥75
	OR of each protective factor on ADL dependency (95% CI)		
High levels of physical activity	0.67 (0.46–0.98)	0.88 (0.53–1.49)	0.48 (0.27–0.85)
Interaction (p-value)		.105	
Married	0.81 (0.56–1.17)	1.18 (0.66–2.14)	0.62 (0.38–1.01)
Interaction (p-value)		.047	
Hypertension	1.13 (0.80–1.59)	1.11 (0.66–1.86)	1.11 (0.68–1.79)
Interaction (p-value)		.946	
Being from a minor ethnicity	1.09 (0.72–1.66)	1.17 (0.64–2.14)	1.02 (0.57–1.82)
Interaction (p-value)		.719	
Non–smoking	0.80 (0.49–1.31)	0.88 (0.46–1.68)	0.72 (0.34–1.54)
Interaction (p-value)		.702	
Sufficient financial resources	0.49 (0.35–0.71)	0.31 (0.17–0.56)	0.67 (0.42–1.07)
Interaction (p-value)		.059	
Rural living environment	0.95 (0.68–1.33)	0.95 (0.58–1.56)	0.98 (0.62–1.56)
Interaction (p-value)		.945	

Note. ADL = activities of daily living. Models were adjusted for age, gender and frailty.

2008; Gu & Yi, 2004, Moody-Ayers et al., 2005) assessed whether people belonged to a minor ethnicity or not, however only 0.5% of our participants belonged to a minor ethnicity. Therefore, we compared people with and without a migration background, which is likely to have influenced our results. Lastly, while we did not found an effect of living environment, Sun et al. (2009) argued that the protective effect of living in a rural area could be due to the fact that these people have to walk more to perform activities such as running errands. While differences between rural and urban areas occur to a lesser extent in the Netherlands, their argument is in line with our finding that physical activity is protective against ADL dependency.

4.1. Strengths and limitations

This study has several strengths. Research on multidimensional frailty and ADL dependency is relatively sparse, as is research on moderating effects. This is the first study to empirically verify all the factors that were previously found to be protective against ADL disability (van der Vorst et al., 2016, for an overview) in one study sample. However, some limitations should also be mentioned. Firstly, a relatively large number of ADL measurements were missing after 24 months. Non-completers were more likely to be frail, less likely to have sufficient financial resources, and less likely to be physically active at baseline. All these factors were found to be associated with an increased risk of developing ADL dependency, and therefore the missing data might have influenced the strength of our findings. Secondly, the generalizability of our findings is limited to community-dwelling physically (pre)frail older people according to Fried's phenotype of frailty (Fried et al., 2001). Moreover, a consequence of this selection criterion might be that older people with only psychological and social frailty were excluded at baseline, and people who were multidimensional frail according to the TFI (Gobbens et al., 2010) might therefore still have been primarily physically frail. Thirdly, our measures of hypertension (self-reported), and migration background (rather than ethnicity) were less suitable.

4.2. Implications for clinical practice and research

Even in a physically (pre)frail population, physical activity and financial resources are protective against developing ADL dependency. Although it may not always be possible to help people financially, an active lifestyle can be promoted, for example, by supporting household chores and walking. In addition, age-friendly cities, with places that enable older people to perform leisure activities, might support preventing older people from becoming dependent in ADL (WHO, 2016). Subsequently, this might give them the opportunity to be involved in

social interactions. However, early detection and prevention of multidimensional frailty are important as well, particularly because physical activity, financial resources, and being married are no longer protective when a person has multidimensional frailty. Therefore, future research, clinical practice, and policy should focus on prevention strategies to prevent older people from becoming (pre)frail.

Future research could specify the moderating effect of the protective factors for each domain of multidimensional frailty, as some factors did have a protective effect in this physically (pre)frail population. In addition, factors that have been found to be protective against ADL disability in community-dwelling people aged ≥65, such as performing volunteer or paid work (Luoh & Herzog, 2002), and positive affect (Diaz-Ramos et al., 2012), should be taken into account.

4.3. Conclusion

People who suffer from multidimensional frailty have an increased risk of developing ADL dependency compared to people who are not frail. This relationship cannot be moderated by physical activity, marital status, hypertension, ethnicity, (non-)smoking, financial resources, and living environment. However, even in physically (pre)frail older people, physical activity was found to be protective against developing ADL dependency, as was having sufficient financial resources in people aged 65–74, and being married in people aged ≥75.

Declarations of interest

None.

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