

## The Social Environment's Relationship With Frailty

Duppen, Daan; Van der Elst, Michael C.J.; Dury, Sarah; Lambotte, Deborah Françoise; De Donder, Liesbeth

*Published in:*  
Journal of Applied Gerontology

*DOI:*  
[10.1177/0733464816688310](https://doi.org/10.1177/0733464816688310)

*Publication date:*  
2019

*Document Version:*  
Accepted author manuscript

[Link to publication](#)

*Citation for published version (APA):*

Duppen, D., Van der Elst, M. C. J., Dury, S., Lambotte, D. F., & De Donder, L. (2019). The Social Environment's Relationship With Frailty: Evidence From Existing Studies. *Journal of Applied Gerontology*, 38(1), 3-26.  
<https://doi.org/10.1177/0733464816688310>

### Copyright

No part of this publication may be reproduced or transmitted in any form, without the prior written permission of the author(s) or other rights holders to whom publication rights have been transferred, unless permitted by a license attached to the publication (a Creative Commons license or other), or unless exceptions to copyright law apply.

### Take down policy

If you believe that this document infringes your copyright or other rights, please contact [openaccess@vub.be](mailto:openaccess@vub.be), with details of the nature of the infringement. We will investigate the claim and if justified, we will take the appropriate steps.

## Title page

### Manuscript title: The social environment's relationship with frailty: evidence from existing studies

Daan Duppen<sup>1</sup>, Michaël C.J. Van der Elst<sup>2</sup>, Sarah Dury<sup>1</sup>, Deborah Lambotte<sup>1</sup>, Liesbeth De Donder<sup>1</sup>, and the D-SCOPE consortium<sup>3</sup>

<sup>1</sup> Faculty of Psychology and Educational Sciences, Vrije Universiteit Brussel, Belgium

<sup>2</sup> Faculty of Medicine, Katholieke Universiteit Leuven, Belgium

<sup>3</sup> Details of the D-SCOPE consortium is given in the acknowledgment section.

### Corresponding author

Daan Duppen

[Daan.Duppen@vub.ac.be](mailto:Daan.Duppen@vub.ac.be)

Tel: +32499.111.774

Vrije Universiteit Brussel, Faculty of Psychology and Educational Sciences, Department of Adult Educational Sciences, Pleinlaan 2 - 1050 Brussels Belgium

### Acknowledgments

This study was supported by a grant from the Flemish government agency for Innovation by Science and Technology (IWT-140027 SBO). Furthermore, we would like to acknowledge Dr C. Eost-Telling from Chester University for her valuable and critical feedback.

The D-SCOPE consortium is an international research consortium and is composed of researcher from Vrije Universiteit Brussel, Belgium (dr. A.-S. Smetcoren, dr. S. Dury, prof. dr. L. De Donder, dr. N. De Witte, prof. dr. E. Dierckx, D. Lambotte, B. Fret, D. Duppen, prof. dr. M. Kardol, prof. dr. D. Verté); College University Ghent, Belgium (L. Hoeyberghe, dr. N. De Witte); Universiteit Antwerpen, Belgium (E. De Roeck, prof. dr. S. Engelborghs, prof. dr. P.P. Dedeyn); Katholieke Universiteit Leuven, Belgium (M. Van der Elst, prof. dr. J. De Lepeleire, prof. dr. B. Schoenmakers) and Maastricht University, The Netherlands (A. van der Vorst, dr. R. Zijlstra, prof. dr. G Kempen, prof. dr. J. Schols)

### Please cite as:

Duppen, D., Van der Elst, M. C., Dury, S., Lambotte, D., De Donder, L., & D-SCOPE. (2019). The social environment's relationship with frailty: Evidence from existing studies. *Journal of Applied Gerontology*, 38(1), 3-26

## **Manuscript: The social environment's relationship with frailty: evidence from existing studies**

### **Abstract**

Increasingly, policy-makers assume that informal networks will provide care for frail older people. While the literature has mainly discussed the role of the family, broader social networks are also considered to be important. However, these social networks can diminish in later life. This systematic review investigates whether the social environment increases the risk of frailty or helps to prevent it. Findings from 15 original studies were classified using five different factors, which denoted five dimensions of the social environment: social networks (i), social support (ii), social participation (iii), subjective neighbourhood experience (iv), and socio-economic neighbourhood characteristics (v). The discussion highlights that the social environment and frailty are indeed related and how the neighbourhood dimensions and social participation had more consistent results than social support and social networks. Conclusively, recommendations are formulated to contemplate all dimensions of the social environment for further research examining frailty and community care.

**Keywords:** frailty, ageing in place, social environment, later life, systematic review

### **Introduction**

The ageing in place concept refers to the idea that most older people prefer to stay in their local community as long as possible (Björnsdóttir, Ceci & Purkis, 2015; Fänge, Oswald & Clemson, 2012). Ageing in the right place extends the concept that the right place to age can either be continuing to live in the same home yet also moving to a home that is more adapted to their needs while maintaining vital connections with their community, friends and family (Beard *et al.*, 2016; WHO, 2015). This remains the case even when older people become frail and have increasing care needs (Wiles, Leibing, Guberman, Reeve & Allen, 2011). Despite the lack of consensus on a definition or the conceptualisation of frailty, most researchers define frailty as a biophysical syndrome (Fried *et al.*, 2001) with underlying physical problems (Strawbridge, Shema, Balfour, Higby & Kaplan, 1998) or an accumulation of deficits (Rockwood, Mitnitski, Song, Steen & Skoog, 2006). Some scholars have criticised this unilateral biomedical approach to frailty and widened the definition to include the following frailty dimensions: psychological (Monteserin *et al.*, 2010), social (Gobbens *et al.*, 2010), cognitive (Puts, Lips & Deeg, 2005) and environmental factors (De Witte *et al.*, 2013).

Preventing frailty is vital in order to avoid associated risks, such as institutionalisation (Rockwood *et al.*, 2006), poor quality of life (Masel, Graham, Reistetter, Markides & Ottenbacher, 2009), and burgeoning public sector expenditure (Bergman, Béland & Perrault, 2002). For example, simple in-house adaptations can keep older people self-reliant. Additionally, new techniques of specialised healthcare (e.g. peritoneal dialysis at home) have been adopted by homecare services to reduce hospital visits (Findlay & Isles, 2015), and recent innovations such as eHealth and mobile health applications have, in several studies, been reported to increase the time that older people remain independent at home (Van Herck, 2015; WHO, 2015).

In addition to these innovative home adaptations, for community-dwelling older people, authorities have increasingly turned to their social network and members of the community to assist with their care and support needs (Koops & Kwekkeboom, 2005). While older people prefer being cared for by informal caregivers (Eckert, Morgan & Swamy, 2004), community care is often used to constrain public sector spending by adapting someone's social network into a source of long-term care (Keating, Offinowski, Wenger, Fast & Derksen, 2003).

Older people's environments have not only been of interest to policy-makers, but they have also received ample research attention in ageing studies. According to theories of environmental gerontology, over their life span, people are influenced by an on-going interchange between the individual and their social and physical environment (Wahl & Oswald, 2010). Studies in environmental gerontology have tended to focus on the physical/material and the spatial components of ageing, while acknowledging the links between the physical, social, psychological, and cultural environments (Peace, Wahl, Mollenkopf & Oswald, 2007). The social environment, however, is essential for all as everyone grows up in their community (Wacker & Roberto, 2014), and it is positively related with feelings of safety (De Donder, De Witte, Buffel, Dury & Verte, 2012), quality of life (Jia, Moriarty & Kanarek, 2009), and general health and well-being in later life (Lehning, Smith & Dunkle, 2014).

In order to age in place and maintain independence, the provision of personal care and support for older people is shifting from purely professional care to inclusive care, provided by both professionals

and informal caregivers (Wiles *et al.*, 2011). This inclusive care provision was based on a particular interest in the social environment of older people (World Health Organization [WHO], 2008). For example, new concepts such as 'Age Friendly Initiatives' reflect a paradigm shift in focus from individual to community support services that promote ageing in place (Greenfield, Oberlink, Scharlach, Neal & Stafford, 2015). Environmental gerontology's theoretical insights indicate that improving the social environment of older people is expected to have a positive impact on reducing disability and loss of autonomy when people age (Wahl & Oswald, 2010). Correlations between the social environment and health have already been reviewed (Annear *et al.*, 2014); however, the nature of the relationship between the social environment and frailty in later life remains unclear.

### Objectives

In order to address the research gap, this article aims to systematically review existing research that has examined the relationship between the social environment and frailty. **Social determinants of health have been conceptualised in many models (Solar & Irwin, 2010)** and a person's social environment includes a range of social factors. In the ecological systems theory, Bronfenbrenner (1994) describes this range of factors as overlapping layers of environmental context that influences the human development. These layers are organised as nested structures and represent different levels of context: micro, meso, exo en macro. Within this ecological model, a microsystem is a pattern of social roles, activities and interpersonal relations in the immediate surrounding (e.g. family). The mesosystem describes the connection and processes between microsystems (e.g. the relations between family members and neighbours). The exosystem includes the linkages between two settings in which events occur that have an indirect influence on the individual (e.g. the socioeconomic deprivation in the neighbourhood). Socio-demographic and socioeconomic elements as individual factors as well as macro factors by means of higher-level economic indicators and their relation with frailty have been studied before in systematic reviews (Mello, Engstrom, & Alves, 2014; Gray *et al.*, 2016). Hence, the meso and exo factors were chosen as the focus of this paper. In conceptualisation of the social environment with these factors, definitions may vary depending on the authors' research paradigm (Van Cauwenberg *et al.*, 2014). For instance, studies refer to social environment as neighbourhood social capital (Carpiano, 2007), social circumstance (Berkman, Glass, Brissette &

Seeman, 2000), or neighbourhood (Gray, 2009). Clearly, the social environment can be recognised as a multidimensional concept (Buffel *et al.*, 2011) and research should take these different dimensions into account. Consequently, this review will investigate which *dimensions* of the social living environment are used in frailty research, and of these, which have a relationship with frailty.

## **Methods**

### Registration

The PRISMA guidelines have been followed in this systematic review (Moher, Liberati, Tetzlaff & Altman, 2009). This review was also registered for review in the PROSPERO database on XX XXXX (registration code CRDXXXXXXXXXX).

### Eligibility criteria

The articles selected were published in peer-reviewed journals and their main or secondary study objective was the relationship between the social living environment and frailty. Grey literature was not included in the literature search as the focus was on the current knowledge specifically related to frailty research. No minimum age was specified in defining 'older people' as an inclusion criteria, however all articles had a focus on older people. Only publications in English were included. Studies were excluded when frailty was not measured with a validated instrument or when the social living environment was only defined as 'living alone'.

### Search

Four databases were searched for relevant articles. Advanced searches were performed in Web of Science, Proquest Social Science and Ovid PsycINFO databases using (health OR frail\* OR vulnerab\* OR well-being) in title and (Frail\*) AND (elder\* OR "later life" OR "older adult\*" OR age\* OR ag\$ing) AND (network OR support OR environment OR cohesion OR capital OR relation\* OR \*social) in the topic or keyword of the article. A similar search was performed in Pubmed using available MeSH

terms. The full search strategy and the search terms for all the databases are available online in the PROSPERO database or in Supplementary Appendix 1.

### Study selection

First, after duplicates were removed, a researcher screened all the records by title and relevant articles were then screened by abstract. Second, full text articles were screened for eligibility and further inclusion by two researchers. Where there was no agreement, a third researcher was consulted. Third, the references and cited articles of the included studies were screened; this included all new publications until 31 December 2015, identified via e-mail alerts sent by the included databases.

### Data extraction and study quality appraisal

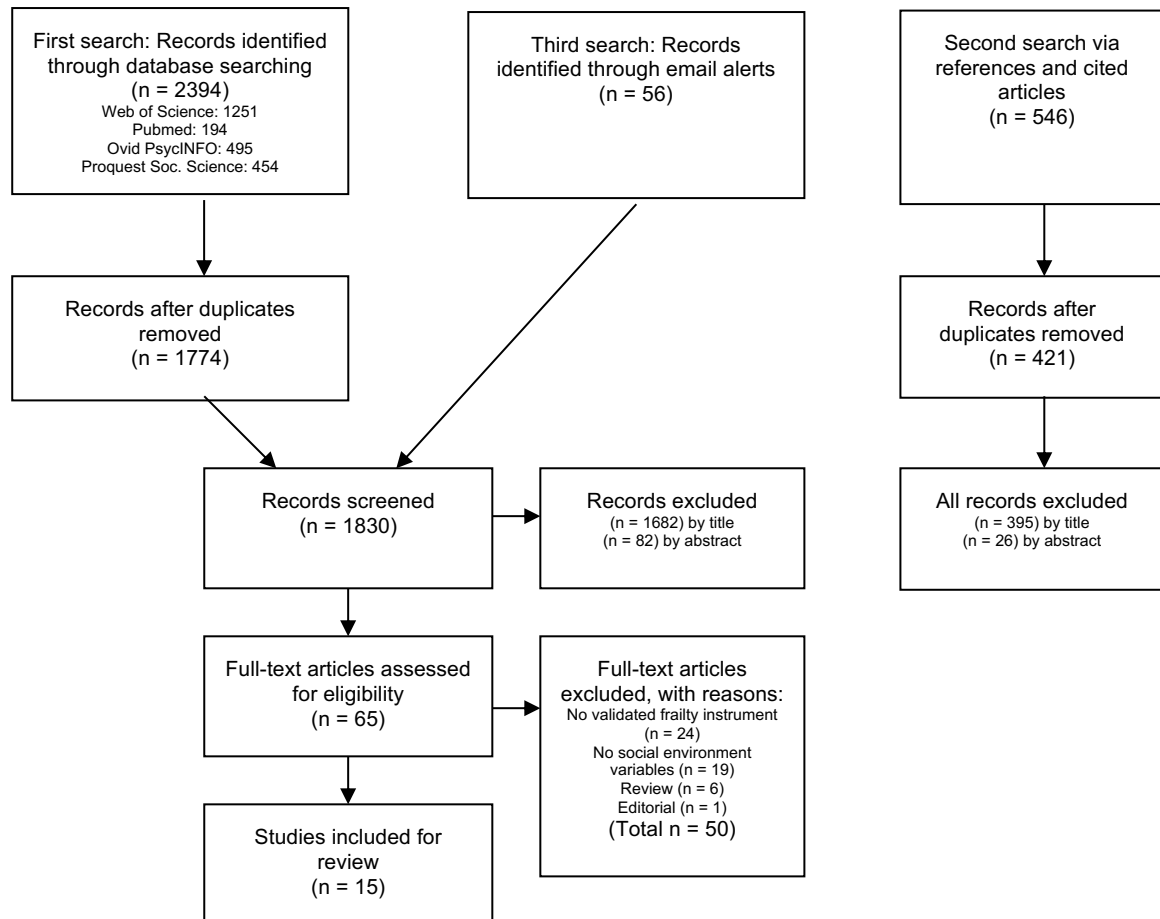
Two researchers separately categorised the study outcomes in two distinct groups. In the first group, frailty was the dependent variable and in the second, adverse outcomes of frailty. All relationships between the social living environment and frailty were analysed and further categorised in five dimensions. These dimensions emerged from inductive classification of the data in the included articles: social network, social support, social participation, neighbourhood characteristics and perceived neighbourhood experience. Three researchers discussed the names of these dimensions until a consensus was reached. The quality of the studies included in this review were appraised using six items (see Supplementary Appendix 2) that were adapted from the STROBE Statement checklist of items that should be included when reporting observational studies (von Elm *et al.*, 2007).

## **Results**

A flow chart illustrates the literature search process (see Figure 1), but can be summarised as follows: Firstly, 1774 original records were found in four databases on 14 August 2015 and 62 full text articles were screened for relationships between the social environment and frailty. Fourteen articles were identified in this first stage. Secondly, the references and cited articles of the included studies were

screened; however this did not yield any new articles. Thirdly, the abstracts of 56 new publications up until 31 December 2015 were screened as a result of e-mail alerts sent by the databases. This strategy resulted in one additional study being included, resulting in fifteen articles identified in total.

Figure 1: Flow chart summarising the literature search



### Study characteristics

Table 1 presents an overview of the study characteristics included. In general, all studies can be classified into two categories with regard to the study outcomes: Eleven studies had frailty as the dependent variable and four studies had adverse frailty outcomes as the dependent variable. In terms of the frailty measurements used: 13 articles used physical frailty, seven used the Fried criteria (Fried *et al.*, 2001) to define physical frailty, four utilised a frailty index that uses a range of deficits (here 35 to 62 items) and one used the brief instrument of frailty (Rockwood *et al.*, 1999) (For more information



on the frailty index, please see Mitnitski, Mogilner, & Rockwood, 2001 or Rockwood & Mitnitski, 2007). One article used the physical domain of the multidimensional Groningen Frailty indicator. Two articles used the Tilburg Frailty Indicator to operationalise multidimensional (i.e. physical-psychological-social) frailty.

The outcomes chosen for adverse frailty were functional decline or disability, functional limitations in activities of daily living (e.g. telephone use, shopping, preparing meals), health care utilisation (e.g. hospitalisation), receiving personal/nursing/informal care, visits to general practitioner, increased care needs on hospital discharge, emergency rehospitalisation one month post-hospitalisation, lower quality of life and mortality (e.g. at 12 months post-hospital discharge).

The studies were carried out in Europe (n = 7), Central/North America (n = 5), and Australasia (n = 3). Numbers of participants ranged from 172 (in a single city) to 14,082 (in a study of 11 European Union countries). Ten out of 15 studies had a longitudinal design from 12 months to 13 years and five studies were cross-sectional. Age inclusion/exclusion criteria were different across the studies. One study only included older adults younger than 65 years, while 12 studies only included participants over 65 years and one study only included male participants. In terms of data analysis, 14 studies used regression analysis (linear, logistic, sequential or combination) and one article used bivariate analysis.

The five dimensions of social environment that appeared in the articles were social networks, social support, social participation, neighbourhood characteristics, and subjective neighbourhood experiences. (i) Social networks were described in terms of having family in the neighbourhood, being satisfied with social relationships and missing people when they were not around. (ii) Social support was described as emotional support, instrumental/practical support or a combination of support from family and neighbours. (iii) Social participation was described as engagement in groups, leisure activities or social activities (e.g. volunteering). (iv) Neighbourhood characteristics were classified as socio-economic deprivation of the neighbourhood and the percentage of persons from the same ethnic group in the neighbourhood. (v) Finally, subjective neighbourhood was identified as experiences neighbourhood security, neighbourhood social cohesion, and sense of belonging, and a combination of enjoying the home and neighbourhood.

## Study appraisal

All included studies used a validated instrument to assess frailty and all dimensions of social environment were explained in the method section of each study. Eight studies used a scale or part of a scale for measuring the social environment dimensions and all referenced their scale (Ament, Vugt, Verhey & Kempen, 2014, Andrew & Keefe, 2014, Cramm & Nieboer, 2013, Dent & Hoogendijk, 2014, Gale *et al.*, 2012, Gobbens, van Assen, Luijkx & Schols, 2012; Lurie, Myers, Goldbourt & Gerber, 2015, Peek, Howrey, Ternent, Ray & Ottenbacher, 2012).

Andrew and Keefe (2014) use a social vulnerability index in their gerontological research. The social vulnerability index measures cumulative social vulnerabilities. In the reviewed article, these social vulnerabilities were grouped in seven factors using principal component analysis. Three of these factors (engagement, social support and relations with others) were consistent with our social environment domains and consequently the results of these factors were discussed in our five dimensions. The remaining factors from this index (contextual SES, self-esteem, sense of control and living situation) are considered as individual social factors and consequently did not fit with our conceptualisation of social environment. Three studies collected official data on the socio-economic status of the neighbourhood to examine the relation between the neighbourhood characteristics and frailty (Aranda, Ray, Al Snih, Ottenbacher & Markides, 2011; Lurie *et al.*, 2015; Peek *et al.*, 2012).

Nine studies performed analysis on data drawn from on-going multi-purpose longitudinal ageing studies (i.e. The Survey of Health, Ageing and Retirement in Europe in Etman, Kamphuis, van der Cammen, Burdorf & van Lenthe, 2015), but failed to provide information such as response rate, study setting or participant eligibility and selection (Andrew & Keefe, 2014; Aranda *et al.*, 2011; Etman *et al.*, 2015; Gale *et al.*, 2012, Hoogendijk *et al.*, 2014; Kawano-Soto, Garcia-Lara, & Alberto Avila-Funes, 2012; Lang *et al.*, 2009, Peek *et al.*, 2012; St John, Montgomery, & Tyas, 2013). The six other studies had response rate information, of which two reported actual percentages (Ament *et al.*, 2014; Cramm & Nieboer, 2013; Dent & Hoogendijk, 2014; Gobbens *et al.*, 2012; Lurie *et al.*, 2015; Woo, Goggins, Sham & Ho, 2005). With the exception of one study, all gave a clear description of the statistical methods and participant characteristics. All longitudinal studies reported follow-up time. Only two

articles described their efforts to address potential sources of bias (Andrew & Keefe, 2014; Etman *et al.*, 2015) and only one article used a theoretical framework (Andrew & Keefe, 2014).

Table 1: Included study synopses (alphabetical)

Reference	Country	N participants	Age (mean) (78,1)	Design (years/months)	Frailty measurement	Dependent variable	1	2	3	4	5
Ament <i>et al.</i> , 2014	The Netherlands	421	≥70 (78,1)	Longitudinal (12m)	Physical domain of the GFI	Adverse frailty outcomes	○	-	-	-	-
Andrew & Keefe, 2014	Canada	2 740	≥65 (73,4)	Longitudinal (10y)	Frailty index	Frailty	○	○	●	-	-
Aranda <i>et al.</i> , 2011	South-Western States USA	2 069	≥75 (m)	Longitudinal (2y)	Fried criteria	Frailty	-	○	-	●	-
Cramm & Nieboer, 2013	The Netherlands	945	≥70 (77,5)	Cross-sectional	TFI	Frailty	-	-	-	-	●
Dent & Hoogendijk, 2014	South Australia – Australia	172	≥70 (m)	Longitudinal (12m)	Fried criteria	Adverse frailty outcomes	○	-	⊙	-	⊙
Etman <i>et al.</i> , 2015	11 EU countries	14 082	≥55 (m)	Longitudinal (2y)	Fried criteria	Frailty	-	-	●	-	-
Gale <i>et al.</i> , 2012	England - UK	482	m (64,8)	Longitudinal (4,4y)	Fried criteria	Frailty	⊙	○	-	-	-
Gobbens <i>et al.</i> , 2012	The Netherlands	484	≥75 (80,3)	Longitudinal (2y)	TFI	Adverse frailty outcomes	⊙	-	-	-	-
Hoogendijk <i>et al.</i> , 2014	The Netherlands	1 665	≥58 (m)	Longitudinal (3y)	Fried criteria	Adverse frailty outcomes	-	○	-	-	-
Lurie <i>et al.</i> , 2015	Israel	558	≤65 (52)	Longitudinal (10-13y)	Frailty index	Frailty	-	●	-	○	-
Kawano-Soto <i>et al.</i> , 2012	Mexico	927	≥70 (78,2)	Cross-sectional	Fried criteria	Frailty	○	○	-	-	-
Lang <i>et al.</i> , 2009	England - UK	4 818	≥65 (74)	Cross-sectional	Frailty index	Frailty	-	-	-	●	-
Peek <i>et al.</i> , 2012	South-Western States USA	3 050	≥65 (75,14)	Longitudinal (12y)	Fried criteria	Frailty	-	⊙	-	-	-
St John <i>et al.</i> , 2013	Canada	1 751	≥65 (77,5)	Cross-sectional	Brief instrument of frailty	Frailty	-	○	-	-	-
Woo <i>et al.</i> , 2005	China	2 032	≥70 (m)	Cross-sectional	Frailty index	Frailty	⊙	⊙	⊙	-	-

TFI = Tilburg frailty indicator, GFI = Groningen frailty indicator, m = missing

1 = relationship between social networks and frailty, 2 = relationship between social support and frailty, 3 = relationship between social participation and frailty, 4 = relationship between neighbourhood characteristics and frailty, 5 = relationship between subjective neighbourhood experience and frailty,

● = significant relationship with frailty or adverse frailty outcomes, ○ = no significant relationship with frailty or adverse frailty outcomes, ⊙ = contested relationship with frailty or adverse frailty outcomes, - = not researched

### Relationship between social environment and frailty

All significant and non-significant relationships in the five dimensions of the social living environment and frailty or adverse frailty outcomes are given in Table 2. For the relationship with *social network*, seven studies were found, three relationships were significant and seven relationships were not significant. Older people with fewer close relationships with others were more at risk of frailty (Gale *et*

*al.*, 2012). However, Woo *et al.* (2005) only found a significant relationship when frequent contact was with relatives and lower frailty rates were found among women, not men. Conversely, one study did not find any relationship between frailty and having friends or relatives in the neighbourhood (Kawano-Soto *et al.*, 2012). Moreover, frail hospitalised older people with poor social relationships had no higher probability of mortality and other adverse outcomes than frail older people with rich social relationships in the study (Dent & Hoogendijk, 2014). Likewise, when physically frail hospitalised older people were also socially frail, there was no higher risk for lower quality of life, new hospital admissions or disability in instrumental activities of daily living (IADL) after one year (Ament *et al.*, 2014).

Nine studies included *social support* as a potential cause or modifier for frailty or adverse frailty outcomes. For these studies, four significant and ten non-significant relationships were found. For older people who were moderately frail, increased social support was associated with less-steep increases of frailty over time. On the other hand, for older people with a high frailty level, there was no significant relationship (Peek *et al.*, 2012). Social support from relatives was associated with lower levels of frailty for older men but not older women. On the other hand, social support from neighbours was related to lower frailty levels for both genders (Woo *et al.*, 2005). A distinction between practical and emotional support was made in five studies. Neither emotional (Aranda *et al.*, 2011, Gale *et al.*, 2012, St John *et al.*, 2013) nor practical support was related to frailty (Gale *et al.*, 2012, Kawano-Soto *et al.*, 2012; St John *et al.*, 2013), or more functional decline and mortality when frail older people were hospitalised (Hoogendijk *et al.*, 2014).

The relationship between *social participation* and frailty was researched in four studies; five relationships were significant and two were non-significant. Helping others was related to lower frailty in one study, as was attending community or religious activities, but only for women (Woo *et al.*, 2005). Another study found a relationship between lower frailty levels and social participation, using the engagement dimension, in the social vulnerability index (Andrew & Keefe, 2014). Not participating in social life was related to a greater risk of frailty and this risk was exacerbated in older people with lower levels of education (Etman *et al.*, 2015). Frail hospitalised older people who did few social activities had a higher likelihood of mortality and being discharged with higher levels of care. However,

there was no increased likelihood of other adverse frailty outcomes such as one-month emergency rehospitalisation or longer stays in non-acute care (Dent & Hoogendijk, 2014).

*Neighbourhood characteristics* and its relationship with frailty were researched in three studies: two reported significant results and one non-significant. One study found a linear relationship between neighbourhood socio-economic deprivation and frailty (Lang *et al.*, 2009). Likewise, Lurie *et al.* (2015) found a relationship between neighbourhood socio-economic status and frailty progression. However, this result was not significant when adjusted for individual socio-economic status, age and health covariates. Another study found that older Mexican Americans were at less risk for increasing frailty when they lived in an ethnically dense Mexican American neighbourhood (Aranda *et al.*, 2011).

With regards to the final dimension, *subjective neighbourhood experience*, two studies researched its relationship with frailty and three found significant results but one was not significant. Social cohesion, neighbourhood belonging and feeling secure were protective factors against frailty (Cramm & Nieboer, 2013). The last significant relationship was found with frail hospitalised older people who reported low levels of enjoyment in their home and neighbourhood. They had a higher likelihood of mortality, discharge to a higher level of care and one-month emergency rehospitalisation. However, they were no more likely to stay longer in non-acute care (Dent & Hoogendijk, 2014).

Table 2: Significant and non-significant associations between social environment and frailty

Significant relationships	Non-significant relationships
<b>Social networks</b>	
	Physical frail older people who were hospitalised are not more at risk for lower quality of life and IADL disability after one year or a new hospital admission in the next year if they are also socially frail (i.e. missing people around, feeling abandoned, experience emptiness) (Ament <i>et al.</i> , 2014).
	Frail hospitalised older people with poor social relationships had no higher likelihood for mortality, discharge to higher level of care, one-month emergency rehospitalisation or longer stay in non-acute care (Dent & Hoogendijk, 2014).
	No relationship between social vulnerability in the social relationships dimension (i.e. frequency of contact with neighbours, friends or caregiving for seniors) and higher levels of frailty (Andrew & Keefe, 2014).
Older women reporting a high level of negative aspects of close relationships were more at risk for frailty compared with those reporting a low level (Gale <i>et al.</i> , 2012).	Older men reporting a high level of negative aspects of close relationships were not more at risk for frailty compared with those reporting a low level of negative aspects (Gale <i>et al.</i> , 2012).
	There is no relationship between frailty and having friends or relatives in the neighbourhood (Kawano-Soto <i>et al.</i> , 2012).
Frequent contact with relatives was related to lower frailty for older women (Woo <i>et al.</i> , 2005).	Frequent contact with relatives was not related to lower frailty for older men (Woo <i>et al.</i> , 2005).
Physical frailty has a negative effect on social quality of life (i.e. relationships) (Gobbens <i>et al.</i> , 2012).	Social and psychological frailty does not have an effect on social quality of life (i.e. relationships) (Gobbens <i>et al.</i> , 2012).
<b>Social support</b>	
	No relationship between social vulnerability in the social support dimension (i.e. advice, help in a crisis, support: someone to confide in, someone to make you feel loved, frequency of contact with relatives) and higher levels of frailty (Andrew & Keefe, 2014).
	Emotional support is not related to frailty (Aranda <i>et al.</i> , 2011, Gale <i>et al.</i> , 2012, St John <i>et al.</i> , 2013).
	Practical support is not related to frailty (Gale <i>et al.</i> , 2012, Kawano-Soto <i>et al.</i> , 2012, St John <i>et al.</i> , 2013).
	Emotional or instrumental support is not related with more functional decline or 3-year mortality post discharge for frail hospitalised older people (Hoogendijk <i>et al.</i> , 2014).
For moderately frail older people, increased social support is related to less-steep increases in frailty over time (Peek <i>et al.</i> , 2012).	For older people with a high frailty level, there is no significant relationship between social support and frailty (Peek <i>et al.</i> , 2012).
Social support from relatives was related to lower frailty older men (Woo <i>et al.</i> , 2005).	Social support from relatives was not related to lower frailty for older women (Woo <i>et al.</i> , 2005).
Social support from neighbours was related to lower frailty for older men and women (Woo <i>et al.</i> , 2005).	
Higher perceived social support level was related to lower frailty risk (Lurie <i>et al.</i> , 2015).	
<b>Social participation</b>	
Higher levels of frailty are related to social vulnerability in the engagement dimension (i.e. frequent group engagement, attending religious service, physical leisure activities) (Andrew & Keefe, 2014).	
Frail older people reporting with low social activities had a higher likelihood for mortality and discharge to higher-level care (Dent & Hoogendijk, 2014).	Frail older people reporting with low social activities had a no higher likelihood for one-month emergency rehospitalisation and longer stay in non-acute care (Dent & Hoogendijk, 2014).
Lower educated older people who were not socially participating in voluntary work, caring for a sick person or participating in a sports club showed an increased risk of worsening frailty compared with those who were highly educated (Etman <i>et al.</i> , 2015).	
Participation in helping other people is related to lower frailty (Woo <i>et al.</i> , 2005).	

---

Attending community or religious activities is related to lower frailty for older women (Woo *et al.*, 2005).

Attending community or religious activities is not related to lower frailty for older men (Woo *et al.*, 2005).

---

#### Neighbourhood characteristics

Older Mexican American people living in an ethnically dense Mexican American neighbourhood were less at risk of increasing frailty than those who did not (Aranda *et al.*, 2011).

There is a linear relationship between frailty and neighbourhood socio-economic deprivation (Lang *et al.*, 2009).

Neighbourhood socio-economic status is not related to frailty risk (Lurie *et al.*, 2015).

---

#### Subjective neighbourhood experience

Feeling secure in the neighbourhood is protective against frailty (Cramm & Nieboer, 2013).

Social cohesion in the neighbourhood and having a sense of belonging protects against frailty (Cramm & Nieboer, 2013).

Frail older people reporting low enjoyment of their home and neighbourhood were at a higher likelihood of mortality, discharge to higher level care and 1-month emergency rehospitalisation (Dent & Hoogendijk, 2014).

Frail older people reporting low enjoyment of their home and neighbourhood had a no higher likelihood for longer stay in non-acute care (Dent & Hoogendijk, 2014).

---

## Discussion

This review builds on environmental gerontology theory by including the social environment as a crucial factor for ageing in place for frail older people or those at risk for frailty. Earlier research has highlighted that human ageing has been de-contextualised and separated from the environment (Peace *et al.*, 2007) and there are still only a few authors who examine the social environment in their frailty research. Fifteen studies were included in this systematic review and five dimensions of social environment associated with frailty were identified. The main finding of this article is the importance of the social environment in preventing or reducing frailty, although different dimensions of social environment have different effects.

In the included studies, the dimensions of social environment most often researched were social networks and social support. Nonetheless, these studies also showed the most inconsistent relationships with frailty in comparison with studies examining other dimensions of social environment. In contrast to other health research where social networks have been found to be important for other health related outcomes (e.g. Barton, Effing & Cafarella, 2015), our study demonstrates that older people without strong social or support networks (both emotional and practical), in general, are not more at risk for frailty or adverse frailty outcomes. In the reviewed articles, it was not always clear if social networks were defined as structural (e.g. contact frequency) or functional (e.g. providing

support). Social and support networks interconnected, as social networks can transform into support or even care-giving networks (Keating *et al.*, 2003). For frail older people however, it might be difficult to depend on social networks for care or support as their social networks change or diminish when people age (Fung, Carstensen & Lang, 2001). In the literature, adverse frailty outcomes focused mainly on health outcomes. For example, Gobbens *et al.* (2012) were the only researchers to investigate the effect of multidimensional frailty on quality of life, and they found that physical frailty had a negative effect on social relationships, yet social and psychological frailty did not (Gobbens *et al.*, 2012). The other dimensions of the social environment indicated totally different results. In contrast to the social networks and social support dimensions, social participation, neighbourhood characteristics, and subjective neighbourhood experience appear to have a protective function against frailty (Andrew & Keefe, 2014; Cramm & Nieboer, 2013; Etman *et al.*, 2015; Woo *et al.*, 2005), this is in addition to several adverse frailty outcomes (Dent & Hoogendijk, 2014).

The differences in results are more notable when subgroups of older populations were analysed in the reviewed articles. For social networks and support dimensions, the differences suggest that outcomes vary depending on gender and level of frailty. The beneficial effects of social networks are greater for older women (Gale *et al.*, 2012; Woo *et al.*, 2005) and older men with greater social support have lower levels of frailty (Woo *et al.*, 2005). Contrastingly, Lurie *et al.* (2015) examined adults less than 65 years of age, and found an association between social support and lower frailty levels 10 to 13 years later. On the other hand, this study found no relationship between neighbourhood characteristics and frailty, while the studies with older people did. These differences illustrate the importance of investigating frailty at an individual level, which was lacking in the majority of the studies.

This study was the first to search for relationships between frailty and the broad social environment and it provides new insight in how to prevent frailty in the community. However, important limitations of this study should be noted. First, social environmental factors were only recently included in frailty studies. Despite the fact that relationships between social factors and frailty have previously been studied, only 15 studies were found to have researched the relationship between frailty and the social environment. Second, our search strategy and inclusion criteria only yielded cohort studies, no controlled trials were found. Furthermore, in order to categorise findings into significant and non-



significant associations, the very small number of qualitative studies found were excluded. However, the decision not to include qualitative research, does not mean qualitative research is not valued here. On the contrary, qualitative research could generate new research questions and explain the differences in the findings of this study in future research (Neuman, 2011). Finally, some studies analysed their findings using secondary data and gave inadequate information about participant selection and used different or even modified versions of frailty instruments. Hence, a rather pragmatic approach for quality appraisal was taken, instead of risk of bias assessment using the Cochrane Risk of Bias Tools (Higgins & Green, 2008). The outcomes of these assessments were used to make comparisons between studies, and no study was excluded because of the low level of study reporting.

With the results of this review, some new research questions arise. Social networks and social support had in general no relationship with frailty. Only in specific cases (e.g. when the source of social support was investigated) a relationship with frailty was found, and even then there were differences between men and women. The networks of older adults are very diverse, even when they are frail (Op het Veld et al., 2015). The association between social connectedness and age is complex. Moreover, it is also dependent on several life course factors. As networks are dynamic and move through time, space and the life course (Fiori et al., 2007), more research in that area is needed. Apart from the association with social domains, the life course also affects the individual's health in later life. Previous research indicated that childhood disadvantages have a long-term effect on frailty trajectories (Xu, 2015). Socioeconomic disadvantage has been linked with higher allostatic load (Robertson, Popham, & Benzeval, 2014), also known as 'the wear and tear' of the body. This allostatic load in turn is related to frailty (Gale, Booth, Starr, & Deary, 2016). The relationship with these individual factors was not included in this study although biological, behavioral and psychosocial processes in the life course are shaped by both individual and environmental characteristics. In the new WHO World report on ageing and health, the emphasis is on a life-course approach as the diversity in the capacities of older adults is rooted in events during the life course (Beard *et al.*, 2016; WHO, 2015). Therefore, this life-course approach needs more attention in further research.

This review demonstrated that it is important to contemplate all dimensions of the social environment. In addition, it indicates that the older population is heterogeneous, and whether older people benefit

from larger social networks or more social support depends on their gender and/or age. Although the number of articles examining neighbourhood and social participation dimensions were lower than those investigating network and support dimensions, the positive results of the former imply attention for further research in order to proceed on policy recommendations. For example, given the impact that social participation has on frailty, establishing and supporting local policy initiatives could be a way to prevent frailty experienced by older citizens. Thus this study is useful to better understand the relation between frailty and the social environment and that the social profile should be systematically assessed and taken into account when evaluating older adults. The study further proposes to include a combination of social environment domains for other research examining frailty and community care, for the development of pilot interventions and controlled trials in the field.

## **Conclusion**

The social environment is a broad concept that includes social networks, social support, social participation, neighbourhood characteristics, and subjective neighbourhood experiences, and there is evidence of relationships with frailty in later life. Social participation and neighbourhood factors have a protective or balancing function in the frailty levels of community-dwelling older people. However, the relationship between frailty, social support, and social networks is contested. It is recommended that in the research for community care and prevention programmes that target frailty in later life, a broad approach to the social living environment is taken.

## **Acknowledgments**

In separate file

## **Conflicts of interest**

None of the authors have any conflicting interests to report.

## **Ethical approval**

This study was conducted according to the ethical guidelines laid down in the Declaration of Helsinki, and because no experiments on humans were conducted, no ethics committee was involved.

### Author contact details

XXXXX

### References

- Ament, B. H. L., Vugt, M. E. de, Verhey, F. R. J., & Kempen, G. I. J. M. (2014). Are physically frail older persons more at risk of adverse outcomes if they also suffer from cognitive, social, and psychological frailty? *European Journal of Ageing*, 11(3), 213–219. <http://doi.org/10.1007/s10433-014-0308-x>
- Andrew, M. K., & Keefe, J. M. (2014). Social vulnerability from a social ecology perspective: a cohort study of older adults from the National Population Health Survey of Canada. *Bmc Geriatrics*, 14, 90. <http://doi.org/10.1186/1471-2318-14-90>
- Annear, M., Keeling, S., Wilkinson, T., Cushman, G., Gidlow, B., & Hopkins, H. (2014). Environmental influences on healthy and active ageing: a systematic review. *Ageing & Society*, 34(04), 590–622. <http://doi.org/10.1017/S0144686X1200116X>
- Aranda, M. P., Ray, L. A., Al Snih, S., Ottenbacher, K. J., & Markides, K. S. (2011). The Protective Effect of Neighborhood Composition on Increasing Frailty Among Older Mexican Americans: A Barrio Advantage. *Journal of Aging and Health*, 23(7), 1189–1217. <http://doi.org/http://dx.doi.org/10.1177/0898264311421961>
- Barton, C., Effing, T. W., & Cafarella, P. (2015). Social Support and Social Networks in COPD: A Scoping Review. *Copd-Journal of Chronic Obstructive Pulmonary Disease*, 12(6), 690–702. <http://doi.org/10.3109/15412555.2015.1008691>
- Beard, J. R., Officer, A., de Carvalho, I. A., Sadana, R., Pot, A. M., Michel, J.-P., ... Chatterji, S. (2016). The World report on ageing and health: a policy framework for healthy ageing. *The Lancet*, 387(10033), 2145–2154. [https://doi.org/10.1016/S0140-6736\(15\)00516-4](https://doi.org/10.1016/S0140-6736(15)00516-4)
- Bergman, H., Béland, F., & Perrault, A. (2002). The global challenge of understanding and meeting the needs of the frail older population. *Aging Clinical and Experimental Research*, 14(4), 223–225. <http://doi.org/10.1007/BF03324442>
- Berkman, L. F., Glass, T., Brissette, I., & Seeman, T. E. (2000). From social integration to health: Durkheim in the new millennium. *Social Science & Medicine* (1982), 51(6), 843–857.
- Björnsdóttir, K., Ceci, C., & Purkis, M. E. (2015). The 'right' place to care for older people: home or institution? *Nursing Inquiry*, 22(1), 64–73. <http://doi.org/10.1111/nin.12041>
- Buffel, T., Verté, D., Donder, L. D., Witte, N. D., Dury, S., Vanwing, T., & Bolsenbroek, A. (2012). Theorising the relationship between older people and their immediate social living environment. *International Journal of Lifelong Education*, 31(1), 13–32. <http://doi.org/10.1080/02601370.2012.636577>
- Carpiano, R. M. (2007). Neighborhood social capital and adult health: an empirical test of a Bourdieu-based model. *Health & Place*, 13(3), 639–655. <http://doi.org/10.1016/j.healthplace.2006.09.001>
- Casale-Martínez, R. I., Navarrete-Reyes, A. P., & Avila-Funes, J. A. (2012). Social determinants of frailty in elderly Mexican community-dwelling adults. *Journal of the American Geriatrics Society*, 60(4), 800–802. <http://doi.org/10.1111/j.1532-5415.2011.03893.x>
- Cramm, J. M., & Nieboer, A. P. (2013). Relationships between frailty, neighborhood security, social cohesion and sense of belonging among community-dwelling older people. *Geriatrics & Gerontology International*, 13(3), 759–763. <http://doi.org/10.1111/j.1447-0594.2012.00967.x>
- De Donder, L., De Witte, N., Buffel, T., Dury, S., & Verte, D. (2012). Social Capital and Feelings of Unsafety in Later Life: A Study on the Influence of Social Networks, Place Attachment, and Civic Participation

- on Perceived Safety in Belgium. *Research on Aging*, 34(4), 425–448.  
<http://doi.org/10.1177/0164027511433879>
- Dent, E., & Hoogendijk, E. O. (2014). Psychosocial factors modify the association of frailty with adverse outcomes: a prospective study of hospitalised older people. *Bmc Geriatrics*, 14, 108.  
<http://doi.org/10.1186/1471-2318-14-108>
- De Witte, N., Gobbens, R., De Donder, L., Dury, S., Buffel, T., Schols, J., & Verte, D. (2013). The comprehensive frailty assessment instrument: Development, validity and reliability. *Geriatric Nursing*, 34(4), 274–281. <http://doi.org/10.1016/j.gerinurse.2013.03.002>
- Eckert, J. K., Morgan, L. A., & Swamy, N. (2004). Preferences for receipt of care among community-dwelling adults. *Journal of Aging & Social Policy*, 16(2), 49–65. [http://doi.org/10.1300/J031v16n02\\_04](http://doi.org/10.1300/J031v16n02_04)
- Etman, A., Kamphuis, C. B. M., van der Cammen, T. J. M., Burdorf, A., & van Lenthe, F. J. (2015). Do lifestyle, health and social participation mediate educational inequalities in frailty worsening? *European Journal of Public Health*, 25(2), 345–350. <http://doi.org/10.1093/eurpub/cku093>
- Fänge, A. M., Oswald, F., & Clemson, L. (2012). Aging in place in late life: theory, methodology, and intervention. *Journal of Aging Research*, 2012, 547562. <http://doi.org/10.1155/2012/547562>
- Findlay, M., & Isles, C. (2015). The Challenges of Renal Replacement Therapy in the Elderly. In *Clinical Companion in Nephrology* (pp. 229–233). Springer International Publishing. Retrieved from [http://link.springer.com/chapter/10.1007/978-3-319-14868-7\\_43](http://link.springer.com/chapter/10.1007/978-3-319-14868-7_43)
- Fried, L. P., Tangen, C. M., Walston, J., Newman, A. B., Hirsch, C., Gottdiener, J., ... McBurnie, M. A. (2001). Frailty in older adults: Evidence for a phenotype. *Journals of Gerontology Series A-Biological Sciences and Medical Sciences*, 56(3), M146–M156.
- Fung, H. H., Carstensen, L. L., & Lang, F. R. (2001). Age-related patterns in social networks among European Americans and African Americans: implications for socioemotional selectivity across the life span. *International Journal of Aging & Human Development*, 52(3), 185–206.
- Gale, C. R., Syddall, H. E., Cooper, C., Sayer, A. A., Bergman, H., & Brunner, E. J. (2012). Close Relationships and Risk of Frailty: The Hertfordshire Cohort Study. *Journal of the American Geriatrics Society*, 60(2), 390–392. <http://doi.org/10.1111/j.1532-5415.2011.03799.x>
- Gale, C. R., Booth, T., Starr, J. M., & Deary, I. J. (2016). Intelligence and socioeconomic position in childhood in relation to frailty and cumulative allostatic load in later life: the Lothian Birth Cohort 1936. *Journal of Epidemiology and Community Health*, 70(6), 576–582. <http://doi.org/10.1136/jech-2015-205789>
- Gobbens, R. J. J., Luijckx, K. G., Wijnen-Sponselee, M. T., & Schols, J. M. G. A. (2010). In search of an integral conceptual definition of frailty: opinions of experts. *Journal of the American Medical Directors Association*, 11(5), 338–343. <http://doi.org/10.1016/j.jamda.2009.09.015>
- Gobbens, R. J. J., van Assen, M. A. L. M., Luijckx, K. G., & Schols, J. M. G. A. (2012). The Predictive Validity of the Tilburg Frailty Indicator: Disability, Health Care Utilization, and Quality of Life in a Population at Risk. *The Gerontologist*, 52(5), 619–631. <http://doi.org/http://dx.doi.org/10.1093/geront/gnr135>
- Gray, A. (2009). The social capital of older people. *Ageing & Society*, 29, 5–31.  
<http://doi.org/10.1017/S0144686X08007617>
- Greenfield, E. A., Oberlink, M., Scharlach, A. E., Neal, M. B., & Stafford, P. B. (2015). Age-Friendly Community Initiatives: Conceptual Issues and Key Questions. *The Gerontologist*, 55(2), 191–198.  
<http://doi.org/10.1093/geront/gnv005>
- H. Koops, & M.H. Kwekkeboom. (2005). *Vermaatschappelijking in de zorg*. Sociaal en Cultureel Planbureau. Retrieved from [http://www.scp.nl/Publicaties/Alle\\_publicaties/Publicaties\\_2005/Vermaatschappelijking\\_in\\_de\\_zorg](http://www.scp.nl/Publicaties/Alle_publicaties/Publicaties_2005/Vermaatschappelijking_in_de_zorg)
- Higgins, J. P., & Green, S. (Eds.). (2008). *Cochrane handbook for systematic reviews of interventions* (Vol. 5). Chichester: Wiley-Blackwell.
- Hoogendijk, E. O., van Hout, H. P. J., van der Horst, H. E., Frijters, D. H. M., Dent, E., Deeg, D. J. H., & Huisman, M. (2014). Do psychosocial resources modify the effects of frailty on functional decline and mortality? *Journal of Psychosomatic Research*, 77(6), 547–551.  
<http://doi.org/10.1016/j.jpsychores.2014.09.017>

- Jia, H., Moriarty, D. G., & Kanarek, N. (2009). County-Level Social Environment Determinants of Health-Related Quality of Life Among US Adults: A Multilevel Analysis. *Journal of Community Health, 34*(5), 430–439. <http://doi.org/10.1007/s10900-009-9173-5>
- Kawano-Soto, C. A., Garcia-Lara, J. M. A., & Alberto Avila-Funes, J. (2012). A Poor Social Network is not Associated with Frailty in Mexican Community-Dwelling Elderly Adults. *Journal of the American Geriatrics Society, 60*(12), 2360–2362. <http://doi.org/10.1111/jgs.12020>
- Keating, N., Otfinowski, P., Wenger, C., Fast, J., & Derksen, L. (2003). Understanding the caring capacity of informal networks of frail seniors: a case for care networks. *Ageing and Society, 23*, 115–127. <http://doi.org/10.1017/S0144686X02008954>
- Lang, I. A., Hubbard, R. E., Andrew, M. K., Llewellyn, D. J., Melzer, D., & Rockwood, K. (2009). Neighborhood Deprivation, Individual Socioeconomic Status, and Frailty in Older Adults. *Journal of the American Geriatrics Society, 57*(10), 1776–1780. <http://doi.org/10.1111/j.1532-5415.2009.02480.x>
- Lehning, A. J., Smith, R. J., & Dunkle, R. E. (2014). Age-Friendly Environments and Self-Rated Health: An Exploration of Detroit Elders. *Research on Aging, 36*(1), 72–94. <http://doi.org/10.1177/0164027512469214>
- Lurie, I., Myers, V., Goldbourt, U., & Gerber, Y. (2015). Perceived social support following myocardial infarction and long-term development of frailty. *European Journal of Preventive Cardiology, 22*(10), 1346–1353. <http://doi.org/10.1177/2047487314544575>
- Masel, M. C., Graham, J. E., Reistetter, T. A., Markides, K. S., & Ottenbacher, K. J. (2009). Frailty and health related quality of life in older Mexican Americans. *Health and Quality of Life Outcomes, 7*, 70. <http://doi.org/10.1186/1477-7525-7-70>
- Mitnitski, A. B., Mogilner, A. J., & Rockwood, K. (2001). Accumulation of deficits as a proxy measure of aging. *TheScientificWorldJournal, 1*, 323–336. <https://doi.org/10.1100/tsw.2001.58>
- Rockwood, K., & Mitnitski, A. (2007). Frailty in relation to the accumulation of deficits. *Journals of Gerontology Series a-Biological Sciences and Medical Sciences, 62*(7), 722–727.
- Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *Annals of Internal Medicine, 151*(4), 264–269. <http://doi.org/10.7326/0003-4819-151-4-200908180-00135>
- Monteserin, R., Brotons, C., Moral, I., Altimir, S., José, A. S., Santauegenia, S., ... Padrós, J. (2010). Effectiveness of a geriatric intervention in primary care: a randomized clinical trial. *Family Practice, 27*(3), 239–245. <http://doi.org/10.1093/fampra/cmp101>
- Neuman, W. L. (2011). *Social Research Methods: Qualitative and Quantitative Approaches, Seventh Edition* (7th ed.). Pearson/AandB.
- Op het Veld, L. P. M., van Rossum, E., Kempen, G. I. J. M., de Vet, H. C. W., Hajema, K., & Beurskens, A. J. H. M. (2015). Fried phenotype of frailty: cross-sectional comparison of three frailty stages on various health domains. *BMC Geriatrics, 15*, 77. <http://doi.org/10.1186/s12877-015-0078-0>
- Peace, S. M., Wahl, H.-W., Mollenkopf, H., & Oswald, F. (2007). Environment and aging (bookchapter). In *Ageing in Society* (3rd ed.). Sage Publishing.
- Peek, M. K., Howrey, B. T., Tement, R. S., Ray, L. A., & Ottenbacher, K. J. (2012). Social support, stressors, and frailty among older Mexican American adults. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences, 67*(6), 755–764. <http://doi.org/10.1093/geronb/gbs081>
- Puts, M. T. E., Lips, P., & Deeg, D. J. H. (2005). Static and dynamic measures of frailty predicted decline in performance-based and self-reported physical functioning. *Journal of Clinical Epidemiology, 58*(11), 1188–1198. <http://doi.org/10.1016/j.jclinepi.2005.03.008>
- Robertson, T., Popham, F., & Benzeval, M. (2014). Socioeconomic position across the lifecourse & allostatic load: data from the West of Scotland Twenty-07 cohort study. *Bmc Public Health, 14*, 184. <https://doi.org/10.1186/1471-2458-14-184>
- Rockwood, K., Stadnyk, K., MacKnight, C., McDowell, I., Hebert, R., & Hogan, D. B. (1999). A brief clinical instrument to classify frailty in elderly people. *Lancet, 353*(9148), 205–206. [https://doi.org/10.1016/S0140-6736\(98\)04402-X](https://doi.org/10.1016/S0140-6736(98)04402-X)
- Rockwood, K., Mitnitski, A., Song, X., Steen, B., & Skoog, I. (2006). Long-term risks of death and institutionalization of elderly people in relation to deficit accumulation at age 70. *Journal of the American Geriatrics Society, 54*(6), 975–979. <http://doi.org/10.1111/j.1532-5415.2006.00738.x>

- Solar, O., Irwin, A., World Health Organization (2010) A conceptual framework for action on the social determinants of health: in Social determinants of health discussion paper 2 (policy and practice). WHO Press, Geneva
- St John, P. D., Montgomery, P. R., & Tyas, S. L. (2013). Social Position and Frailty. *Canadian Journal on Aging-Revue Canadienne Du Vieillissement*, 32(3), 250–259.  
<http://doi.org/10.1017/S0714980813000329>
- Strawbridge, W. J., Shema, S. J., Balfour, J. L., Higby, H. R., & Kaplan, G. A. (1998). Antecedents of frailty over three decades in an older cohort. *Journals of Gerontology Series B-Psychological Sciences and Social Sciences*, 53(1), S9–S16.
- Van Cauwenberg, J., De Donder, L., Clarys, P., De Bourdeaudhuij, I., Buffel, T., De Witte, N., ... Deforche, B. (2014). Relationships between the perceived neighborhood social environment and walking for transportation among older adults. *Social Science & Medicine*, 104, 23–30.  
<http://doi.org/10.1016/j.socscimed.2013.12.016>
- Van Herck, P. (2015). *Transformeren om te overleven in de zorg - healthcare in het nieuwe tijdperk* (1st ed.). LannooCampus. Retrieved from <http://www.lannoo.be/transformeren-om-te-overleven-de-zorg>
- von Elm, E., Altman, D. G., Egger, M., Pocock, S. J., Gøtzsche, P. C., Vandenbroucke, J. P., & STROBE Initiative. (2007). The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *Annals of Internal Medicine*, 147(8), 573–577.
- Wacker, R., & Roberto, K. A. (2014). *Community Resources for Older Adults* | SAGE Publications Ltd. Retrieved 3 January 2016, from <https://uk.sagepub.com/en-gb/eur/community-resources-for-older-adults/book237153>
- Wahl, H., & Oswald, F., (2010). Environmental Perspectives on Ageing (bookchapter) in Tinker, A. (2011). *The Sage Handbook of Social Gerontology. Ageing & Society*, 31, 887–888.  
<http://doi.org/10.1017/S0144686X11000110>
- World health organization. (2008) *The solid facts: Home care in Europe*. Retrieved from [http://www.euro.who.int/\\_data/assets/pdf\\_file/0005/96467/E91884.pdf](http://www.euro.who.int/_data/assets/pdf_file/0005/96467/E91884.pdf)
- Wiles, J. L., Leibing, A., Guberman, N., Reeve, J., & Allen, R. E. S. (2011). The Meaning of 'Ageing in Place' to Older People. *The Gerontologist*, gnr098. <http://doi.org/10.1093/geront/gnr098>
- Woo, J., Goggins, W., Sham, A., & Ho, S. C. (2005). Social determinants of frailty. *Gerontology*, 51(6), 402–408. <http://doi.org/10.1159/000088705>
- Xu, Z. (2015). Childhood Disadvantages and Age Trajectories of Frailty in China: A Life Course Approach. *Gerontologist*, 55, 823–823.

## Supplementary Appendix 1: Search strategy

*For Web of Science core collection*

#6	(#5) AND LANGUAGE: (English) Indexes=SCI-EXPANDED, SSCI, A&HCI,CPCI-S, CPCI-SSH Timespan=All years
#5	#4 AND #3 AND #2 AND #1 Indexes=SCI-EXPANDED, SSCI, A&HCI,CPCI-S, CPCI-SSH Timespan=All years
#4	TS=(Frail*) Indexes=SCI-EXPANDED, SSCI, A&HCI,CPCI-S, CPCI-SSH Timespan=All years
#3	TS=(elder* OR "later life" OR "older*" OR age* OR ag\$ing) Indexes=SCI-EXPANDED, SSCI, A&HCI,CPCI-S, CPCI-SSH Timespan=All years
#2	TS=("network" OR "support" OR environment OR "cohesion" OR "capital" OR relation* OR *social) Indexes=SCI-EXPANDED, SSCI, A&HCI,CPCI-S, CPCI-SSH Timespan=All years
#1	TI=(health OR frail* OR vulnerab* OR well-being) Indexes=SCI-EXPANDED, SSCI, A&HCI,CPCI-S, CPCI-SSH Timespan=All years

*For Pubmed*

((("social environment"[MeSH Terms] OR "community networks"[MeSH Terms] OR "social support"[MeSH Terms]))) AND "Frail Elderly"[MeSH Terms] AND (frail\*[Title/Abstract] OR health[Title/Abstract] OR vulner\*[Title/Abstract]) AND English[lang])

*Ovid Pscychinfo*

(health or frail\* or vulnerab\* or well-being).ti. and frail\*.ab. and (network or support or environment or cohesion or capital or relation\* or \*social/).ab.

*Proquest Social Science*

(EconLit (1969 - current) ,ERIC (1966 - current) PILOTS: Published International Literature On Traumatic Stress (1871 - current), Social Services Abstracts (1979 - current), Sociological Abstracts (1952 - current)

S4	ti(health OR frail* OR vulnerab* OR well-being) AND ab(frail*) AND (network OR support OR environment OR cohesion OR capital OR relation* OR *social)
S3	(network OR support OR environment OR cohesion OR capital OR relation* OR *social)
S2	ab(frail*)
S1	ti(health OR frail* OR vulnerab* OR well-being)

## Supplementary Appendix 2: study appraisal

*Adapted Strobe statement – checklist of items that should be included in reports of observational studies:*

Participants: Give the eligibility criteria, the sources and methods of selection of participants.

Data measurement: For each variable for social environment and frailty, give sources of methods of assessment.

Bias: describe any efforts to address potential sources of bias.

Statistical methods: Describe all statistical methods, including those used to control for confounding

Participants: Give numbers of individuals at each stage of study. Response rate.

Descriptive data: summarise follow-up time.

*STROBE Statement—checklist of items that should be included in reports of observational studies*

	Item No.	Recommendation
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found
<b>Introduction</b>		
Background/rational	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
<b>Methods</b>		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up <i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls <i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants (b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed <i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ meas	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias



Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed <i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses
<b>Results</b>		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest (c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time <i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure <i>Cross-sectional study</i> —Report numbers of outcome events or summary measures
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
<b>Discussion</b>		
Key results	18	Summarise key results with reference to study objectives

Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
<b>Other information</b>		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based