Active ageing and quality of life

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Active Ageing and Quality of Life

Community-dwelling older adults in deprived neighbourhoods

Annemiek Bielderman

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TABLE OF CONTENTS

Chapter 1

General Introduction

1

BACKGROUND

The number of older adults worldwide is rapidly increasing. In the Netherlands, 17.4 percent of the total population is aged 65 years and older [1], and this proportion will even increase up to 25 percent in 2050 [2]. Maintaining quality of life for those in this advancing age is an overall goal for policymakers [3,4]. Especially vulnerable groups of the population including frail older adults living in socioeconomically deprived neighbourhoods need specific attention in order to maintain or optimize quality of life.

This chapter begins with providing background information on the scope of this thesis followed by why more extensive insight into the relationship between socioeconomic status and quality of life is required. Furthermore, the research objectives will be provided and, finally, the aims and outline of this thesis are presented.

Physical function at older age

Ageing is associated with a decline in several physiological systems, such as the musculoskeletal, cardiovascular and nervous systems, that influence a person's physical, cognitive, and psychosocial capacity [5]. Consequently, several components of physical fitness, including muscular strength, cardiovascular endurance, flexibility, balance, and reaction time may be negatively influenced by the ageing process [5]. Muscular strength gradually deteriorates with age as a consequence of decreasing muscle mass, i.e. sarcopenia, and alterations in neural control [6,7]. A decline in maximal aerobic performance is related to ageing due to a decrease in cardiac output and oxygen uptake in the muscle [8,9]. Furthermore, older persons perform more inferior in flexibility, balance, and reaction time outcomes compared to younger individuals [5]. These age-related declines in physiological systems affect physical function and the ability to perform everyday physical activities. In addition to age-related declines, diseases may also have negative effects on physical function. Physical activity may prevent or delay this age-related decline throughout the lifespan to optimize physical function during older ages [10].

Frailty

The cumulative age-related decline in multiple physiologic systems during older ages may result in frailty [11,12]. Frailty is characterized by a decline in reserve capacity in those functions that are essential to maintain an acceptable level of physical, social, and psychological functioning [13]. As a consequence of the decreased reserve capacities, frail older adults have an increased risk of negative health-related events such as falls, degenerating disability, hospitalizations, and institutionalization [11,12,14].

Early detection of frailty with feasible screening instruments is crucial in order to initiate further assessment, appropriate care, and specific preventive interventions for

frail, community-dwelling, older adults. Multiple self-report and performance-based screening instruments have been developed over the last few decades based on various definitions. Multidimensional screening of frailty such as the Frailty Index [15], the Sherbrooke Postal Questionnaire (SPQ) [16], the Tilburg Frailty Indicator (TFI) [17], and the Groningen Frailty Indicator (GFI) [13] appears most suitable considering the multidimensional nature of frailty. Psychometric properties of these instruments have been studied in several previous studies [17-19].

Research regarding appropriate frailty screening and assessment is ongoing and in a development stage. Measuring the dynamic and multidimensional nature of frailty poses a specific challenge. Most frailty screening instruments are designed as multidimensional instruments; however, they are often used as one-dimensional scales using a sum score as the homogeneous indicator of frailty. Furthermore, the dynamic nature of frailty implies that instruments should be sensitive to change in order to assess frailty over a period of time.

In this thesis, attention was focused on one specific frailty screening instrument, i.e., the GFI. The GFI seems to demonstrate adequate psychometric characteristics and acceptable accuracy for indicating frailty on a one-dimensional level [12,18-20]. An individual is considered as frail when the GFI sum score is four points or higher [21]. It is ambiguous if the underlying dimensions of the GFI can be assessed separately to facilitate a differentiated assessment of frailty. To answer that question, assessment of the various dimensions of frailty is required, and underlying dimensionality of the GFI should be examined.

Resilience

Inevitably related to the process of ageing is the fact that older adults must cope with the experienced age-related functional limitations, disabilities, and possible frailty. When facing the challenges of ageing, resilience capacities of older adults appear to play a role [22,23]. Resilience refers to a dynamic process encompassing positive adaptation in the context of significant adversity [22,24]. Insights into the resilience level and the type of resources of older adults may be beneficial in order to adequately support them. However, currently, a theory-based instrument to assess resilience in older adults is unavailable, and the majority of instruments that assess resilience were developed for psychiatric patients [25]. An adequate resilience scale should reflect the recent resilience literature and include the potential resources of resilience and protect against common adversities related to the ageing process. The process of coping with age-related issues is very complex and multiple resources are concerned, therefore, a comprehensive multidimensional resilience scale for older adults needs to be developed.

Quality of life at older age

The above mentioned constructs of health, frailty, and resilience are all closely related to a person's quality of life. These constructs share their multidimensional, dynamic, and multiplex nature, and the relationship between these constructs is very complex. Quality of life is defined as a subjective and multidimensional construct that is affected in a complex manner by an individual's physical health, psychological state, level of independence, social relationships, personal beliefs, and their relationship with salient features of their environment [26]. Quality of life is a dynamic construct, is highly individualistic, and is influenced by numerous determinants. Older adults may be vulnerable for deterioration of quality of life due to several factors including diminishing physical and cognitive capabilities and a greater possibility of the deaths of contemporaries or a partner [3].

During older ages, factors such as an inadequate financial situation, depression, and experienced functional limitations may negatively affect quality of life, however, trustful relationships with relatives and living in an appreciated neighbourhood appear to positively influence quality of life [27]. There is evidence that quality of life may increase during the earlier years of old age until the age of ca 68 years and, afterwards, a gradual decline may be experienced [27]. However, with increasing age, the individual differences and the heterogeneity in the population increase. Therefore, maintaining and optimizing quality of life is of substantial importance in older ages, and it is becoming even more important due to prolonged life expectancy. Worldwide, there is an increasing recognition that society must be concerned with optimizing quality of life for people as they age [3,4,28]. To improve quality of life during older ages, gaining a comprehensive understanding of the determinants of quality of life, including socioeconomic status, is of major importance.

Quality of life is a difficult construct to measure adequately. In literature, several perspectives towards quality of life are described, and multiple measures are developed. Measures of health status are often used as a proxy for quality of life [29,30]. The multidimensional nature of quality of life should be reflected in an adequate instrument, therefore, over the last few decades, several research groups developed instruments intending to address gaps in existing instruments. One of these groups developed an instrument that measures quality of life distinguished from contextual and individual phenomena by using a needs satisfaction approach [30] whereby the focus is predominantly on the perceived satisfaction, expectations, and fulfillment of the needs of older adults [31,32]. In this thesis, the CASP-19 questionnaire is employed to measure the broad concept of quality of life by measuring the degree in which human needs are fulfilled in four domains, i.e., control, autonomy, self-realization, and pleasure.

Ageing in a deprived neighbourhood

Socioeconomic factors may influence health and quality of life on different levels, e.g., individual, household, and neighbourhood levels [33,34]. Persons with the lowest and intermediate income and education levels are less healthy than the wealthiest and most educated [35]. Several causal pathways are proposed to explain this relationship such as physiological, environmental, and psychosocial pathways [33,36-38]. Residing in a deprived neighbourhood is associated with several negative health outcomes even after accounting for individual risk factors [39-42].

Socioeconomic status is a compound construct that is often conceptualized as a combination of financial, occupational, and educational influences [43]. In health-related research, education is often exploited as a single parameter and emerged as a strong and consist predictor of good health [43]. Older inhabitants in deprived neighbourhoods develop more adverse physical health outcomes such as decreased mobility and more chronic diseases as well as additional adverse psychosocial health outcomes such as increased feelings of loneliness and depression [40,44-47]. In addition, the prevalence of physical inactivity is greatest in older age groups and residents of socioeconomically deprived neighbourhoods [48-50]. Furthermore, older adults living in deprived neighbourhoods are at risk of developing frailty and becoming care dependent with adverse consequences for a person's quality of life [44,51].

Therefore, it is crucial to determine feasible and effective ways to maintain or improve quality of life for elderly people living in deprived neighborhoods. Elaborated insights into the relationship between socioeconomic status and quality of life are needed to define guiding principles in order to create interventions to improve quality of life in older adults. In addition, understanding older adults' perspectives on ageing may assist in providing appropriate care.

Approach to enhance active ageing: Groningen Active Ageing Strategy

Most available intervention programs are designed for the general population of older adults. These projects often fail to recruit older participants with lower socioeconomic status or living in deprived neighbourhoods. Therefore, approaches should be tailored to the desires and characteristics of this target population.

This thesis reports on a specific approach that has been developed to encourage community-dwelling, physically underactive, older adults living in deprived neighbourhoods to inspire a healthier lifestyle. This approach is referred to as the Groningen Active Ageing Strategy (GAAS). The aim of GAAS is to enhance active ageing and improve quality of life in physically underactive, community-dwelling, older adults residing in deprived neighbourhoods. The GAAS consists of four stages: (1) Tailoring of the project; (2) Recruitment of physically underactive older adults; (3) Applying healthy lifestyle intervention; and (4) Maintenance of behavioural change. In a deprived

neighbourhood in the north of the Netherlands, the GAAS approach was applied in the 'Delfgoud Project'. The effects of this project on quality of life and physical fitness should be established to obtain knowledge of the employability of this approach.

KEY ISSUES OF THIS THESIS

This thesis contains studies on topics relevant for clinical practice and public health in the scope of an ageing society. Various study types are used, and several aged populations are investigated to increase knowledge about assessing frailty and resilience in older adults (*Key Issue 1*), the determinants of quality of life in older adults (*Key Issue 2*), and ageing in a deprived neighbourhood (*Key Issue 3*). Table 1 presents an overview of the different study settings applied in this thesis.

Table 1 Overview of the objectives, study types and study population of the separate chapters of this thesis.

Chapter	Subject and aim	Study type	Study population			
			Aged, 65+	Community-dwelling	Deprived neighbourhood	Physically underactive
2	Screening instrument frailty To evaluate the dimensionality of the GFI.	Cross-sectional	X	X		
3	Assessment instrument resilience To develop and evaluate the GARI.	Cross-sectional	X	X		
4	Determinants quality of life To determine the relationship between QOL, psychosocial functioning, and SES.	Cross-sectional	X	X		
5	Older adults' perspectives on ageing To explore how older adults address ageing issues.	Qualitative	X	X	X	
6	Community-based lifestyle intervention To examine the effects on QOL, physical function, and psychosocial functioning.	Intervention trial	X	X	X	X

GFI = Groningen Frailty Indicator; GARI = Groningen Ageing Resilience Inventory; QOL = Quality of life; SES = Socioeconomic status.

Key issue 1: suitable instruments to identify frailty and resilience in older adults

As noted previously, research regarding appropriate frailty screening and assessment is ongoing and in the development stages. In addition, information about the application of existing instruments on a multidimensional level, such as from the GFI questionnaire, is very limited. Therefore, in this thesis, the aim was to evaluate the underlying dimensionality of the GFI in community-dwelling older adults to test if this instrument is suitable for providing differentiated information about the dimension in which the problems manifest.

Furthermore, a theory based instrument to assess resilience in older adults has not yet been made available. Therefore, this thesis focused on the development of a conceptual model of resilience during the ageing process in which potential resources of resilience will be reflected. Subsequently, it was aimed to develop a multidimensional resilience scale based on this conceptual model which was termed the Groningen Ageing Resilience Inventory. The psychometric properties of this scale will be examined.

Key issue 2: determinants of quality of life in older adults

To improve quality of life in the elderly population, a comprehensive understanding of the determinants of quality of life is of fundamental significance. From literature it is known that socioeconomic status is an important determinant of quality of life. However, it has not been intensively studied whether the relationship between socioeconomic status and quality of life is direct or indirect. In addition, several determinants of quality of life are also associated with socioeconomic status such as social and psychological factors as well as physical function. Therefore, studies investigating the relationship between quality of life and socioeconomic status should incorporate the possibility of direct and indirect effects of other variables such as social functioning, depressive symptoms, global self-efficacy, and physical function. This thesis aims to determine the relationship between quality of life, social functioning, depressive symptoms, self-efficacy, physical function, and socioeconomic status by using structural equation modeling in community-dwelling older adults.

Key issue 3: active ageing in a deprived neighbourhood

In order to provide appropriate care for older adults living in deprived neighbourhoods, insights are needed into the way these older adults address ageing issues. Especially because these older adults are at risk of developing frailty and becoming care dependent. Information regarding these older adults' perceptions is limited. Therefore, this thesis aims to explore the perspectives on ageing among this group of older adults.

Finally, effective and feasible interventions to promote healthy lifestyles in older adults living in deprived neighbourhoods need to be developed. As mentioned previously, to recruit the intended participants, approaches should be specifically targeted to the population. This thesis aims to develop and assess the effectiveness of a community-based intervention targeted at physically underactive, older adults living in deprived neighbourhoods. In the project, participants were trained to manage the project responsibilities in order to attain ownership of the project. The program consisted of weekly group exercise sessions in combination with integrated six-week interval lifestyle modules regarding feelings of depression and loneliness, and physical activity in daily living. This thesis also aims to examine the effects of one-year participation in this intervention on quality of life, including physical functioning, social functioning, and psychological functioning, in underactive, community-dwelling older adults living in a deprived neighbourhood.

OUTLINE OF THIS THESIS

Chapter 2 and 3 contribute to increased knowledge of the assessment of the ageing-related concepts of frailty and resilience. First, the psychometric characteristics of the GFI, a frailty screening instrument, are presented in **Chapter 2**. Structural validity, internal consistency, and criterion validity of the GFI questionnaire were examined in a community-dwelling, older population. In addition, the composition of the GFI subscale scores is presented. The study described in **Chapter 3** evaluated a newly developed instrument that assesses resilience in older adults: the Groningen Ageing Resilience Inventory (GARI).

Chapter 4 contributes to a more comprehensive understanding of the determinants of quality of life in older adults. In this chapter, the relationship between quality of life, social functioning, depressive symptoms, self-efficacy, physical function, and socioeconomic status was determined using structural equation modeling. Path analysis results are presented.

Chapter 5 and 6 focus specifically on community-dwelling, older adults living in deprived neighbourhoods in the Netherlands. In **Chapter 5**, the results of a qualitative study to explore how older adults living in these neighbourhoods address ageing issues are presented. The consequences for community health providers such as the community nurse are specifically described. In **Chapter 6**, the effects of a community-based lifestyle intervention on physical function, psychosocial functioning, and quality of life are presented. In addition, the project approach, in which involvement of the community was essential, and the recruitment method are described.

Finally, the primary findings of the preceding chapters, the theoretical and methodological considerations, and the implications for practice and future research will be discussed in the General Discussion (**Chapter 7**).

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Chapter 2

Multidimensional structure of the Groningen Frailty Indicator in community-dwelling older people

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ABSTRACT

Background Due to the rapidly increasing number of older people worldwide, the prevalence of frailty among older adults is expected to escalate in coming decades. It is crucial to recognize early onset symptoms to initiate specific preventive care. Therefore, early detection of frailty with appropriate screening instruments is needed. The aim of this study was to evaluate the underlying dimensionality of the Groningen Frailty Indicator (GFI), a widely used self-report screening instrument for identifying frail older adults. In addition, criterion validity of GFI subscales was examined and composition of GFI scores was evaluated.

Methods A cross-sectional study design was used to evaluate the structural validity, internal consistency and criterion validity of the GFI questionnaire in older adults aged 65 years and older. All subjects completed the GFI questionnaire (n=1508). To assess criterion validity, a smaller sample of 119 older adults completed additional questionnaires: De Jong Gierveld Loneliness Scale, Hospital Anxiety Depression Scale, RAND-36 physical functioning, and perceived general health item of the EuroQol-5D. Exploratory factor analysis and Mokken scale analysis were used to evaluate the structural validity of the GFI. A Venn diagram was constructed to show the composition of GFI subscale scores for frail subjects.

Results The factor structure of the GFI supported a three-dimensional structure of the scale. The subscales Daily Activities and Psychosocial Functioning showed good internal consistency, scalability, and criterion validity (Daily Activities: Cronbach's $\alpha = 0.81$, $H_s = .84$, $r = -.62$; Psychosocial Functioning: Cronbach's $\alpha = 0.80$, $H_s = .35$, $r = -.48$). The subscale Health Problems showed less strong internal consistency but acceptable scalability and criterion validity (Cronbach's $\alpha = .57$, $H_s = .35$, $r = -.48$). The present data suggest that 90% of the frail older adults experience problems in the Psychosocial Functioning domain.

Conclusions The present findings support a three-dimensional factor structure of the GFI, suggesting that a multidimensional assessment of frailty with the GFI is possible. These GFI subscale scores produce a richer assessment of frailty than with a single overall sum GFI score, and likely their use will contribute to more directed and customized care for older adults.

BACKGROUND

Frailty is characterized by a decline in reserve capacity in different domains of functioning, resulting in a decline in mobility, unintended weight loss, an elevated risk of morbidity, an increase in depression and anxiety, institutionalization, and premature death [1,2]. Due to the rapidly increasing number of older people worldwide, the prevalence of frailty among older adults is increasing and expected to escalate in coming decades [3,4]. In order to prevent the detrimental consequences of frailty, like the loss of balance and the decrease in muscle strength and walking speed, it is crucial to recognize early onset symptoms and then initiate appropriate care and specific preventive interventions. A number of review studies have shown that several interventions may be beneficial for older adults in different stages of frailty [5-8].

Early detection of frailty in older adults is feasible with appropriate screening instruments. These screening instruments measure frailty in various ways [9]. Some measurements are based on a clinical assessment by a geriatrician others use performance-based tests or self-report questionnaires. A number of frailty assessment instruments have emerged in the last decade [1,9-23]. These instruments are designed to screen older adults in a valid and feasible way. The majority of these screening instruments include items on physical frailty characteristics like mobility and nutritional status. Only some instruments include items in multiple frailty domains, like the Frailty Index, the Groningen Frailty Indicator, the Tilburg Frailty Indicator and the Edmunton Frail Scale [9]. Especially frailty instruments used for case finding and screening, evaluate frailty dichotomously: persons are considered as either frail or not frail, regardless of the multiple dimensions measured by the instrument [9].

One of these multidimensional screening instruments is the Groningen Frailty Indicator (GFI). The GFI is a widely used screening instrument for identifying frail older adults [22,24]. The GFI consists of 15 self-report items and is a feasible way to assess frailty in both community-dwelling and institutionalized older people [25,26]. Psychometric studies examining the overall internal consistency of the GFI show a range of Cronbach's α values, from $\alpha = 0.68$ to $\alpha = 0.73$, indicating moderate internal consistency [25-27]. Besides feasibility and reliability, the construct and discriminant validity of the GFI were examined in previous research [26].

However, the GFI is being used as a one-dimensional scale based on an overall sum score of 15 items. A person is considered to be frail when the GFI sum score is 4 points or higher [26,27]. The sum score is used as a homogeneous indicator of frailty, without reference to specific problems like sensorimotor functioning, cognitive functioning, mobility, or psychosocial functioning. Consequently, a variety of different frailty-related problems can lead to a sum score of 4 points. We believe that the GFI has the potential to provide more differentiated information about the salience of specific frailty-related problems, and thus direct a more adequately focused program for the care

and support frail older adults need. For this reason, an assessment of the various dimensions of frailty is obviously needed.

The main objective of this study was to evaluate the underlying dimensionality of the GFI questionnaire for screening frailty in community-dwelling older persons. In addition, we examined the criterion validity of the GFI subscales. Furthermore, we evaluated the composition of GFI subscale scores for subjects identified as frail based on the currently used cutoff score of 4 points.

METHODS

Study design

A cross-sectional study design was used to evaluate the structural validity and criterion validity of the GFI questionnaire in older adults aged 65 years and older. In this study, data of older adults living in a small city in a centrally located region of the Netherlands were used (N = 1508). In a smaller sample (N = 119), we examined the criterion validity of the GFI subscales.

Study sample and data collection

In 2008, 3083 older adults (65 years and older) were approached by their local health authorities to fill in the GFI questionnaire. Besides, a smaller sample of 200 older adults was approached by community centers to fill in the GFI and additional questionnaires. In total, 1508 persons completed the GFI and 119 persons completed the additional questionnaires. Under Dutch legislation, ethical approval was not required in this cross-sectional non-obtrusive observational study. All subjects gave their consent to participate in the study.

Measures

GFI

The GFI is a 15-item screening instrument used to determine the level of frailty [22]. Eight items have two response categories (*yes* / *no*), six items have three response categories (*yes / sometimes / no)*, and one item has a Likert response category (*1–10)*. All items were dichotomized to calculate GFI sum scores. A higher GFI sum score indicates a greater level of frailty, with a maximum score of 15. The GFI is displayed in Appendix 1.

To examine criterion validity, we used four additional scales or subscales: De Jong Gierveld Loneliness Scale [28], Hospital Anxiety Depression Scale (HADS) [29], physical functioning subscale of the RAND-36 [30], and the perceived general health item of the EuroQol-5D [31].

De Jong Gierveld Loneliness scale

The 6-item De Jong Gierveld scale was used to measure loneliness [28]. This 6-item Likert scale is a reliable and valid instrument for measuring overall, emotional, and social loneliness in large surveys of older adults (Cronbach's α = 0.61 - 0.73) [32]. All items have five response categories (*no! / no / more or less / yes / yes!).* After recoding, higher scores indicate greater levels of loneliness.

HADS

The Dutch version of the 14-item HADS was used to assess the presence of anxiety and depressive states independent of coexisting general medical conditions [29]. The HADS consists of an anxiety subscale (7 items) and a depression subscale (7 items). In a general population aged 65 years and over, the reliability of both the anxiety and depression subscales as the total scale varied with Cronbach's α values between 0.71 and 0.8 [29]. Higher scores represent greater anxiety and/or more depressive symptoms.

RAND-36

Self-reported physical functioning was assessed using the 10-item physical functioning subscale of the Dutch RAND 36-item Health Survey (RAND-36). The RAND-36 is a reliable and valid scale for measuring different aspects of health in different age groups [30,33]. The overall scale contains eight subscales: physical functioning, social functioning, role limitations caused by physical health problems, role limitations caused by emotional problems, mental health, vitality, bodily pain, and general health perceptions [30]. The physical functioning subscale is a reliable and valid scale for measuring limitations in daily activities due to health problems (Cronbach's α = 0.92) [30]. The respondent reports to what extent he feels limited in a particular activity (*limited a lot / limited a little / not limited at all).* Raw scores are transformed into index scores ranging from 0 to 100. After transformation, lower scores on the physical functioning subscale indicate more limitations in activities of daily living.

EuroQol-5D

Perceived general health was assessed on a Likert scale of 1 to 10, where 10 represents excellent general health. This item represents one item in the overall EuroQol-5D questionnaire [31].

Statistical analyses

Descriptive statistics were used to report subject characteristics of the study sample. Structural validity is defined as the degree to which the scores are an adequate reflection of the dimensionality of the construct to be measured [34]. Structural validity was assessed using exploratory factor analysis. Exploratory principal component analysis

followed by oblique rotation according to the direct oblimin criterion was conducted to explore factor structure. The number of factors was based on the scree plot evaluation, the size of the eigenvalues, and their confidence intervals. All factors with eigenvalues greater than one were retained. In case an item did not discriminate well between factors, decisions were made based on the content of the item and the results of the reliability analysis of the subscales. Reliability of the factor solution was determined by calculating internal consistency using Cronbach's α with corresponding 95% Confidence Intervals (CI). A Cronbach's α coefficient of ≥0.80 was considered "good," 0.70 – 0.80 "acceptable," 0.60 – 0.70 "questionable," 0.50 – 0.60 "poor," and <0.50 "unacceptable" [35,36].

In addition, scale analysis of the GFI was applied using Mokken item response theory model of monotone homogeneity [37]. Mokken scale analysis tests the homogeneity of the subsets of items of test batteries that are multidimensional by construction [38]. A Loevinger's scalability coefficient (*H*) of 0.30 - 0.39 indicates a weak scale, *H* 0.40 - 0.49 indicates a moderate scale, and *H* ≥ 0.50 indicates a strong scale [39].

Criterion validity is defined as the degree to which the scores are an adequate reflection of a "gold standard" [34]. To establish criterion validity of the observed GFI subscales, the GFI subscales were compared to related reliable and valid scales considered to be gold standards of the individual dimensions. Positive relations were hypothesized between GFI subscale Psychosocial Functioning and HADS and the Jong Gierveld Loneliness scale. Negative relations were hypothesized between GFI subscale Daily Activities and RAND-36 physical functioning scale, and between GFI subscale Health Problems and Perceived general health (EuroQol-5D). Pearson correlations (two-tailed) between GFI subscales and related scales were calculated. A correlation of <0.30 was considered "low," 0.30 – 0.60 "moderate," and > 0.60 "high" [40].

A Venn diagram was constructed to show the composition of GFI subscale scores for all subjects identified as frail based on the currently used cutoff score of 4 points. The diagram provides information about the composition of a score of 4 (or more) points. Only subjects that perceived problems in 25% of the items of each subscale are represented in the Venn diagram. Differences between the groups within the Venn diagram were tested by using the Chi^2 test for categorical data and ANOVA test for continuous data.

For frail older adults, frequency distributions for different age groups were calculated and tested for dependencies by using the Chi^2 test and estimation of a log-linear model. We used the factors indicating age (in categories) and perceived problems in the subscales Daily Activities, Psychosocial Functioning, and Health Problems (score on 25% of the subscale items). To increase power, we treated the latter variables as ordinals.

Data from subjects were excluded from further analyses when more than five items (30%) of the GFI were missing. In total, 17 persons were excluded from further analyses because of missing data on the GFI. In the analyzed sample, 1277 persons had no missing data at all, 194 persons had one missing value, 27 persons had two missing values,

4 persons had three missing values and 6 persons had four or five missing values on the GFI. These remaining missing values were imputed by the logistic regression data imputation method [41].

Data were processed using the statistical software SPSS statistics 19 (SPSS Inc., Chicago, IL, USA) and the R statistical programming system (R Development Core Team, 2011). Statistical significance level was set to $p = 0.05$.

RESULTS

Participants

A total of 1508 persons participated in the study. Age of the respondents ranged from 65 to 97 years, with a mean (SD) age of 75 (7) years; 49.3% were female, and 41.7% were living alone. Table 1 shows the characteristics of all participants.

Table 1 Characteristics of the participants (n = 1508).

	Overall sample (n = 1508)	**Main sample (n = 1389)**	**Smaller sample (n = 119)**	**t (df)† or Chi² (df)‡**	**p**
Mean age (y) ± SD	74.5 ± 6.9	74.3 ± 6.8	77.1 ± 7.7	-3.94 (135.5)†	<0.001*
Age groups, n (%)					
65 – 69 y	418 (29.2)	392 (29.8)	26 (21.8)	20.01 (4)‡	<0.001*
70 – 74 y	363 (25.3)	344 (26.2)	19 (16)		
75 – 79 y	301 (21.0)	274 (20.9)	27 (22.7)		
80 – 84 y	206 (14.4)	181 (13.8)	25 (21)		
> 84 y	145 (10.1)	123 (9.4)	22 (18.5)		
Gender, n (%)					
Male	730 (50.7)	695 (52.7)	35 (29.4)	30.81 (2)‡	<0.001*
Female	709 (49.3)	625 (47.3)	84 (70.6)		
Educational level, n (%)					
Low	644 (47.1)	582 (46.4)	62 (55.4)	5.47 (2)‡	0.065
Middle	507 (37.1)	467 (37.2)	40 (35.7)		
High	216 (15.8)	206 (16.4)	10 (8.9)		
Living situation, n (%)					
Living together	848 (58.3)	807 (60.4)	41 (34.7)	29.37 (1)‡	<0.001*
Single living	606 (41.7)	529 (39.6)	77 (65.3)		
GFI, mean ± SD	3.0 ± 3.0	2.9 ± 3.0	3.4 ± 2.7	-1.77 (1506)†	0.078

GFI = Groningen Frailty Indicator.
* Values are percentages unless indicated otherwise.
† Independent t-test results.
‡ Chi^2 test results.
* $p < 0.05$.

As can be seen in Table 1, the smaller sample differed from the main sample in mean age, gender, and living situation. Compared to the main sample, the smaller sample consisted of persons with a higher average age (77 vs 74 years), relatively more females (71% vs 47%) and more single living persons (65% vs 40%). Educational level and GFI total scores of the smaller sample did not differ significantly from the main sample.

Factor structure of the GFI

Table 2 shows the factor loadings after oblimin rotation and eigenvalues from the principal component analysis. Evaluation of the scree plot and the size of the eigenvalues strongly suggest that the GFI has a three-dimensional structure, explaining 50.6% of the variance. This analysis produced three subscales: (1) Daily Activities (items 1−4), (2) Psychosocial Functioning (items 11−15), and (3) Health Problems (items 5−10).

The rotated factors did not clearly discriminate item 5 ("*How do you rate your physical fitness?"*). Based on content and reliability analysis, this item was assigned to factor 3 (subscale Health Problems). Cronbach's alpha decreased (from .81 to .77) when

Table 2 Factor loadings and eigenvalues from the principal component analysis of the GFI scale (n = 1508).

	Factor*		
	Daily Activities	**Psychosocial Functioning**	**Health Problems**
1. Shopping	**.646**		
2. Walking outdoors	**.848**		
3. Dressing and undressing	**.855**		
4. Going to the toilet	**.848**		
5. Physical fitness	.326	.303	**.252**
6. Vision problems			**.742**
7. Hearing problems			**.737**
8. Unintentional weight loss			**.374**
9. Use of more than three medicines			**.498**
10. Memory complaints			**.339**
11. Experience of emptiness		**.820**	
12. Missing people around		**.803**	
13. Feeling abandoned		**.789**	
14. Feeling sad/dejected		**.708**	
15. Feeling nervous/anxious		**.598**	
Initial eigenvalues (95% CI)	4.42 (4.15-4.69)	1.99 (1.85-2.16)	1.18 (1.10-1.29)
Cumulative variance (%)	29.45	42.74	50.58

GFI = Groningen Frailty Indicator*; CI* = confidence interval.
*Factor loadings <0.30 are not presented, except for item 5. Bold loadings correspond to the subscales.

item 5 was assigned to factor 1 (subscale Daily Activities), and increased (from .47 to .57) when item 5 was assigned to factor 3 (subscale Health Problems).

The GFI subscales Daily Activities and Psychosocial Functioning showed good internal consistency, with Cronbach's α = 0.81 (95% CI = 0.79-0.83) and Cronbach's α = 0.80 (95% CI = 0.78-0.82), respectively. By contrast, the subscale Health Problems showed a poor internal consistency (Cronbach's α = 0.57; 95% CI = 0.54-0.61). In all subscales, Cronbach's α decreased when any of the items were deleted.

Scale analysis of GFI subscales

Table 3 shows the scaling coefficients (*H*) from the Mokken scale analyses for each of the GFI subscales. The subscales Daily Activities and Psychosocial Functioning were identified as strong scales, with H_s = 0.84 and H_s = 0.54, respectively. On the other hand, the subscale Health Problems was identified as a weak scale (H_s = 0.35).

Table 3 Scaling coefficients from Mokken scale analyses for items of the GFI subscales (n = 1508).

Item	Daily Activities (item 1–4)	Health Problems (item 5–10)	Psychosocial Functioning (item 11–15)
	H_i (95% CI) *	H_i (95% CI)	H_i (95% CI)
1	0.89 (0.84-0.95)	0.40 (0.35-0.45)	0.57 (0.54-0.61)
2	0.83 (0.77-0.89)	0.34 (0.28-0.39)	0.56 (0.52-0.61)
3	0.78 (0.71-0.85)	0.28 (0.23-0.33)	0.58 (0.53-0.62)
4	0.83 (0.74-0.91)	0.30 (0.24-0.35)	0.51 (0.47-0.55)
5	-	0.45 (0.39-0.51)	0.47 (0.42-0.51)
6	-	0.29 (0.23-0.35)	-
H_s	0.84 (0.78-0.89)	0.35 (0.31-0.39)	0.54 (0.50-0.57)

H_i, = scaling coefficient of item; H_s = scaling coefficient of total subscale;
GFI = Groningen Frailty Indicator; *CI* = confidence interval.
*Interpretation Loevinger's scaling coefficients: H_s of 0.30 - 0.40 indicates a weak scale; H_s of 0.40 – 0.50 indicates a moderate scale; H_s >0.50 indicates a strong scale.

Criterion validity of GFI subscales

We assessed the criterion validity of GFI subscales by calculating correlation coefficients among the subscales and four related scales (Jong Gierveld Loneliness Scale, HADS, physical functioning subscale of the RAND-36, HADS, and perceived general health item of the EuroQol-5D) (see Table 4). The subscale Daily Activities was strongly correlated with the RAND-36 physical functioning scale (r = –0.62). The subscale Psychosocial Functioning was strongly correlated with the HADS (r = 0.67) and the Jong Gierveld loneliness scale (r = 0.67). The subscale Health Problems was moderately correlated with the general health rating of the EuroQol-5D (r = –0.48). Furthermore, moderate correlations were found between the Health Problems subscale and the RAND-36 physical functioning (r = –0.53), the HADS (r = 0.36), and the Jong Gierveld Loneliness Scale (r = 0.37). The rating of general

Table 4 Pearson correlations between the GFI subscales and related scales (n = 119).

	RAND-36 Physical Functioning	Perceived general health (EuroQol-5D)†	HADS	De Jong Gierveld Loneliness scale
GFI subscale:	*r* (95% CI)	*r* (95% CI)	*r* (95% CI)	*r* (95% CI)
Daily Activities	**−0.617*** **(−0.72 - −0.49)**	−0.308 (−0.46 - −0.13)	0.264 (0.08 - 0.43)	0.003 (−0.18 - 0.19)
Health Problems	−0.525 (−0.64 - −0.38)	**−0.480*** **(−0.66 - −0.41)**	0.355 (0.18 - 0.51)	0.367 (0.20 - 0.52)
Psychosocial Functioning	−0.237 (−0.40 - −0.06)	−0.439 (−0.58 - −0.28)	**0.668*** **(0.55 - 0.76)**	**0.671*** **(0.59 - 0.76)**

GFI = Groningen Frailty Indicator; *HADS* = Hospital Anxiety and Depression Scale; *CI* = confidence interval.
* Bold loadings represent related scales.
† Perceived general health item of the EuroQol-5D questionnaire.

health was moderately correlated with all three GFI subscales—Daily Activities, Health Problems, Psychosocial Functioning (r = –0.31, r = –0.48, r = –0.44, respectively).

Composition of GFI score for frail subjects

Figure 1 gives a Venn diagram representation of the distribution of the subscale scores for all subjects with a total GFI score of ≥4 (N = 540). For about one quarter of the frail subjects (26.9%), the GFI score was exclusively composed of perceived problems in one domain. In just a limited number of subjects, the GFI score was exclusively composed of perceived problems in the Daily Activities domain (0.9%) or the Health Problems domain (4.1%). For 21.9% of the frail subjects, the Psychosocial Functioning domain contributed exclusively to the GFI scores.

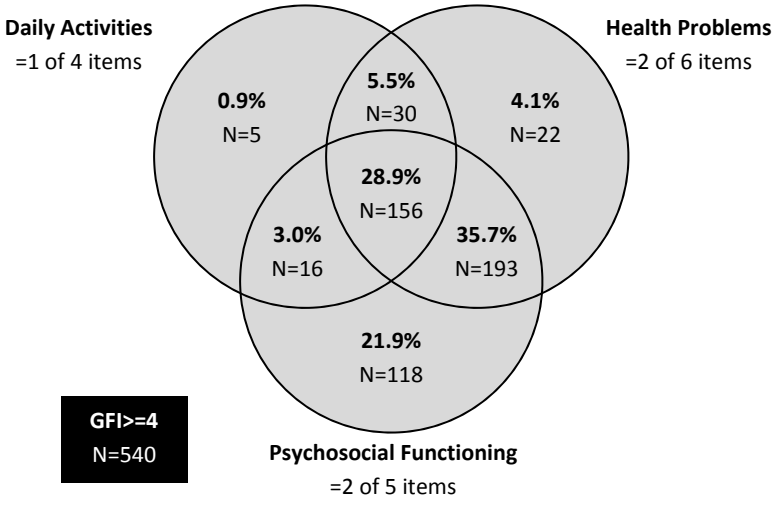

Figure 1 Venn diagram of the frequency distribution of subscale scores for persons with a total GFI-score ≥4 (n = 540).

For almost half of the frail subjects (44.3%), the GFI score was composed of perceived problems in two domains. In only a limited number of subjects, the GFI score was composed of problems in both the Daily Activities and Psychosocial Functioning domains (3.0%), or composed of both the Daily Activities and Health Problems domains (5.5%). For 35.7% of the subjects, both the General Health and the Psychosocial Functioning domain contributed to the GFI scores. In total, 28.9% of the subjects experienced problems in all three domains of frailty.

The Venn diagram revealed three groups: persons with problems in one subscale (N = 145), those with problems in two subscales (N = 239), and those with problems in all three subscales (N = 156). Table 5 shows the characteristics of these subjects. Subjects that had problems in multiple subscales were significantly older, on average ($p < 0.001$), and had attained a significantly lower educational level ($p = 0.004$) than those with problems in only one subscale. Gender, living situation, and financial status did not differ between any of the three groups ($p > 0.05$).

Table 5 Percentages of frail persons (GFI≥4) who experience problems in one, two, or three GFI domains (n = 540)*.

	One Domain (n = 145)	**Two Domains (n = 239)**	**Three Domains (n = 156)**	**F (df)† or Chi² (df)‡**	**p**
Mean age (y) ± SD	73.54 ± 5.99	77.46 ± 6.84	80.71 ± 7.19	41.14 (2)†	<0.001§
Age groups					
65 – 69 y	27.1	15.2	9.4	76.63 (8)‡	<0.001§
70 – 74 y	31.4	16.5	10.7		
75 – 79 y	25.0	30.4	20.8		
80 – 84 y	11.4	22.8	26.2		
> 84 y	5.0	15.2	32.9		
Gender					
Male	41.0	43.3	32.0	5.02 (2)‡	0.081
Female	59.0	56.7	68.0		
Educational level					
Low	44.6	60.6	65.7	15.26 (4)‡	0.004§
Middle	40.0	31.7	25.0		
High	15.4	7.7	9.3		
Living situation					
Living together	41.0	43.7	43.7	0.30 (2)‡	0.861
Single living	59.0	56.3	56.3		
Financial status					
No financial problems	83.9	77.2	79.0	2.41 (2)‡	0.299
Financial problems	16.1	22.8	21.0		

GFI = Groningen Frailty Indicator.
* Values are percentages unless indicated otherwise.
† One-way ANOVA test results.
‡ Chi² test results.
§ $p < 0.05$.

Among frail subjects, the Chi^2 test revealed dependency between age and the domains Daily Activities ($Chi^2 = 45.72$; df = 4; $p < 0.001$) and Health Problems ($Chi^2 = 38.69$; df = 4; $p < 0.001$). The data provided no support for an increase of psychosocial problems with increasing age ($Chi^2 = 5.04$; df = 4; $p = 0.284$). ANOVA revealed interactions between age and Health Problems ($p < 0.001$), and age and Daily Activities ($p < 0.001$). Age did not interact with Psychosocial Functioning ($p = 0.433$).

DISCUSSION

In this study, we examined the structural validity and criterion validity of the GFI questionnaire in older adults. In addition, we evaluated the composition of GFI scores for frail older adults. Our findings support a three-dimensional factor structure of the GFI, in terms of the subscales Daily Activities (items 1–4), Psychosocial Functioning (items 11–15), and Health Problems (items 5–10). This model explains 50.6% of the overall variance. The internal consistency, scalability, and criterion validity of the GFI subscales Daily Activities (Cronbach's $\alpha = .81$, $H_s = .84$, $r = -.62$) and Psychosocial Functioning (Cronbach's $\alpha = .80$, $H_s = .54$, $r = .67$) are good. Consequently, both subscales identify problems in these frailty domains in a reliable and valid way. The internal consistency, scalability, and criterion validity of the GFI subscale Health Problems is less strong (Cronbach's $\alpha=.57$, $H_s=.35$, $r=-.48$). We surmise that the poor reliability and weak scalability of the Health Problems subscale is due to the heterogeneity of items pertaining physical health problems perceived by older adults. The Venn diagram showing the distribution of all subjects with a total GFI score of ≥4 revealed that 27% of older adults had problems in only one domain, 44% had problems in two domains, and 29% had problems in all three domains (see Figure 1). Furthermore, the present data suggest that 90% of the frail older adults experience problems in the Psychosocial Functioning domain.

In the literature, frailty is hypothesized to arise from multiple causes and to affect multiple domains of physical and cognitive functioning [9,42,43]. In different models of frailty, like the Functional Domains model (the accumulation of deficits), the Burden model (the index of health burden) and the Biologic Syndrome model (frailty as a biological syndrome) multidimensional screening instruments are considered to be most appropriate in screening frailty [44]. Although the conceptualization of the multiple domains of frailty is generally used, there is no agreement about the included dimensions in frailty instruments [11,15,45].

In the assessment of frailty, screening instruments are mostly employed in a one-dimensional way. Originally, the GFI applied a cutoff point of a sum score of 4 points or higher, regardless of the number of domains in which an older adult faced problems. In addition, other screening instruments that distinguish different domains, like the Tilburg

Frailty Indicator and the Edmunton Frail Scale, also use total sum scores to identify frail older adults [11,46].

We suggest the results of our study may improve the adequacy of screening on frailty and will offer specific indications for intervening in the early onset of frailty. In this study, three separate dimensions of the GFI were established. These results lend support to the use of the GFI screening instrument as a multidimensional tool for the analysis of frailty. When we compare our multidimensional analysis with the originally used one-dimensional approach, as we showed in the Venn diagram, we now get a clearer picture of the underlying problems in the frailty sum scores. Therefore, we question the use of an overall cutoff point to identify frail older adults. It is clinically relevant to use the GFI as a multidimensional scale consisting of three subscales in order to direct the most appropriate care and to provide focused support to older adults facing problems in the different dimensions of frailty. Besides providing support for the use of the GFI screening instrument in a multidimensional way, the present study prompts a fundamental question about using an overall score without delineating specific frailty problems. The question is: Which combinations of pre-conditions are in fact essential for a valid assessment of frailty? The lack of a conceptual model in which frailty is specified results in overestimation and inconsistent identification of frailty in older adults. We propose exploring the possibility of using a conditional cutoff score, one based on *both* the sum score and the subscale scores. We believe this is necessary for establishing a more convergent diagnosis.

We suggest employing a multidimensional assessment of frailty with the GFI, one that uses a conditional cutoff point to establish a more convergent diagnosis of frailty. Because frailty is characterized by a decline in reserve capacity in *different* domains of functioning, we may consider a person to be frail if he or she obtains a GFI sum score of at least 4 points and reports problems in at least two domains of frailty.

A number of relevant methodological issues should be considered in interpreting the results of this study. First, the design was cross-sectional. Thus, we did not evaluate screening results of the GFI over time. Since frailty is a dynamic process that may be reversible, it is relevant to establish the sensitivity of the GFI as a screening instrument [47,48]. So far, the GFI is not been used as an evaluative measurement instrument. Longitudinal studies should clarify the potential of the GFI as an evaluative measurement instrument to assess the changes in frailty status over time.

Second, item 5 of the GFI ("*How do you rate your physical fitness?*") did not discriminate well among the factors. This finding may be explained by the fact that physical fitness is a multidimensional construct including multiple subcomponents. Furthermore, item 5 is a self-reported measure of physical fitness. It is known that levels of self-reported functioning may be influenced by affective functioning of an older adult [49]. Therefore, the content of item 5 seems to be covered best by the subscale Health

Problems, and reliability analysis supports its assignment (higher Cronbach's α) to this subscale.

Third, a number of relevant personal characteristics were not taken into account in the analyses of our psychometric study. Since our data originated from epidemiological data collected by local health authorities, it contained a limited number of biographic and behavioral data. Therefore, in this study, we could not assess the impact of chronic diseases that may have been present, daily physical activity, physical fitness, and pharmaceutical consumption. It is likely relevant to control for these characteristics to gain more insight into applying the GFI.

CONCLUSIONS

The use of GFI subscale scores is directly relevant to the care of older adults. In our study, we identified three GFI subscales for assessing frailty more specifically. These GFI subscale scores produce a richer assessment of frailty than with the overall sum GFI score, and likely their use will contribute to more directed and customized care for older adults.

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APPENDIX 1

The Groningen Frailty Indicator (GFI)

Daily Activities

Are you able to carry out these tasks independently without any help? The use of resources such as walking stick, walking frame, wheelchair, is considered independent.

1. Shopping
2. Walking around outside (around the house or to the neighbors)
3. Dressing and undressing
4. Going to the toilet

Health Problems

5. How do you rate your physical fitness? (scale 0 to 10)
6. Do you experience problems in daily life due to poor vision?
7. Do you experience problems in daily life due to being hard of hearing?
8. During the last 6 months, did you lost a lot of weight unwillingly? (3 kg in 1 month or 6 kg in 2 months)
9. Do you take 4 or more different types of medicine?
10. Do you have any complaints about your memory?

Psychosocial Functioning

11. Do you sometimes experience an emptiness around you?
12. Do you sometimes miss people around you?
13. Do you sometimes feel abandoned?
14. Did you felt downhearted or sad recently?
15. Did you felt nervous or anxious recently?

Scoring:
Questions 1–4: Yes = 0; No = 1
Question 5: 0–6 = 1; 7–10 = 0
Questions 6–9: Yes = 1; No = 0
Question 10: Yes = 1; Sometimes = 0; No = 0
Question 11–15: Yes = 1; Sometimes = 1; No = 0

Chapter 3

Building from a conceptual model of the resilience process during ageing, towards the Groningen Ageing Resilience Inventory

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ABSTRACT

Background Ageing is a process that is often accompanied by functional limitation, disabilities and losses. Instead of focusing on these negative events of ageing, there are opportunities in focusing on adaptation mechanisms, like resilience, that are helpful to cope with those adversities. Aim of this study is to develop and psychometrically test the Groningen Ageing Resilience Inventory.

Method The cross-sectional study was conducted from 2011–2012. First, a conceptual model of resilience during the ageing process was constructed. Next, items were formulated that made up a comprehensive template questionnaire reflecting the model. Finally, a cross-sectional study was performed to evaluate the construct validity and internal consistency of this template 16-item questionnaire.

Findings Participants (N = 229) with a mean age of 71.5 years, completed the template 16-item Groningen Ageing Resilience Inventory, and performance based tests and psychological questionnaires. Exploratory factor analysis resulted in a two factor solution of internal and external resources of resilience. Three items did not discriminate well between the two factors and were deleted, remaining a final 13-item questionnaire that shows evidence of good internal consistency. The direction and magnitude of the correlations with other measures support the construct validity.

Conclusions The Groningen Ageing Resilience Inventory is a useful instrument that can help nurses, other healthcare workers, researchers and providers of informal care to identify the internal and external resources of resilience in individuals and groups. In a multidisciplinary biopsychosocial approach this knowledge provides tools for empowering older patients in performing health promoting behaviors and self-care tasks.

INTRODUCTION

Ageing is a process that is often accompanied by functional limitation, disabilities and losses. Instead of focusing on these negative events of ageing, there are opportunities in focusing on adaptation mechanisms, like resilience, that are helpful to cope with those adversities. Resilience is a relatively new concept in the field of health sciences. Resilience refers to a dynamic process encompassing positive adaptation in the context of significant adversity [1]. The concept emerged in the seventies and eighties from the research of pioneering psychologists, primarily interested in child development [2-4]. Over the last 20 years, resilience has repeatedly emerged in the field of ageing and has been recognized as a useful concept identifying factors of successful ageing.

Several conditions define the dynamic process of resilience [1,5,6]. Resilience is a result of adversity such as discrete adverse experiences, cumulative risk factors, acute trauma or chronic life difficulties [7]. The consequence or outcome of the resilience process in response to adversity is positive adaptation, effective coping or mastery. Furthermore, the resilience process is highly influenced by protective factors that modify the negative effects of the adversity in a positive direction [7]. Protective factors are described as individual or internal assets and social or external resources [6,8,9].

There are differences in resilience related coping-mechanisms across the life-span [10]. Focusing on the older population, van Kessel (2013) performed a meta-synthesis of qualitative descriptions and found internal factors like caring for self, spirituality, orientation to the future, life experience, meaningfulness, caring for others, acceptance and environmental factors, such as social support and ability to access care [9]. Protective factors are contextual, situational and individual and lead to varying outcomes; protective factors that are beneficial for one individual may not be present or beneficial for another individual [11]. When this is taken in account, resilience can be a useful concept in determining the kind of resources that can help older adults to cope with the adversities of later life by developing skills to regain a level of physical or emotional health. Increase in knowledge of the concept offers opportunities for enhancing those skills.

BACKGROUND

Most instruments that assess resilience were developed for psychiatric patients, adults with anxiety, depression or post-traumatic stress disorder [12]. We identified three resilience scales that are appropriate for, or were tested in older populations. The Connor Davidson Resilience Scale was originally developed for people with anxiety disorders like Posttraumatic Stress Disorder, however, was tested in a sample community-dwelling older women as well [13]. Exploratory factor analysis yielded four factors, however, only internal consistency for the total scale was reported with a Crohnbach's α of 0.92. The

Resilience Scale (RS) was originally developed and psychometrically tested in mostly elderly unmarried women [14]. The scale is one-dimensional with items that generally address dispositional personality aspects of resilience. However, it might be useful to measure physical, psychological and emotional characteristics of resilience as well [15]. Hardy et al. (2004) developed a 6-item scale that assessed resilience in community-dwelling older adults in response to a specific life event identified by the respondent [16]. This instrument specifically focusses at a particular stressful life event in the last five years and does not focus at other sources of adversity during ageing, like accumulation of physical, psychological or social stressors in daily functioning.

In conclusion, a comprehensive multidimensional resilience scale for older adults is needed, developed from a theory based model reflecting potential resources of resilience protecting against common adversities related to the ageing process. As both the proportion of older people, and the life expectancy increases, many people will be facing the challenges of ageing. Measuring resilience in the context of promoting successful ageing, should integrate a multidisciplinary biopsychosocial approach to focus at the potential useful assets older patients possess to overcome adversity.

METHODS

The aim

The purpose of the study was to develop and test the psychometric properties of the Groningen Ageing Resilience Inventory (GARI). By identifying internal and external resources that could help to positively adapt to those adversities, we aspire to give a comprehensive, valid and reliable measure of resilience.

Methodology

The GARI was developed in different stages. In the first stage a conceptual model was developed to give the basis for item generation. In the second stage, items were formulated, by a group of experts in the field of ageing, that reflect the model and constitute a comprehensive resilience questionnaire for older adults. In the last stage, a cross-sectional study was performed to evaluate the construct validity and internal consistency of the newly developed GARI. In addition to the GARI, the following psychological and physical measurements were administered to get more insight in the composition of the research population. Furthermore, they were used to analyse the construct validity of the GARI. These measurements give more insight in the level of frailty and psychological and physical fitness of the research population. Because resilience is a concept that can help to indicate the level of adaptive coping mechanisms, we were interested in these variables that are expected to reveal something about the adversities

that this research population deals with, like frailty, decline of physical health, loneliness and psychological issues. Therefore, in the descriptive statistics these variables reveal characteristics on the psychological and physical hardships and for the construct validity we expect the presence or absence of certain relationships between these characteristics and resilience.

Frailty

The Groningen Frailty Indicator (GFI) is a 15-item screening instrument used to determine the level of frailty [17,18]. Eight items have two response categories (yes/no), six items have three (yes/sometimes/no) and one item has ten (1–10). All items were dichotomized to calculate GFI sum scores. A higher GFI sum score indicates a greater level of frailty, with a maximum score of 15. A person with a total score of 4 or more points is considered to be frail.

Quality of life

The CASP-19 questionnaire was used to measure the broad concept of quality of life based on a need satisfaction approach. CASP-19 is an instrument that is extensively used to assess the quality of life in older adults and comprises 19 items in four domains: (C) control, (A) autonomy, (S) self-realization and (P) pleasure [19]. The first letter of each domain label are joined together to create the acronym, CASP. The CASP-19 is developed from a needs satisfaction approach and measures the degree to which human needs are fulfilled. The validity and reliability of the CASP has been previously documented in a population of older persons. In British older adults, the reliability and validity was satisfactory (α = 0.55–0.86; r = −0.58) [20]. The items have four response categories (often/not often/sometimes/never). The range of the CASP-19 is 0 to 57, with the higher scores indicating a better quality of life.

Social network size

Social network size was assessed using the 6-item Lubben Social Network Scale (LSNS). This 6-item scale is a valid and reliable scale to assess the size of the family and friends network (α = 0.83; congruent validity r = 0.68–0.78) [21]. Higher scores indicate a more extensive social network.

Depression

Depression was measured with the Dutch version of The Center for Epidemiologic Studies Depression Scale (CES-D). The self-report 20-item CES-D scale is valid and reliable to measure depressive symptoms and behaviors experienced during the previous week in older adults (α = 0.79–0.92; r = 0.73–0.83) [22]. All items have four response categories

(rarely or never/sometimes or little/regular/mostly or always). Higher scores indicate more elevated levels of depression.

Loneliness

The 6-item De Jong Gierveld scale was used to measure loneliness [23]. This 6-item Likert scale is a reliable and valid instrument for measuring overall, emotional and social loneliness in large surveys of older adults (Cronbach's α = 0.61-0.73). All items have five response categories (no! / no / more or less / yes / yes!). After recoding, higher scores indicate greater levels of loneliness.

Self-efficacy

Self-efficacy was assessed with the Dutch version of the 16-item General Self-Efficacy Scale (ALCOS) that includes three subscales: competence, initiative and perseverance [24]. The Dutch version of the General Self-Efficacy Scale appeared moderately reliable to measure generalized expectations of self-efficacy (α = 0.81) [25]. All items incorporate five response categories (totally disagree/disagree/neutral/agree/totally agree). A higher score indicates a diminished level of general self-efficacy.

Physical function

Physical function was measured with four validated and standardized performance based tests.

Leg strength was assessed using the 30-seconds Sit-To-Stand Test [26]. The number of complete sit-to-stands in 30 seconds without using arms was counted.

Aerobic endurance was assessed by using the Two Minute Step Test [26]. During this test, the participant marched in place for two minutes while lifting the knees. The total number of times the knee was lifted was counted.

Dynamic balance was assessed employing the Timed Up-and-Go Test [27]. The time required to rise from the chair, walk to a cone and return to the seat, all as quickly as possible, was measured. The best score from two trials was recorded.

Grip strength was assessed using a handheld dynamometer (Jamar). The participant was instructed to squeeze with maximum force using the dominant hand. The highest score from three trials was recorded.

Statistical analysis

The analyses were performed using the Statistical Package for the Social Sciences (SPSS Inc.) 20 for Windows and the R statistical programming system (R Development Core Team 2013). Questionnaires with more than one missing item were deleted, questionnaires with one missing item were imputed with the mean of the total score.

Construct validity is defined as the degree to which the scores are an adequate reflection of the dimensionality of the construct to be measured [28]. Construct validity was assessed using exploratory factor analysis. Exploratory principal component analysis followed by oblique rotation according to the direct Oblimin criterion was conducted to explore factor structure. The direct Oblimin rotation was applied, because the underlying factors of resilience are related and therefore correlation between factors is permitted. The number of factors was based on Scree plot evaluation, size of eigenvalues and their confidence intervals. All factors with eigenvalues significantly greater than one were retained. In case an item did not discriminate well between factors in the sense of having loadings >0.250, it was deleted from further analysis. In addition, scale analysis of the GARI was applied using Mokken item response theory model of monotone homogeneity [29]. Mokken scale analysis tests the homogeneity of the subsets of items of test batteries that are multidimensional by construction [30]. A Loevinger's coefficient (H) 0.30–0.39 indicates weak, H 0.40–0.49 moderate and H ≥ 0.50 strong scalability [31].

Internal consistency was determined by calculating Cronbach's α with corresponding 95% confidence intervals (CI). A Cronbach's α coefficient ≥ 0.80 was considered 'good,' 0.70–0.80 'acceptable,' 0.60–0.70 'questionable,' 0.50–0.60 'poor,' and <0.50 'unacceptable'. Stepwise deletion was performed to determine if the α changed in the absence of any items.

To analyse the construct validity of the GARI further, we hypothesized associations between resilience and other measures in terms of the magnitude and direction of the correlations. These hypotheses are based on correlations found in earlier research [9,10,13]. We suggest there is no association between resilience and age, and low associations with physical health. Resilience can be achieved both at young and old age and people with low health status can still be very resilient and able to adapt to the situation. Although resilience is a different concept, it is probably more related to other psychological measures. Depression and a low quality of life influences the positive attitude towards the future and a low self-efficacy inhibits someone's believe to overcome problems. When loneliness is present, or a small social network, there are probably little external support systems had can help someone to adapt. Therefore, we expect low to moderate associations of resilience with the: CES-D (depression), De Jong- Gierveld (loneliness), CASP (quality of life) and the ALCOS (self-efficacy). The association with depression, self-efficacy and loneliness will be in the opposite direction.

Sample and participants

The validation study of the GARI took place in a large lifestyle intervention study. In 2011–2012, a random sample of 1976 older inhabitants was selected by the municipality from both socioeconomically deprived and socioeconomically average neighbourhoods of a mid-sized city, in the northern part of the Netherlands and was informed and invited for

participation in the study. Participants were recruited door to door, were aged 65 years and older and were community-dwelling. Candidate participants were excluded when they did not demonstrate enough mobility to move independently. A sample of 293 participants was willing to participate in the study and eligible to complete the template 16-item GARI questionnaire and additional performance based tests and questionnaires.

Instrument

The GARI was developed in two phases. The first phase was to construct a theoretical model that schematically represents the resilience process during ageing. This model should represent the conditions that define the dynamic process of resilience. Therefore, we first identified common adversities that occur during the ageing process. These adversities are often related to characteristics of frailty: a multidimensional concept reflecting functional limitation, disabilities and psychosocial problems. We retrieved several frailty domains from three frailty measurement instruments: the Frailty Index (FI) [32], the Groningen Frailty Index (GFI) [17] and the Frailty Phenotype [33]. These frailty domains comprise the starting point of the model (Figure 1).

The next step was to identify resources of resilience, reflecting the capacities to adapt to those adversities during ageing. For this purpose, a selection among various sources of literature was used; i.e., analyses of the resilience concept [5,6,9], psychometric studies of resilience scales [14,34,35], multimethod approach studies [7,36] and qualitative studies in samples of older adults [37-40]. When a resilience resource was mentioned in at least two different studies, it was further clustered into subcategories of resources that are related to each other. Resilience appears to have a small cluster of external resources, like social support and secure relationships and a large cluster of internal resources, like self-determination and positive emotions that enable people to 'bounce back' from difficult experiences and adapt well (Figure 1). The final part of the model represents the different outcomes of the resilience process; persons can regain a level of emotional and physical health after adverse events, sometimes with gains and sometimes with losses [41].

In the second phase, items were formulated that reflect the model and constitute a comprehensive resilience questionnaire for older adults. Therefore, a group of experts in the field of ageing from the Northern of the Netherlands were invited to formulate the items. We defined experts as having over five years of professional (clinical or scientific) experience in the field of ageing and health. The experts were a psychologist, two physiotherapists and two scientists in the field of ageing who had both clinical- and scientific experience and publications on ageing research. They were asked to formulate items on the basis of the model, that reflect a resource to overcome the adverse events during ageing. Ten older adults completed this preliminary questionnaire of 26 items and

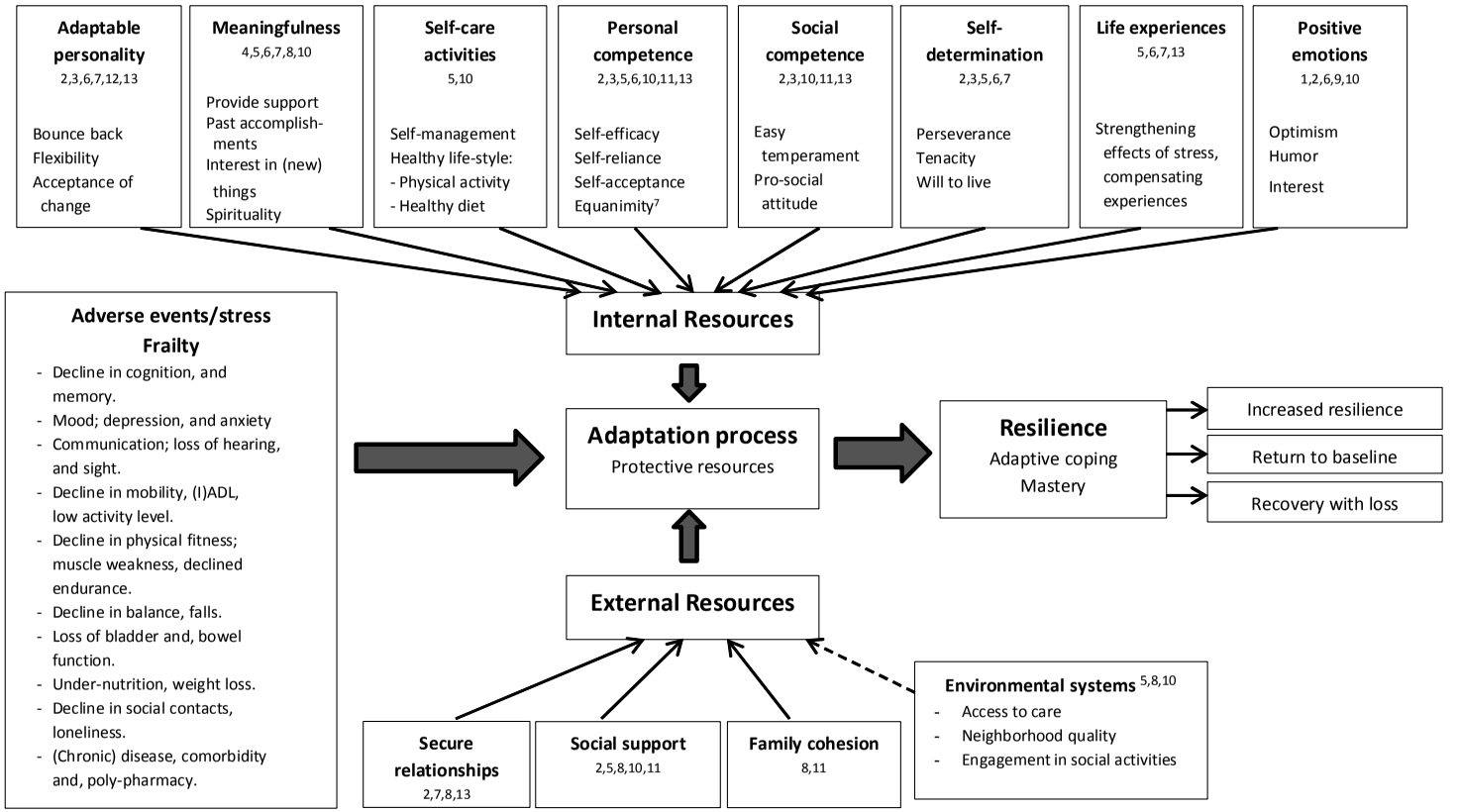

Figure 1 Conceptual model of the resilience process during ageing.
1: Ong *et al.* (2009); 2: Earvolino-Ramirez (2007); 3: Dyer & Mc Guinness (1996); 4: Kinsel (2005); 5: Felten & Hall (2001); 6: Wagnild & Young (1996); 7: Connor & Davidson (2003); 8: Janssen *et al.* (2011); 9: Tugade & Frederickson (2004); 10: Wiles *et al.* (2012); 11: Friborg *et al.* (2003); 12: Sinclair & Wallston (2004); 13: Baruth & Carrol (2002).

marked the questions they did not fully understand. When questions were not clear for two or more participants they were removed or rephrased. This resulted in a template questionnaire of 16 items reflecting internal and external resources of resilience (Appendix 1). Responses were rated on a 5 point Likert scale ranging from never (1) - always (5).

Ethical considerations

The study has been approved by the ethical committee of the Institute of Human Movement Sciences Groningen and has been performed in accordance with the ethical standards as stated the 1964 Declaration of Helsinki and its later amendments. All persons granted their informed consent prior to their inclusion in the study.

RESULTS

A total of 293 older adults were asked to fill out the questionnaires. Sixty-four cases were deleted because of more than one missing item, 57 of those 64 participants did not respond to any of the questionnaires. Fourteen cases with only one missing item were imputed with the mean value of the questionnaire. A total of 229 questionnaires were analysed. The characteristics of the participants are shown in Table 1. Mean age of the participants is 71.5 years, 44 % are men and 20 % of the population is moderately to severely frail. The research sample shows a low level of loneliness and depression, a moderate quality of life and a considerable level of self-efficacy.

The exploratory principal component analysis followed by oblique rotation resulted in a two factor solution explaining 48.2% of the variation (Table 2). Table 2 further shows the factor loadings of the items, Eigenvalues and the cumulative variance. The two subscales correspond with the internal and external resources of the resilience construct. Items 2, 4, 7, 8, 13, 14, 15 and 16 reflect internal resources and items 5, 9, 10 and 11 reflect external resources of resilience. Item 3, 6 and 12 are removed from the template questionnaire and from further analysis, because these items were not sufficiently discriminative in the sense of having a factor loading > 0.25. Table 3 shows the scaling coefficients (H) from the Mokken scale analyses for each of the GARI subscales. The subscale 'internal resources' was identified as a moderate scale, with H_s = 0.42. The subscale 'external resources' was identified as a strong scale, with H_s = 0.52.

The total scale shows good internal consistency with a Crohnbach's α of 0.85. This also applies to the subscales of the internal and external resources with a Crohnbach's α of, respectively, 0.83 and 0.79. The α's did not improve in the absence of any of the items.

Table 1 Characteristics of the participants (n = 229).

	Percentage or Mean (SD) [range]
Gender	
Men	44
Women	56
Marital status	
Married	77
Divorced	3
Widow(er)	15
Single	3
With a partner	2
Education	
Low	23
Average	65
High	12
Frail	20
Age (years)	71.5 (5.3) [65-92]
Loneliness	1.0 (1.4) [0-6]
Depression	6.3 (6.2) [0-60]
Quality of life	30.9 (4.0) [0-57]
Self-efficacy	38.2 (7.9) [16-80]

Table 2 Factor loadings and Eigenvalues from the principal component analysis of the GARI.

		Factor loadings	
		Internal resources	External resources
4.	I enjoy learning new things at my age	**.855**	-.232
13.	I enjoy participating in new activities at my age	**.812**	-.226
16.	I have confidence in my body to do outdoor activities	**.647**	.040
14.	I tend to bounce back after hardship	**.604**	.170
1.	I am optimistic	**.598**	.246
15.	I use practical solutions to cope with ageing	**.572**	-.025
8.	I am a flexible person	**.553**	.224
7.	I can easily start a conversation	**.552**	.123
2.	I give my best effort to stay physically active	**.538**	-.064
6.	I feel my life still means something to others*	**.535**	.261
3.	During hard times, I trust things will get better*	**.505**	.284
12.	Past experiences give me confidence in new challenges*	**.428**	.345
9.	I can share good and bad times with family and friends	.099	**.775**
5.	When sick, I can count on help from friends or family	.031	**.740**
11.	When I feel down or lonely, I have someone to turn to	.095	**.732**
10.	I have close contacts with my family	-.087	**.731**
	Initial Eigenvalues	6.03	1.68
	Cumulative variance (%)	37.7	48.2

* These items were removed from the scale due to cross loadings on both scales >0.25.
The bold values represent the highest factor loadings.

The mean total score on the remaining 13 items of the GARI is 54.4 (SD 4.2) within a range 5–65. The remaining nine items of subscale 'internal resources' have a scoring range from 9-45. The mean score in the 229 participants is 37.1 with a minimum score of 26 and a maximum score of 45 points (Figure 2a). The four items of the subscale 'external resources' have a scoring range from 4 to 20; participants have a mean score of 17.4 within a range of 7–20 (Figure 2b). It seems that there is a relative high level of resilience measured with the GARI in this research population, particularly in the external resources. An independent T-test revealed no statistically significant difference in mean resilience scores between men and women. The content validity is adequate, because the items of the GARI cover the internal and external domains in the resilience model based on the concept analysis presented in Figure 1. The correspondence between the items and domains are shown in Appendix 1.

The hypotheses of the direction and magnitude of the correlations of the resilience construct with other measures support the construct validity of the GARI (Table 4). There is no correlation between the GARI subscales and age, or the subscale 'external resources' and physical health. There are low correlations between the subscale 'internal resources' and physical health, like leg strength, grip strength, balance and endurance. There are low correlations between the GARI subscales and psychological measures like loneliness, social network and quality of life. There is a moderate correlation between the subscale 'internal resources' and depression.

Table 3 Scaling coefficients from Mokken scale analyses for items of the GARI subscales (n = 229).

	Internal resources (Item 1, 2, 4, 7, 8, 13-16)	**External resources** (Item 5, 9-11)
Item	H_i (95% CI)	H_i (95% CI)
1	0.46 (0.42-0.50)	0.50 (0.45-0.55)
2	0.30 (0.25-0.35)	0.58 (0.54-0.62)
3	0.49 (0.46-0.52)	0.47 (0.41-0.53)
4	0.39 (0.35-0.43)	0.53 (0.47-0.59)
5	0.42 (0.38-0.46)	-
6	0.46 (0.41-0.51)	-
7	0.47 (0.42-0.52)	-
8	0.37 (0.32-0.42)	-
9	0.43 (0.39-0.47)	-
H_s	0.42 (0.39-0.45)	0.52 (0.47-0.57)

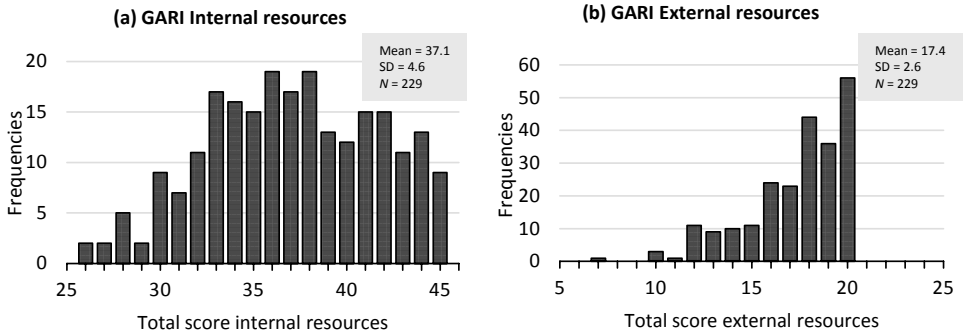

Figure 2 Scoring frequencies of the two GARI subscales (N = 229).

Table 4 Correlation matrix between the GARI subscales, and age, physical function, psychological function, quality of life, and self-efficacy.

	GARI subscales	
	Internal Resources	**External Resources**
Age	–0.76	–0.22
Physical function		
Leg strength	0.21*	0.06
Endurance	0.19**	0.13
Balance	–0.15*	–0.10
Grip strength	0.16*	0.01
Psychological functioning		
De Jong Gierveld (Loneliness)	–0.27*	–0.43**
CES-D (Depression)	–0.55**	–0.44**
LSNS total (social network)	0.20**	0.41**
Quality of life		
CASP control	0.37**	0.34**
CASP autonomy	0.39**	0.35**
CASP pleasure	0.40**	0.46**
CASP self-realization	0.48**	0.40**
Self-efficacy		
ALCOS competence	–0.41**	–0.21**
ALCOS initiative	–0.25**	–0.13
ALCOS perseverance	–0.35**	–0.21**

* Significance at the <0.05 level; ** Significance at the <0.01 level.

DISCUSSION

The development of the GARI is based on a thorough conceptual analysis and distinguishes itself from current resilience scales, because it was specifically developed for identifying resources of resilience in older adults. Common adversities during the ageing process were identified as the starting point for developing the GARI and matched with resources of resilience that were identified during a concept analyses from different sources of literature. Furthermore, the strength of the GARI is that the scale represents a multidimensional concept of resilience, with items that reflect a broad range of internal and external resources of resilience. The final instrument consists of 13 items (Appendix 1). The psychometric study of the current version shows evidence of good internal consistency, as well as satisfying content- and construct validity reflected by the hypothesized correlations with other psychological constructs.

Identifying resources of resilience in later life could give an important target for nurses, other healthcare workers and providers of informal care. Both the proportion of older people, and live expectancy increases globally. Ideally, ageing will be accompanied by longer periods of good health, a sustained sense of well-being and extended periods of social engagement and productivity. Resilience as a useful concept of successful ageing, should integrate a multidisciplinary biopsychosocial approach to focus at the potential internal and external resources older patients have to overcome adversity instead of focusing at disability, losses and limitations.

The resilience concept provides nurses, physiotherapists, social workers and other health workers tools for empowering their patients in performing health promoting behaviors and self-care tasks. For example, redirecting patients to, or organizing programs for increasing physical activity, prevention of falls, successful hospital to home transitions, social activities etc. Knowledge about personal internal and external resources available to the older patient, can help to promote the right match between personal goals, personal resources and interventions. For example, in a study of Hardy et al. (2002), 35% of older participants stopped activities that were important to them as a result of a stressful event [41]. This could lead to a negative sequence of more functional decline, loneliness and dependence. Information from involved nurses, or other healthcare workers about the benefits of engaging in (new) activities, self-care activities, positive emotions, social contacts and rebuilding self-confidence and self-efficacy can benefit the resilience process to master the stressful event.

There are some limitations to the present research. As a group, the study participants show high levels of resilience measured with the GARI. Specifically, the scores on the subscale ‘external resources’ are very high. This could be explained by the high percentage of participants that is married or living with a partner what may represent having important external resources of resilience. These characteristics correspond with the relative low levels of depression and loneliness and high levels of quality of life and

self-efficacy. Furthermore, the positive psychosocial characteristics may be overrepresented in populations that are willing to participate in scientific research. A potential bias inherent in Likert scales is to agree with statements as presented; the acquiescence bias, or to portray themselves in a favourable light; the social desirability bias. In this research population, there was a strong tendency to avoid the responses 'never' or 'hardly ever'. However, the tendency of high scoring means is a common feature in resilience research [9,13].

CONCLUSION

The GARI is a resilience instrument that can help nurses, other healthcare workers, researchers and providers of informal care to identify the adaptive capacity and internal and external resources of resilience in older individuals and groups. In a multidisciplinary biopsychosocial approach this knowledge provides tools for empowering older patients in performing health promoting behaviors and self-care tasks.

The currently examined psychometric properties of the 13-item GARI are satisfactory. Further research is recommend to test the reliability and validity of the GARI in other older populations with different socioeconomic and cultural backgrounds. Additionally, designing and testing interventions that can be provided by nurses and other health workers, that can help older adults to adapt to negative events during the ageing process, is needed.

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APPENDIX 1

Original and final items of the GARI, and the associated resilience domains

Original items	Final items	Resilience domain of internal and external resources
1. I am optimistic	1. I am optimistic	Positive emotions
2. I give my best effort to stay physically active	2. I give my best effort to stay physically active	Self-care activities
3. During hard times, I trust things will get better*	3. I enjoy learning new things at my age	Meaningfulness
4. I enjoy learning new things at my age	4. When sick, I can count on help from friends or family	Social support Secure relationships
5. When sick, I can count on help from friends or family	5. I can easily start a conversation	Social competence
6. I feel my life still means something to others *	6. I am a flexible person	Adaptable personality
7. I can easily start a conversation	7. I can share good and bad times with family and friends	Secure relationships Family cohesion
8. I am a flexible person	8. I have close contacts with my family	Family cohesion
9. I can share good and bad times with family and friends	9. When I feel down or lonely, I have someone to turn to	Secure relationships
10. I have close contacts with my family	10. I enjoy participating in new activities at my age	Meaningfulness/Social competence
11. When I feel down or lonely, I have someone to turn to	11. I tend to bounce back after hardship	Life experiences/ Perseverance
12. Past experiences give me confidence in new challenges*	12. I use practical solutions to cope with ageing	Adaptable personality
13. I enjoy participating in new activities at my age	13. I have confidence in my body to do outdoor activities	Personal competence/Self-care activities
14. I tend to bounce back after hardship		
15. I use practical solutions to cope with ageing		
16. I have confidence in my body to do outdoor activities		

* Deleted because the item did not discriminate between subscales. Items are scored on a 5-point Likert scale ranging from never (1) to always (5)

Chapter 4

Relationship between socioeconomic status and quality of life in older adults: a path analysis

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ABSTRACT

Purpose The main objective of this study was to determine the relationship between quality of life, social functioning, depressive symptoms, self-efficacy, physical function, and socioeconomic status (SES) in community-dwelling older adults.

Methods A cross-sectional design was used to examine the relationships. A sample of 193 community-dwelling older adults completed the measurements. Structural equation modeling with full information maximum likelihood in LISREL was used to evaluate the relationships between the latent variables (SES, social functioning, depressive symptoms, self-efficacy, physical function, and quality of life).

Results The path analysis exhibited significant effects of SES on physical function, social functioning, depressive symptoms, and self-efficacy (γ = 0.42–0.73), and significant effects in regard to social functioning, depressive symptoms, and self-efficacy on quality of life (γ = 0.27–0.61). There was no direct effect of SES on the quality of life. The model fit indices demonstrated a reasonable fit (χ^2 = 98.3, *df* = 48, $p < 0.001$), matching the relative Chi-square criterion and the RMSEA criterion. The model explained 55.5 % of the variance of quality of life.

Conclusions The path analysis indicated an indirect effect of SES on the quality of life by social functioning, depressive symptoms, and self-efficacy in community-dwelling older adults. Physical function did not have a direct effect on the quality of life. To improve the quality of life in older adults, additional focus is required on the socioeconomic psychosocial differences in the community-dwelling older population.

INTRODUCTION

Due to prolonged life expectancy, retaining a good quality of life (QoL) at an older age is of increasing importance and interest. QoL is an important outcome of many studies in older adults. In these studies, a plethora of definitions is applied to specify QoL [1-4]. Conceptual and methodological ambiguity continues on how to define and measure QoL [1,3-6]. Furthermore, there is an ongoing and challenging search to identify determinants of QoL aiming at determining indicators for improving QoL.

QoL is a subjective and multidimensional construct, which is affected in a complex manner by the person's physical health, psychological state, level of independence, and social relationships to noticeable characteristics of the environment [7]. From this perspective, QoL transcends physical health [8,9]. This is also applicable to older adults and superimposes with other concepts such as active, successful, and healthy ageing [4,10]. Enjoying positive social relationships, being active and capable of participating in meaningful activities, and having no functional limitations are especially beneficial for QoL at an older age [4]. Therefore, a need-satisfaction approach appears most appropriate in order to study QoL in older adults, as from this perspective, the focus is predominantly on the perceived satisfaction, expectations, and fulfillment of the needs of older adults [11,12].

To improve QoL, gaining a comprehensive understanding of the determinants of QoL is of fundamental significance. Socioeconomic status (SES) is an important determinant of QoL [13,14]. Both education and income were determined to be robust predictors of QoL in later life [13,15]. In this association, several determinants may act as intermediate factors such as social and psychological factors, physical function, and SES. Psychosocial factors accounted for the majority of the changes in long term QoL in older adults [16]. For instance, a lack of perceived social support, a small social network, and living without a partner may have a negative impact on the QoL of older persons [16,17]. Additionally, associations of depressive symptoms and psychological resources, such as self-efficacy, with QoL were demonstrated [16,18]. Moreover, physical function has been associated with QoL in older adults [19-22]. Increased levels of physical function such as muscular strength, agility, and aerobic endurance can contribute to the enhancement of QoL [22-24]. In addition, these determinants of QoL are also associated with SES. SES differences in self-reported physical function, social network size, feelings of loneliness, and depression are especially demonstrated [25-34]. Therefore, studies investigating the relationship between QoL and SES should incorporate the possibility of direct and indirect effects of other variables such as social functioning, depressive symptoms, global self-efficacy, and physical function. Still, only minimal information is evident regarding the latent factors SES and QoL in older adults. In regression analysis, such factors cannot be treated as being latent. For that reason, multivariate analysis techniques, such as

structural equation modeling, are statistically adequate methods to examine the relationship between SES and QoL [35].

The main objective of this study is to determine the relationship between QoL, social functioning, depressive symptoms, self-efficacy, physical function, and SES in community-dwelling older adults.

METHODS

Study sample and study design

In 2011 and 2012, a sample of 1,976 older inhabitants of a mid-sized city, Delfzijl, in the northern part of the Netherlands was invited for participation in the study. Participants who were recruited from both socioeconomically underprivileged and average neighborhoods were aged 65 years and older, and were not institutionalized. Candidate participants were excluded when they did not demonstrate enough mobility to move independently. All participants were informed about the goal and procedure of the study and written informed consent was obtained from the same. The research was performed in compliance with the Declaration of Helsinki. A total of 193 participants completed the measurements comprising performance-based tests and questionnaires. A cross-sectional design was employed.

Data collection

All participants were invited to participate in the health measurements. Performance-based physical function was measured, and questionnaires were assessed. Preceding the physical function tests, the Physical Activity Readiness Questionnaire (PAR-Q) was assessed by a physiotherapist to determine any possible risk of exercising and to guarantee safety [36]. Additionally, blood pressure was measured with an electronic sphygmomanometer. When the systolic blood pressure was >150 mmHg or the diastolic pressure was >90 mmHg, participants were excluded from participation in the endurance test in order to guarantee safety. All physical function tests were individually assessed and administered by well-trained test leaders. Following the physical function tests, participants individually filled in all questionnaires under the supervision of research assistants.

Measures

Participant characteristics

Height and weight of the participants were measured to calculate the body mass index (BMI). BMI is calculated by dividing weight (in kilograms) by the square of height (in meters). Additionally, morbidity was assessed as the total number of present chronic

diseases or disorders. The presence of 26 common chronic conditions was mapped [37,38].

Quality of life

We employed the CASP-19 questionnaire to measure the broad concept of QoL based on a need satisfaction approach. CASP-19 is an instrument that is extensively used to assess the QoL in older adults and comprises 19 items in four domains: control, autonomy, self-realization, and pleasure [39]. The CASP is developed from a needs-satisfaction approach and measures the degree to which human needs are fulfilled. The range of the CASP-19 is 0–57, with the higher scores indicating a better QoL. The validity and reliability of the CASP has been previously documented in a population of older persons. In British older adults, the reliability and validity was satisfactory (α = 0.55–0.86; r = −0.58), and the CASP-19 mean (SD) score in the Office for National Statistics Omnibus Survey in 2008 for people aged 65 years and older was 41.8 (8.1) [40].

Social functioning

Partner status was measured by recording the presence of a partner (no or yes).

Loneliness was assessed with the 6-item De Jong Gierveld Scale. This 6–item Likert scale is a reliable and valid instrument for measuring overall, emotional, and social loneliness in substantial surveys of older adults (α = 0.70–0.76; congruent validity r = 0.93–0.95) [41]. All items have five response categories. The loneliness scale scores ranges from 0 (*not lonely*) to 6 (*extremely lonely*).

Social network size was assessed utilizing the 6-item Lubben Social Network Scale. This 6-item scale is a valid and reliable scale to assess perceived social support received by family and friends (α = 0.83; congruent validity r = 0.68–0.78) [42]. The scores range from 0 (*very small network*) to 30 (*extensive network*). In a large European older sample, the mean (SD) score varied from 16.1 (5.5) to 17.9 (5.3) [42].

Social support is assessed with the SSL12-I scale. This 12-item scale has satisfactory psychometric properties to assess the extent of received social support in an older population (α = 0.83) [43]. All items have four response categories. The scores range from 12 (*low level of support*) to 48 (*high level of support*). In a Dutch older population, the mean (SD) SSL12-I scale was 25.5 (5.0) [43].

Depression

Depression was measured with the Dutch version of the CES-D questionnaire. The self-report 20-item CES-D scale is valid and reliable to measure depressive symptoms and behaviors experienced during the previous week in older adults (α = 0.79–0.92; r = 0.73–0.83) [44]. The items have four response categories. CES-D scores range from 0 (*no*

depression) to 60 (*high level of depression*). In an older population, the mean (SD) CES-D score was 8.33 (6.84) [45].

Self-efficacy

Self-efficacy was assessed with the Dutch version of the 16-item General Self-Efficacy Scale [46]. All items incorporate five response categories. The Dutch version of the General Self-Efficacy Scale appeared moderately reliable to measure generalized expectations of self-efficacy ($\alpha = 0.81$) [47]. Scores range from 16 (*very high self-efficacy*) to 80 (*very low self-efficacy*).

Physical function

Physical function was measured with three validated and standardized performance-based tests.

Leg strength was assessed utilizing the 30-s Sit-To-Stand Test [48]. The number of complete sit-to-stands in 30 s without using arms was counted.

Aerobic endurance was assessed by using the 2-min step test [48]. During this test, the participant marched in place for 2 min while lifting the knees. The total number of times the knee was lifted was counted.

Dynamic balance was assessed employing the Timed Up-and-Go Test [49]. The time required to rise from the chair, walk to a cone, and return to the seat, all as quickly as possible, was measured. The best score from two trials was recorded.

For these physical function tests, norm values adjusted to age and gender were calculated whereby participants were scored below average, average, or above average (according to their age and gender).

Socioeconomic status (SES)

Two indicators of SES were used: income and education. Personal monthly net income was measured with an ordinal scale consisting of the three categories: <1,100 euro, 1,100–1,600 euro, and >1,600 euro. Three education categories were distinguished: high (high school, university), medium (advanced elementary education, occupational education), and low (primary school).

Statistical analyses

Model specification

Based on a review of the literature, a model of the relationships between SES, social functioning, depressive symptoms, self-efficacy, physical function, and QoL was conceptualized. Figure 1 shows the assumed associations and directions. We hypothesized direct effects of SES on QoL [13-15], physical function [33,34], social functioning [27-29], depressive symptoms [30,31], and self-efficacy. Furthermore, we hypothesized direct

effects of physical function on QoL [19-24], social functioning on QoL [16,17,50], depressive symptoms on QoL [16], and self-efficacy on QoL [18]. The variables were modeled as latent variables exploiting the indicators income and education for SES; loneliness, partner status, social network size, and social support for social functioning; and leg strength, dynamic balance, and aerobic endurance for physical function. The latent variables depression, self-efficacy, and QoL had a single indicator.

All latent variables were scaled by fixation of factor loadings of observed variables. SES was scaled on the variable education, social functioning was scaled on loneliness, and physical function was scaled on aerobic endurance. These factor loadings were set equal to 1.00 or −1.00 in such a manner that higher scores indicate greater levels of functioning. The error variance of the latent variables depression, self-efficacy, and QoL was set equal to 1.00.

Estimation method

Descriptive statistics were employed to summarize subject characteristics of the study sample. Data were processed using statistical software SPSS statistics 19 (SPSS Inc.) and LISREL 9.10 (Scientific Software International, Lincolnwood, IL). Structural equation modeling in LISREL was used to evaluate the fit of the proposed model. PRELIS was used to compute the correlation matrix for the analyses using Pearson product moment correlations between continuous variables, polychoric correlations between ordinal variables, and polyserial correlations between ordinal and continuous variables. A correlation <0.30 was considered “low,” 0.30–0.60 “moderate,” and >0.60 “high”[51].

The data were analyzed by the full information maximum likelihood (FIML) estimation, which is recommended as a method to deal with missing data in structural equation modeling [52,53]. In the current data, 10.9 % of education data, 7.8 % of income data, 12.4 % of depression data, 3.6 % of morbidity and social network data, 3.1 % of partner status data, 2.1 % of loneliness data, 1.6 % of self-efficacy, social support and quality of life data, and 0.5 % of leg strength data were missing. Age, gender, BMI, dynamic balance, and endurance data were complete.

Model testing

Structural equation modeling was used to test the relationships between six latent variables (SES, social functioning, depression, self-efficacy, physical function, and QoL). The fit of the model was evaluated on the basis of multiple criteria: (relative) Chi-square, Chi-square *p*-value, root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), and the comparative fit index (CFI). The model fit is acceptable if the ratio of Chi-square to the degree of freedom is between 2 and 5 [54,55]; the Chi-square *p*-value is nonsignificant [56]; the RMSEA is <0.07 [57]; the SRMR is <0.08

[58], and the CFI is >0.90 [59]. RMSEA or SRMR values above 0.10 indicates poor fit [58]. The statistical significance level was set to 0.05.

Power analysis

Power analysis was executed to determine required sample size to achieve adequate power to test close fit of the hypothesized structural model. Minimum sample size is determined, given the significance level (α = 0.05), the desired level of power (power = 0.80), degrees of freedom of the model (d = 48), and the hypothesized values of the RMSEA [60]. The null hypothesis specifies the hypothesized value of the RMSEA, and in our study, the model fit is acceptable if the RMSEA is <0.07 [57]. The RMSEA value under the null hypothesis was set to 0.07 and under the alternative hypothesis to 0.10. Based on the calculations specified by MacCallum et al. [60], we calculated a minimum sample size of 194 participants (ceiled).

RESULTS

Subject characteristics

Data from 193 older adults were employed for the analyses. Table 1 shows the personal and socioeconomic characteristics of the subjects. The ages ranged from 65 to 94 years with a mean (SD) age of 71.6 (4.9) years. Most participants possessed only a low or medium education (88 %), and half of the participants (53 %) received a net month income of <1,600 euro.

Highly educated persons and persons with a higher income level (>1,600 euro) were slightly older and primarily male compared with the low educated persons and persons with an income between 1,100 and 1,600 euro. Persons with an income between

Table 1 Characteristics of the participants (*n* = 193).

	Total	**Educational level**			**Income** (personal monthly, net)		
	Mean ± SD	**Low**	**Medium**	**High**	**<1,100 euro**	**1,100 – 1,600 euro**	**>1,600 euro**
N	193	38	113	21	40	55	83
Mean age (y)	71.6 ± 4.9	72.5 ± 4.8	71.5 ± 4.5	69.4 ± 3.8*[a]	71.3 ± 5.1	73.1 ± 5.9	70.4 ± 3.6*[b]
Gender (% female)	59.1%	92.1 %	49.6 %	38.1 %*[c]	82.5 %	72.7 %	37.3 %*[d]
Body Mass Index	28.1 ± 4.1	29.5 ± 4.5	28.1 ± 4.2	27.0 ± 4.2	28.1 ± 5.7	28.9 ± 3.8	27.4 ± 3.3
Morbidity	2.3 ± 2.0	2.9 ± 1.9	2.1 ± 1.9	2.1 ± 2.1	2.3 ± 2.0	3.0 ± 2.1	1.8 ± 1.9*[e]

*p<0.05.

[a] F = 3.35; $df = 2$; p = 0.04. [b] F = 5.36; $df = 2$; p < 0.01. [c] χ^2 = 24.78; $df = 2$; p < 0.001. [d] χ^2 = 29.36; $df = 2$; p < 0.001.
[e] F = 5.32; $df = 2$; p<0.01.

1,100 and 1,600 euro reported a higher number of chronic diseases or disorders than persons with a higher income (>1,600 euro). The BMI did not vary between the education and income levels. The scores of the outcome variables physical function, social functioning, depression, self-efficacy, and quality of life are shown in Table 2.

Table 2 Descriptive summary of outcome variables (*n* = 193).

Outcome variable	*n* (%)	Mean ± SD
Physical function		
Leg strength		
Below average	92 (48)	
Average	64 (33)	
Above average	36 (19)	
Dynamic balance		
Below average	36 (19)	
Average	61 (31)	
Above average	96 (50)	
Aerobic endurance		
Below average	75 (39)	
Average	44 (23)	
Above average	74 (38)	
Social functioning		
Partner status		
Single living	41 (22)	
Living together	146 (78)	
Loneliness		0.8 ± 1.2
Social network size		16.3 ± 5.0
Social support		32.7 ± 5.7
Depression		5.6 ± 5.5
Self-efficacy		37.7 ± 8.2
Quality of life		47.7 ± 5.9

SD = Standard Deviation

Associations between QoL and the determinants

Pearson product moment, polyserial, and polychoric correlations between all pairs of variables are shown in Table 3. As expected, SES indicators were moderately correlated (r = 0.36) just as with the physical function components (r = 0.23–0.46). Within social functioning indicators, most indicators were also significantly correlated (r = −0.35 to 0.16); only partner status and social support were not significantly correlated. Education and income correlated low with all other variables (r = 0.01–0.28). QoL was minimally correlated with SES indicators (r = 0.09–0.19); physical function components (r = 0.07–0.22); social network size (r = 0.27); partner status (r = 0.23); and social support (r = 0.27). QoL was moderately correlated with loneliness (r = −0.47), depression (r = −0.58),

Table 3 Correlation matrix of the variables entered into the structural equation model (n = 193).

		1	2	3	4	5	6	7	8	9	10	11
1	Education[b]											
2	Income[b]	0.360*										
3	Leg strength[b]	0.011	0.059									
4	Dynamic balance[b]	0.007	0.146	0.227*								
5	Aerobic endurance[b]	0.198*	0.193*	0.447*	0.456*							
6	Loneliness[a]	−0.217*	−0.211*	0.102	−0.141	−0.096						
7	Social network size[a]	0.136	0.232*	0.105	0.136	0.232*	−0.350*					
8	Partner status[b]	0.119	0.242*	0.103	0.164*	0.150*	−0.311*	0.161*				
9	Social support[a]	−0.206*	0.020	0.008	0.097	0.070	−0.230*	0.294*	0.126			
10	Depression[a]	−0.133	−0.245*	−0.102	−0.212*	−0.236*	0.501*	−0.132	−0.314*	−0.093		
11	Self-efficacy[a]	−0.284*	−0.223*	−0.177*	−0.178*	−0.303*	0.282*	−0.165*	−0.260*	−0.081	0.440*	
12	Quality of life[a]	0.087	0.189*	0.073	0.221*	0.185*	−0.469*	0.273*	0.232*	0.266*	−0.577*	−0.430*

* Significant correlation ($p < 0.05$)

[a] Continuous variable

[b] Ordinal variable.

and self-efficacy (r = −0.43). Additionally, loneliness and partner status were moderately correlated with depression (resp. r = 0.50; r = −0.31); aerobic endurance was moderately correlated with self-efficacy (r = −0.30); and depression was moderately correlated with self-efficacy (r = 0.44).

Structural equation model

Based on the literature, we hypothesized that SES has a direct and indirect effect on QoL by physical function, social functioning, and psychological functioning (depressive symptoms and self-efficacy). The path diagram of the model, including standardized regression coefficients, is shown in Fig. 1. The model fit indices demonstrated a reasonable fit (χ^2 = 98.3, df = 48, p < 0.001), matching the relative Chi-square criterion (χ^2 /*df* < 5) and the RMSEA criterion (RMSEA ≤ 0.07). The SRMR value was 0.083, indicating mediocre fit (a value between 0.08 and 0.10). The CFI value was lower than the conventional criteria of 0.90, indicating minimal acceptable fit. The Chi-square *p*-value criterion was not met. Overall, the model explained 55.5 % of the variance of QoL.

The model indicates significant effects of SES on physical function (γ = 0.42, p = 0.001), social functioning (γ = 0.73, p < 0.001), depression (γ = −0.70, p < 0.001), and self-efficacy (γ = 0.63, p < 0.001). Furthermore, social functioning, depression, and self-efficacy have a significant direct effect on QoL (resp. β = 0.61, p = 0.02; β = −0.51, p = 0.001; β = 0.27, p = 0.03), whereas the effect of physical function on QoL was not significant (β = 0.05, p = 0.57). There was no direct effect of SES on QoL (β = −0.53, p = 0.24).

The standardized direct, indirect, and total effect of SES, physical function, social functioning, depression, and self-efficacy on QoL are presented in Table 4. The results demonstrated that SES, social functioning, depression, and self-efficacy had substantial total effects on QoL and that physical function had only a minimal total effect on QoL.

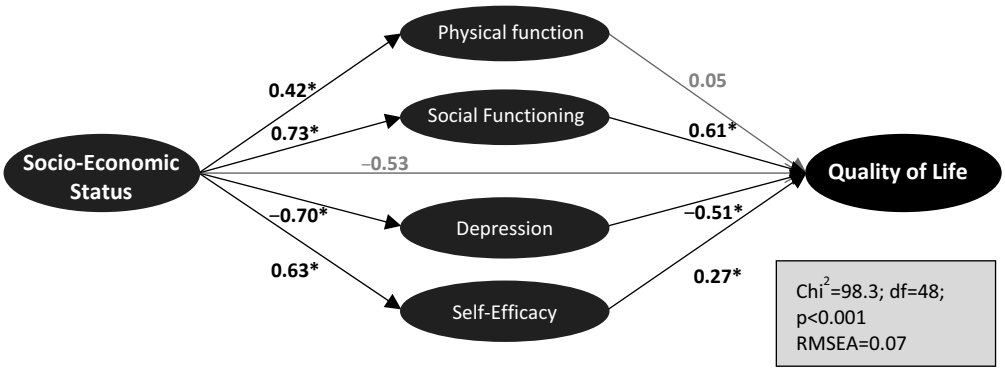

Fig.1: Path diagram of the hypothesized model illustrating the relationship between socioeconomic status and quality of life. Presented are the standardized coefficients. Non-significant path coefficients are displayed in grey.

An alternative theory driven model was tested as a sensitivity analysis. Inspired by social cognitive theory and earlier research, effects of self-efficacy and social functioning on physical function were added and estimated in the model. This alternative model did not reveal any new significant indirect effects. The overall fit of this model was sufficient, but weaker than the hypothesized model ($\chi^2 = 95.4$, df = 46, $p < 0.001$; RMSEA = 0.08). Besides, basic regression analysis was performed to check if the results were consistent with those from path analysis. The results of these analyses were similar.

Table 4 Standardized direct, indirect and total effects of SES, physical function, social functioning, depression, and self-efficacy on quality of life.

Variables	Quality of life		
	Direct effect	Indirect effect	Total effect
SES	0.456*	0.987*	1.444*
Physical function	0.419	-	0.419
Social functioning	0.734*	-	0.734*
Depression	–0.696*	-	–0.696*
Self-efficacy	0.629*	-	0.629*

* Significant effect ($p < 0.05$)

DISCUSSION

In the present study, a path analysis indicates an indirect effect of SES on QoL by social functioning, depressive symptoms, and self-efficacy in community-dwelling older adults. Persons with a more moderate SES reported poorer social functioning, more frequent depressive symptoms, lower self-efficacy, and, as a consequence, a less fulfilled QoL. Surprisingly, physical function had neither a direct or indirect effect on QoL. The model has a reasonable overall fit and explained 55.5 % of the QoL variance.

An association between SES and QoL is often presupposed; however, it has not been intensively studied whether the relationship is direct or indirect. The majority of previous studies examined separate bivariate relationships between indicators of SES, such as income or education, and measures of QoL [4,14,15]. The current multivariate analysis afforded the opportunity to evaluate both direct and indirect relationships utilizing path analysis. Our analysis revealed only indirect effects of SES on QoL by social functioning, depressive symptoms, and self-efficacy. Our results imply that SES does not directly affect QoL. Nonetheless, SES does influence a person's social and psychological functioning, and consequently influences a person's QoL. Several studies questioned the size of the direct relationship between SES and QoL. This relationship appeared to be relatively minimal for people habituating in developed countries. In a number of review studies, it was reported that measures of SES explain only 2–3 % of the variance in

individual subjective well-being [15,61]. It is suggested that once basic needs are fulfilled such as having food, shelter, and clothing, income is of negligible relevance [61]. In our multivariate model, we discovered more substantial relationships. According to our model, 20.8 % of the variance in QoL was explained by SES, social functioning, depressive symptoms, and self-efficacy.

Physical function is not related to QoL in our study sample. This is not in accordance with correlational studies that actually ascertained relationships between measures of physical function and feelings of well-being or QoL [20,22-24]. A plausible explanation for the variance between our results and other studies may be that our study population was relatively (physically) healthy. Our study population experienced a considerable range in physical function from below to above standard. All participants were community-dwelling older adults, independent of help or care from others, and reporting no or only minor problems with daily living. As supported by several studies, we expect that physical function will only influence the QoL if activities of daily living are impaired. In nursing home residents, being physically mobile was mentioned as a prerequisite for independence and mentioned as a determinant of QoL [62]. Additionally, a study of Garatachea and colleagues [20] demonstrated that there were diminished feelings of subjective well-being for dependent, less physically active subjects compared with those who were independent and less physically active.

According to our analyses, poor social functioning, reporting depressive symptoms, and experiencing minimal self-efficacy contribute to a less fulfilled QoL. The amount of social functioning and depressive symptoms are, moreover, described as direct determinants of QoL [16,17]. However, self-efficacy is often specified to have an indirect influence on QoL through determinants of QoL, e.g., physical activity [63]. Self-efficacy is defined as the evaluation and the conviction in one's individual abilities to achieve particular goals [64]. Most studies examined self-efficacy beliefs in the capacity of executing specific health behaviors such as performing physical exercises or employing a healthy diet. Alternatively, we measured global self-efficacy in our study sample whereby global self-efficacy was determined to be a direct determinant of QoL and not merely having an indirect influence on QoL through indicators of physical and psychosocial health. It appears that persons who believe that individual actions are responsible for successful achievements are generally inclined to adopt beneficial health behavior that may contribute to an enhanced QoL [64]. Some concepts of self-efficacy are associated with concepts of QoL from a need-satisfaction perspective. It is possible that the extent to which people succeed in achieving their goals may be associated with the degree in which human needs are satisfied. It is also plausible that persons who succeed in easily achieving their goals, more often fulfill their needs and subsequently experience an improved QoL.

When we compare our results to models that explain socioeconomic health differences, we can determine certain resemblances, for example, explanations provided

in the reserve capacity model indicate similarities. This model suggests that those persons with a low SES have a more moderate bank of psychosocial resources and, consequently, are more inclined to develop inferior physical health [65]. Findings supporting this framework are in accordance with our results. We also ascertained an indirect relationship between SES and QoL through psychosocial determinants. We contend that this framework may also be applied to explain socioeconomic differences in QoL.

A number of methodological issues may be relevant while interpreting our results. First, we employed a cross-sectional study design. Therefore, we concentrated on the current situation and did not investigate determinants of change in QoL. To establish whether the proposed relationships maintain over a period of time and to specify the direction of cause and effect, longitudinal randomized controlled trials in more substantial study samples will be required. Second, the mean age of participants with a low SES was significantly higher compared with participants with a high SES. However, this difference in mean age was only 3 years. Therefore, we presuppose that this difference is not clinically relevant and would not have influenced our findings. Additionally, we noticed a somewhat skewed gender distribution in relationship to the SES. In our study sample, as well as in the general population of older adults, older females are more often less educated and receive less income than older males. Third, all study participants live in a developed economy meeting their basic needs such as having food, shelter, clothing, sanitation, education, and healthcare. We may expect that income has a greater effect on the well-being of persons living in underdeveloped economies [61]. Therefore, in order to draw conclusions about the relationship between SES and QoL in older adults living in underdeveloped countries, our study should be replicated in other districts and countries.

The results that are presented indicate potential determinants to address in order to ultimately enhance QoL in both (relative) low- and high-SES older adults. Longitudinal analyses are required to determine whether the proposed relationships maintain over a period of time. To improve QoL in older adults, we need an increased focus on the socioeconomic psychosocial differences and subsequently develop tailored interventions to improve psychosocial functioning in the community-dwelling older population.

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Chapter 5

Understanding how older adults living in deprived neighbourhoods address ageing issues

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ABSTRACT

Purpose Older adults living in deprived areas are at risk of developing frailty and becoming care dependent. The aim of this qualitative study is to explore how community-dwelling, older adults living in deprived neighbourhoods address ageing issues.

Methods In-depth interviews were conducted with 20 participants who were community-dwelling (independently living), aged 65 years and older, not dependent on care, and living in a socioeconomically deprived urban neighbourhood in the northern part of the Netherlands. Data were analysed using the constant comparative method.

Findings Our findings emphasise the resourcefulness of these older adults when coping with apparent adversities. Simultaneously, the findings convey deficits concerning knowledge about ageing and health. Despite this, it appeared that these older adults possess an optimistic view of life, accept their situation, and are content with the capacities they still possess.

Conclusions Perspectives on how older adults address ageing issues are important for developing leads for nursing practice. Nurses will be challenged to recognise the coping strategies of these older adults, particularly considering their deficits in health knowledge. The results of this study may serve as a basis for community nurses to manage care for older adults in deprived neighbourhoods.

BACKGROUND

Maintaining a good quality of life in advancing age is relevant in the ageing process and, subsequently, an overall goal for policymakers [1,2]. Nursing care has the potential to improve the health care of older adults and optimise their quality of life in older adults [3-5]. Maximising patients' quality of life by managing health care throughout their lives is an aim in nursing [6]. Optimising quality of life with nursing care merits primary attention, especially in frail older adults.

Owing to the rapidly increasing number of older people across the world, the importance of nursing care for community-dwelling older adults will continue to grow [7,8]. Older adults with a low socioeconomic status and residing in socioeconomically deprived neighbourhoods are at risk of developing frailty and becoming care dependent [9,10].

Living in a deprived neighbourhood is associated with a variety of adverse physical, cognitive, and psychosocial health prospects including a greater risk of mobility difficulties and chronic diseases, such as diabetes and cardiovascular disease, as well as increased feelings of loneliness and depression [11-16]. In addition, the onset of multiple morbidities, including mental health disorders, occurs 10–15 years earlier in people living in the most socioeconomically deprived areas compared with those living in more affluent areas [17]. As a consequence, older adults living in deprived areas are at risk of developing frailty, experiencing a lower quality of life and subsequently becoming care dependent and a target group for community nursing care [10,18].

Health literacy refers to a set of cognitive and social skills that determine the motivation and ability of people to gain access, understand, and use information in order to enhance and maintain good health by modifying personal lifestyles and living conditions [19]. An inadequate health literacy is one of the suggested causes of less adequate health outcomes in older adults living in deprived areas [20-22]. This deficiency is often associated with inadequate socioeconomic circumstances and, in older adults, is related to a less healthy overall status, frailty, and higher overall mortality rates [23-26].

Considering that nursing encompasses specific responsibilities for the detection of vulnerable populations such as older adults with inadequate health literacy, the challenges in health promotion require an awareness of obvious conflicting opinions [27]. Community nurses providing health care at home encounter community-dwelling older patients in deprived neighbourhoods. Therefore, older adults' perspectives on ageing may serve as a guide for the nurse to provide appropriate care. Since there is a lack of information regarding these older adults' perceptions, the perspectives on ageing and frailty among this group of older adults needs to be explored. The aim of this qualitative study is to explore how community-dwelling, older Dutch adults living in deprived neighbourhoods address ageing issues.

METHODS

Design

The research can be characterised as a qualitative descriptive and exploratory study using in-depth interviews with 20 participants. The interviews were performed using a qualitative case study design [28]. This method is used to explore and obtain depth of understanding on how older adults living in a deprived neighbourhood address ageing issues. This design is chosen to capture the multitude of perspectives in dealing with ageing. In this method, ensuring diversity of perceptions is crucial.

Participants

Included participants were community-dwelling, aged 65 years and older, not dependent on care, and living in a socioeconomically deprived urban neighbourhood in the northern part of the Netherlands. The participants reside in a deprived neighbourhood of a mid-sized city in the Netherlands. According to data from the Netherlands Institute for Social Research, this neighbourhood has a low-socioeconomic-status score based on the area's education, income, and occupation levels [29]. Compared with other areas in the Netherlands, this neighbourhood belongs to the 10 % of areas with the lowest area socioeconomic status score in the country.

Participants were recruited from a community-based lifestyle programme for physically inactive older adults from this area (*n* = 120). A purposive sampling strategy was used to recruit older adults in order to obtain a study sample comprising a wide array of personal characteristics such as age, sex, health status, and living status, that are an accurate reflection of the population at large [30]. In this qualitative study, 20 older adults were personally invited to participate. The older adults were informed about the intent of this study by information leaflets and were asked to provide their written informed consent.

Data collection

In-depth interviews were conducted in March, April, and May 2013 by six trained interviewers. Participants could choose to be interviewed at the community centre or at their own home. In the interviews, a biographical method was used to collect a detailed account of a participant's life. The interviewer began by asking the respondent to describe his/her own family history, including the birthplace, living environment, and family. The interviewer asked subsequent probing questions in order to gather more relevant information if a respondent mentioned a life event that was important or related to the ageing process or frailty. All interviews were audio-recorded and transcribed verbatim. We continued collecting data until saturation occurred, that is, until no new themes, factors, attributes, or suggestions for categories emerged [31].

Data analysis

Transcribed interviews were analysed with the help of ATLAS.ti (version 6.0.15). Following the constant comparative method of Boeije [32], codes were allocated to meaningful sentences or fragments (open coding). These codes were ordered and grouped into categories (axial coding). Finally, data were integrated by connecting categories (selective coding). In order to obtain investigator triangulation, two independent researchers individually coded the transcribed data. A third researcher was consulted to discuss differences in coding. Collectively, the three researchers decided on and concurred with the final categorisation. To present our results, verbatim quotes were selected to illustrate the findings.

Ethical considerations

The university ethics review board granted exemption from ethical review considering the minimal burden for the participants. All participants gave their written informed consent to participate in the study. The research was performed in compliance with the Declaration of Helsinki.

FINDINGS

Characteristics of the participants

In-depth interviews of 1–3 hour duration were conducted with 20 older adults. Table 1 shows the characteristics of the participants. The age of the participants ranged from 65 to 86 years with a mean (SD) age of 72.5 (6.2) years. Majority of the participants were female (65 %) and were residing with a partner (65 %). Half the number of participants had low educational attainment, while the other half had moderate education attainment. One participant was highly educated (high school). All participants were of Dutch nationality.

Early life experiences of participants

In order to illustrate the participants' background, the participants were asked to narrate their childhood memories and young adulthood experiences.

Half the number of participants were born during the period of the Second World War; the other half were born shortly thereafter. Only the oldest participants (75+ years) reported unfavourable memories of the War period; a vast majority of them mentioned that they had lived in poverty during that time, with a scarcity of food. Almost all participants grew up in large families in small working-class cottages in rural areas. In the time when they were young, it was unusual to continue one's education following primary school, as financial means were insufficient. For the participants, it was customary to help

Table 1 Characteristics of the participants (n = 20).

Characteristic		Number	Percentage (%)
Gender	Male	7	35
	Female	13	65
Age	65–69 years	9	45
	70–74 years	3	15
	75–79 years	6	30
	80+ years	2	10
Partner status	Living alone (single)	7	35
	Living together	13	65
Education level*	Low[a]	8	47
	Moderate[b]	8	47
	High [c]	1	6

* Only 17 out of 20 participants specified their education level. [a]Low: primary school; [b]Moderate: advanced elementary education, occupational education; [c]High: high school, university.

parents with daily activities, such as assisting in housework or working on the farm and performing agricultural work. Participants reported that in those days, it was unusual to discuss personal problems or feelings. Despite the scarcity of food, participants reported that there was always enough, and any available food was shared. Income was also shared at all stages of life. Most participants began working at the age of 16 years. Participants reported that, at that time, women worked until they were married, and it was common for women to be wed because they became pregnant. The participants usually married between the ages of 20–23 years. The male participants were the primary source of income for their familes and mainly worked in shipping, (heavy) industries, or factories. Consequently, participants relocated from the rural country-side to urban villages to be near their work facilities.

Perspectives on ageing and health

The first finding focuses on the participants' evaluation of health and the (lack of) knowledge about health and ageing. Subsequently, attitudes regarding health are discussed.

Participants' evaluation of health

Individual health and the health of one's partner were described as: 'the most important thing of people's life' or 'the greatest wealth that exists'. A female participant, aged 68 years, explained why health is so vital to her:

> *"If you feel healthy, you feel comfortable. You are not sullen unless the weather is bad. Health is simply important. You need it for everything."*

As a consequence of ageing, most participants have experienced diminished health, which they described as 'part of life', 'that's simply the way it is', 'it just happens to you', or 'we have no influence over it'. Another female participant, aged 68 years, andwith progressive knee problems, explained it as follows:

> *"It became increasingly worse, but you adjust to the situation. It causes annoyance, but you are getting used to it. At a certain point, they operated on my knees and, now, I can walk again, and that is worth a lot. I am getting older, and I have to accept that."*

The same was valid for participants with a limited social network. Participants who reported having only a small circle of friends stated that it is a primary consequence of ageing.

> *"Oh well, as you grow older, you lose contacts with others. I just see my friend [girlfriend] and that's enough." (male, aged 74)*

> *"No, no, I don't have contacts anymore. When you age, friendships just disintegrate, don't they?" (female, aged 75)*

Participants varied in their level of awareness of the effects of lifestyle on their individual health. Several participants stated that they attempt to lead healthy lives by being aware of what they eat and performing physical exercise. In addition, they considered 'just continuing with your activities' to be a component of a healthy lifestyle. In spite of age-related health problems or functional disabilities, continuing life ('just move on') was important to them. Other participants did not mention the effects of lifestyle in relation to health.

Several participants described the consequences and causes of health problems or disorders. In these responses, the consequences of disorders were often underestimated. For example, a male participant, aged 77 years and diagnosed with diabetes, explained that the main consequence of being diagnosed with diabetes is: 'It's no great matter, I just need some pills.' A female participant, aged 78 years and diagnosed with diabetes, reported that she does not always have her diabetic insulin pen with her:

> *"I never think of it. If things keep running well, then I don't worry about it all the time."*

Examples of ignoring signs of age-related decline in health were observed. Participants acknowledged that they more or less intentionally ignored signs of the disease in the beginning such as pain due to osteoarthritis or heart palpitations. This often corresponded with requiring medical help at a late stage. As one female participant, aged 66 years, explained:

> *"And the general practitioner asked: 'For how long have you been suffering from these symptoms?' Way too long, of course. But again, you do not think you're sick."*

Other participants were not aware of the signs of health problems. A 77-year-old male participant spoke about the emergency care he required:

> *"Yes, last Saturday I almost needed emergency care. It was a close call. I ate fried rice. And then, a piece stuck in my oesophagus. Everything went completely black, so I thought, 'Now I will die'. I could not stand, I could not lie. My wife wanted to call a doctor, but I said 'No, don't call a doctor'. After half an hour it went away. It was caused by the fried rice, I said to the doctor. But the doctor wanted to make an ECG immediately and advised us to call the emergency number immediately the next time. The ECG was okay. So, it was caused by the fried rice, it was way too dry."*

Mental health problems were described as being most restrictive to participants. None of the participants reported perceiving limitations due to cognitive impairments, but they mentioned being very anxious at the possibility of experiencing cognitive health problems, such as severe cognitive impairment, dementia, or behavioural problems in the future.

Attitudes regarding health

Participants appeared to use certain coping strategies to address health problems. Three primary attitudes were identified: acceptance of one's situation, contentment, and having an optimistic view.

Acceptance of one's situation

Health was perceived as a prerequisite for maintaining a degree of autonomy and independence and to be able to do the activities you desire. 'Life happens to you' is a much used expression. One participant, female, aged 65 years, described it as "If it is like this, so be it. That's life." Another female, aged 77 years, indicated, "You're not always in control; it just happens to you." This submission to life and its experiences signified acceptance of the situation which is reflected in the manner in which participants perceived the process of ageing. Most say: 'You will simply age.' A participant, aged over 80 years, stated:

> *"The facts are like that, there is nothing but to reconcile oneself to the facts. I could become furious, but I am the one who'll suffer. It's no bloody use."*

Participants mentioned that they adjust their activities according to their current capabilities. The same applies to their attitude toward death, as one female participant, aged years 66, stated:

> *"Everyone will come in its time. No one ever passed away before his time. There is nothing to say about it."*

Contentment

There is a saying in the local dialect that 'nagging and complaining will not help. You must just take action and manage with what one possesses.' Participants stated that the emphasis falls on the things one is still capable of doing and managing. A female participant, aged 68 years, mentioned:

> *"You have to be grateful for all the things you still can do; you shouldn't look at the things you cannot manage anymore."*

It appeared that this perception of life resulted in contentment with their situation. Participants reported little ambition to change their way of life and stated being satisfied with what they have achieved. Participants considered having children and grandchildren, being able to participate in leisure-time activities, and experiencing (relatively) good health as being sufficient to creating contentment in their lives. A male participant, aged 77 years, stated:

> *"I give my life a 10, because my life is good. I have two granddaughters, and I have one daughter; what else can I wish?"*

Even when life was or appeared to be troublesome, participants emphasised their contentment with all they have. It is illustrated with an example of a female participant, aged 67 years, with financial and personal troubles in her life:

> *"I am well pleased. I have never been jealous of others, although I have acquaintances and family members that are much better off. I've never been jealous. I always had second hand things, but well, 'if you make it your own and light a candle', I always say. You look around and think, 'Even though it is a scrambled bunch, it is still mine'. It belongs to me."*

An optimistic view

Most participants exhibited positive feeling regarding their circumstances. They explicitly indicated that being optimistic in life is very important for overcoming difficulties , not only for their own wellbeing, but also for the sake of close relatives. A female participant, aged 77 years, illustrated this with an example:

> *"I'm not saying that you should see everything in a humorous way, but you have to remain positive. If you continue to see the negative side, the whole family becomes negative. But one thing is certain; life comes with ups and downs. You have to keep seeing the positive side of life."*

To remain positive, participants compared themselves and their situation with others. The fact that everyone has their individual personal issues was also mentioned. Even if physical limitations were experienced, they mentioned that they would rather experience these than mental or cognitive limitations. They emphasised the opportunities they are

given and their abilities to still be able to accomplish them. As illustrated by a female participant, aged 68 years:

> *"Be happy! Many people can't do it. I always look at the positive side. That's the way I am. You weigh up the pros and cons. Some things I can't manage anymore, others I still can. I rather prefer to stay 18, but I am getting older, and I have to accept that. The physical ailments of getting older do bother me sometimes, but fortunately my mental health is still fine."*

DISCUSSION

In this study, we aimed to explore how community-dwelling, older Dutch adults living in socioeconomically deprived neighbourhoods address ageing issues; we used in-depth interviews to gather the information. We observed gaps in the participants' knowledge of the consequences of health issues. Despite these knowledge gaps, we noticed patterns of a shared attitude regarding life and health problems in the participants' responses. The participants: (1) possess an optimistic view of life, (2) accept their situation, and (3) are content with the resources and capacities they still have. All participants mentioned that health is the most important aspect of life. Still, not all the participants are aware of how to adequately address age-related health problems.

In the current study, older adults living in deprived neighbourhoods mentioned being content with their lives even if their lives were difficult or troublesome. Literature shows that, in general, older adults' perspectives on quality of life are heterogeneous [33,34]. Furthermore, longitudinal cohort studies show that quality of life will decline with older age [35,36]. However, in the current study this decline was not reported by the older adults. We also observed a similarity in the way participants deal with perceived health. Even when participants developed a disorder, they mentioned feeling blessed with their current health. In literature this incongruence is known as the disability paradox [37]. The fluid and complex nature of the reality that the participants presented is difficult to capture in a theoretical model.

Nurses, who comprise the vast majority of professionals in health care, are faced with an apparent contradiction. On the one hand, nurses should recognise and acknowledge the remarkable resilience of older adults living in deprived neighbourhoods. However, on the other hand, nurses should not lack awareness of the deficits in the older adults' health knowledge. Nurses should be aware of what Whitehead (1953) refers to as 'the fallacy of misplaced concreteness' [38]. A patient's attitude may differ from actual reality owing to his/her inadequate health literacy. It is essential for nurses to assess the patient's level of health literacy and identify those at risk for inability to adhere to health-care recommendations [39]. Health education by community nurses may be an essential tool to support older adults in coping with age-related adversities. We suggest that the

acknowledgement of patients' resilience, affiliation with the patients' wishes, and talking about the consequences of disorders and possible care actions might support health benefits for the patients.

Some methodological strengths and limitations may be relevant to interpret our findings. First, investigator triangulation was used to verify the validity of data interpretation. The transcribed data were coded independently by two researchers. These results were discussed with a third colleague within the field of study in order to optimise the validity of the analysis. All evaluators concurred with the final codes and categorisation. This strategy resulted in a comprehensive understanding of the issues and maximised confidence in our findings. In addition, we collected data until saturation occurred and no new themes or insights emerged [31]. A methodological limitation in this study was that participation in the study was entirely voluntary. Therefore, it is plausible that persons with fewer resources and probably a less optimistic perception of life were hesitant to participate. To diminish this selection bias, vulnerable participants were personally invited by familiar acquaintances.

We evaluated the demographics of the participants, and it appeared that we recruited a broad study sample considering age, gender, living status, and health status. Therefore, we assume to have studied a representative sample of older adults living in the specified deprived neighbourhood. In this study, we noticed a shared attitude toward health among the participants. Nevertheless, it raises questions on the transferability of the observed attitude. Is the shared attitude toward health common for all older adults living in deprived neighbourhoods, including more urban regions, or is it a common outlook in the northern regions of the Netherlands? To investigate the influence of culture on people's attitude, additional qualitative studies are recommended in multiple deprived areas.

CONCLUSION

In this qualitative study, we explored how community-dwelling, older Dutch adults living in socioeconomically deprived neighbourhoods address ageing issues. We observed deficits in the older adults' health knowledge that influence the manner in which these people addressed ageing issues and frailty. Despite these gaps, it appeared that these older adults possess an optimistic view on life, accept their situation, and are content with the resources and capacities they still have. The ability to deal with setbacks and to take life as it is has indeed been remarkable but may unintentionally mask the deficits in the patients' health knowledge. Nurses will be challenged to recognise the coping strategies of these older adults, especially considering their deficits in health knowledge.

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Chapter 6

Ownership as a key to improving quality of life in older residents of deprived neighbourhoods: A community-based lifestyle intervention

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Submitted

ABSTRACT

Objective To examine the effects of a one-year participation in a community-based lifestyle intervention on quality of life, including physical functioning, social functioning, and psychological functioning, in underactive, community-dwelling older adults living in a deprived neighbourhood.

Methods A quasi-experimental study design was used to examine the intervention effects. The project was implemented in close collaboration with the community to achieve community ownership of the intervention. The intervention consisted of weekly group exercise sessions with integrated, 6-week interval, lifestyle modules regarding feelings of depression and loneliness as well as physical activity in daily living. The reference group received no intervention. Primary outcome was quality of life. Secondary outcomes included physical fitness (leg strength, balance, and endurance), social network size, and depressive symptoms. Outcomes were measured at baseline and after 12 months. Intervention effects were analyzed by linear mixed-effects modelling.

Results In total, 198 persons participated in the study (150 intervention group; 48 reference group). The analyses revealed significant increases in leg strength and aerobic endurance. No statistically significant intervention effects were determined for the other outcomes, i.e. quality of life, balance, social network size, and depression.

Conclusions In underactive, community-dwelling older adults living in a deprived neighbourhood, a community-based intervention program appears to effectively retain the level of quality of life and improve physical fitness, i.e. leg strength and endurance, over a one-year period. Our study indicates the feasibility of recruiting, motivating, and engaging older adults in deprived neighbourhoods for physical exercise. A community-based recruitment and intervention approach is recommended for this aged population.

INTRODUCTION

During ageing, quality of life will progressively decline in older adults [1]. Therefore, it is of increasing importance and interest to maintain a good quality of life at an older age, particularly in the most vulnerable groups of older adults. Quality of life is a subjective and multidimensional construct and defined by the World Health Organization as "Individuals' perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns." [2]. Quality of life is influenced by multiple determinants such as physical health, physical activity level, and psychosocial functioning [2,3].

Older inhabitants in socioeconomically deprived neighbourhoods are at an even greater risk of experiencing a lower quality of life [4]. Living in a deprived neighbourhood is associated with a diversity of adverse outcomes in physical, social, and psychological functioning [5-10]. Consequently, these older adults are at higher risk to develop frailty [5], which is characterized by a decline in reserve capacity of those functions that are essential for maintaining an acceptable level of physical, social, and psychological functioning [11]. In addition, the onset of multi-morbidity occurred earlier in people living in the most socioeconomic deprived areas compared with those in the most affluent [12].

Furthermore, physical inactivity may have a large negative influence on quality of life in older adults [13,14]. Lower levels of physical activity are associated with an increased risk of obesity, some cancers, chronic diseases such as diabetes mellitus and cardiovascular diseases, and psychological difficulties [15-17]. Globally, approximately one third of the adult population is insufficiently physically active [18]. In particular, physical inactivity prevalence is highest in older age groups and residents of deprived neighbourhoods [19-23]. Therefore, the older inhabitants of deprived neighbourhoods who are physically underactive should be especially targeted for intervention programs that will enhance quality of life.

Adults with a low socioeconomic status are often underrepresented in lifestyle interventions [24]. It may be difficult to motivate adults from deprived neighbourhoods to participate in community lifestyle interventions. Financial arguments, time investment, less willingness to modify their lifestyle, or minimal interest in the study emerged as reasons for non-participation in a lifestyle intervention study [24]. To surmount these barriers, community involvement and collective capacity appear to be influential components to implement health promotion projects in the community [25-27]. In addition, the limited personal and interpersonal resources of older adults should be considered when engaging older adults in exercise programs [28]. Programs that operate locally with individual attention which provide opportunities for social interaction and creating a sense of ownerships appear to be the most appropriate to engage older adults in exercise [28].

The main objective of this study is to examine the effects of one-year participation in a community-based lifestyle intervention on quality of life, including physical, social, and psychological functioning in Dutch underactive, community-dwelling, older adults living in a deprived neighbourhood.

MATERIALS AND METHODS

A quasi-experimental study design was used to examine the effects of a lifestyle intervention in physically underactive older adults living in a deprived neighbourhood in the Netherlands. The study was conducted in the city of Delfzijl, the Netherlands.

Community-based approach

The program was developed as a community-based intervention. From the very beginning, members of the community were involved in the project organization, and the project was implemented in close collaboration with the community association. By means of the community involvement, we aim to achieve collective capacity-building and community ownership of the intervention. Collective capacity was formed following four stages [27]. First, the neighbourhood was specified, and relationships with the community were initiated. Second, the project was attuned in cooperation with the community. Third, the project was executed in partnership with the community association. Fourth, the ownership and responsibilities of the program were transferred to the participants and the community. Additionally, during the study period, the investigator was accessible to residents and present at a location in the actual neighbourhood itself which contributed to a collaboration and relationship with the community members.

To optimize the effectiveness of the program, the recruitment strategy as well as the intervention were tailored to the characteristics of the community. The recruitment strategy was developed to comply with participants' expectations. A composite recruitment strategy consisted of door-to-door visits as described by Stevens et al. (2008) combined with the back-door and the network-method [29]. First, all older inhabitants of the neighbourhood received a written invitation (based on the municipality's population data) and were visited in their homes by trained research assistants and members of the community association (door-to-door visits). In addition, inhabitants were recruited by community key-peers from the neighbourhood (back-door method) and by local professional organizations such as churches, social welfare organizations, and home care organizations (network-method).

Participants

Participants were aged 65 years and older, community-dwelling, physically underactive according to the Dutch Standard for Healthy Exercise that was based on the ACSM recommendations (less than 30 minutes of moderate-intensity exercise per day for more than two days per week), and living in a deprived neighbourhood. Candidate participants were excluded when they did not demonstrate enough mobility to move independently.

The intervention and reference group were recruited separately between September 2011 and September 2012 in deprived neighbourhoods in Delfzijl, the Netherlands. In total, 1,226 older inhabitants were invited for participation in the intervention group whereby 364 persons were eligible for participation in the study and, finally, 150 persons were motivated and willing to start with the intervention program. In the reference group, 750 older inhabitants were invited to participate in the reference group in which 149 persons were eligible for participation in the study and, finally, 48 persons were willing to volunteer in the pre- and post-measurements of the study. The flowchart of the study is presented in Fig. 1.

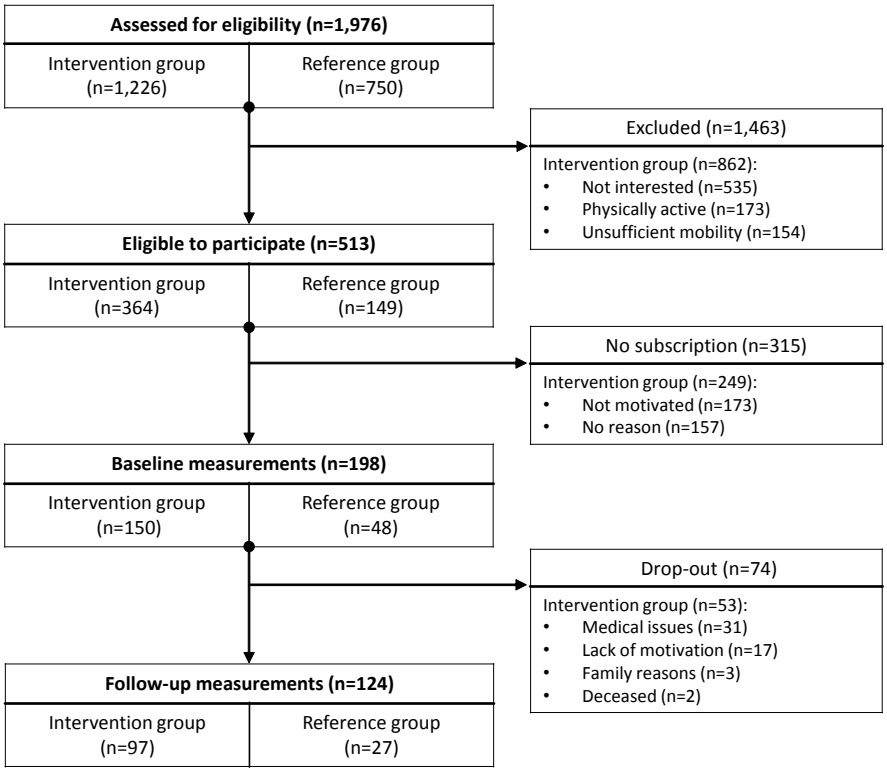

Fig. 1 Flowchart of the study.

Lifestyle intervention program

The 12-months lifestyle intervention consisted of weekly group exercise sessions in combination with integrated, 6-week interval, lifestyle modules regarding feelings of depression and loneliness ("Feel good!" module) and physical activity in daily living. The endeavor was intended to establish a sustainable community project. The exercise sessions lasted 60 minutes and were performed according to the Groningen Active Living Model (GALM) method [30,31]. The GALM program is a leisure-time physical activity program emphasizing moderate-intensity sports activities as described by De Jong et al. [30]. Three experienced exercise-for-seniors instructors supervised the exercise program. Following the exercise sessions, the group met for a coffee/tea meeting to support social cohesion within the group. Two different lifestyle modules occurred after the exercise sessions (during the coffee/tea meeting), i.e., the “Feel good!” module and the “Physical activity in daily living” module. These lifestyle modules continued for six sessions of 30 – 60 minute intervals. The "Feel good!" module was supervised by a psychologist and was based on a Dutch coping with depressive symptoms course. This module aimed to improve coping skills of participants regarding feelings of loneliness and depression. The “Physical activity in daily living” module was supervised by a physiotherapist. Participants were coached and encouraged to enhance their daily activity level with the use of a pedometer.

Participants were assigned to different exercise groups according to an evaluation of their physical functioning level. The resulting seven exercise groups comprised approximately 20 participants. Group instructors, being very concerned for their groups, adjusted the program to the desires and needs of the participants by tailoring physical activities in regard to type, format, and intensity. The instructors used music to support the exercise lessons that were held in a community centre located in the middle of the neighbourhood. The exercise sessions were graduated in intensity level and difficulty in order to create an overload to obtain an incremental increase in physical fitness.

In this study, the participation of 12 months in the program was evaluated. The project will be continued after the study period. During the study period, participation in the program was free of charge. The participants were informed that the program will continue after the study period, however, a financial contribution will then be requested.

Reference group

The reference group received no intervention. These volunteers participated in the pre- and post-measurements and received insights in their fitness scores and their health status. Six months after the baseline-measurement, a meeting was organized for the reference group participants about recent and future developments in the health care sector and the role of new technologies therein. Twelve months following the baseline-

measurement, reference group participants were invited to participate in the post measurements. They were offered participation in the exercise program subsequent to the study.

Data collection

Participants of both the intervention and the reference groups were invited to participate in measurements at baseline and after 12 months (immediate post-intervention). Questionnaires and performance based physical function tests were assessed. Participants individually filled in the questionnaires under the supervision of research assistants. Assistance was provided when needed. The physical function tests were individually performed and administered by well-trained test leaders. Preceding the physical function tests, the Physical Activity Readiness Questionnaire (PAR-Q) was assessed by a physiotherapist to determine any possible risk of exercising and to guarantee safety [32]. Additionally, blood pressure was measured with an electronic sphygmomanometer. When the systolic blood pressure was greater than 150 mmHg or the diastolic pressure was greater than 90 mmHg, participants were excluded from participation in the endurance test in order to guarantee safety.

All response variables (physical function, social network size, depression, and quality of life) were measured at baseline and immediately post-intervention (after one year). The covariates age, gender, educational level, morbidity, body mass index (BMI), frailty, and resilience level were measured at baseline.

Measures

Primary outcome measure

We employed the CASP-19 questionnaire to measure the broad concept of quality of life based on a 'needs satisfaction' approach which assumes that quality of life should be assessed according to the degree in which human needs are satisfied. CASP-19 is an instrument that is extensively used to assess quality of life in older adults and comprises 19 items in four domains: control, autonomy, self-realization, and pleasure [33]. The CASP is developed from a needs satisfaction approach and measures the degree to which human needs are fulfilled. The range of the CASP-19 is 0 to 57 with the higher scores indicating a better quality of life. The validity and reliability of the CASP has been previously documented in a population of older persons. In British older adults, the reliability and validity was satisfactory (Cronbach's alpha $\alpha = 0.55 – 0.86$; $r = -0.58$) [34].

Secondary outcome measures

Physical function was measured with three validated and standardized performance based tests. *Leg strength* was assessed utilizing the 30-seconds Sit-To-Stand Test [35]. The number of complete sit-to-stands in 30 seconds without using arms was compiled.

Dynamic balance was assessed employing the Timed Up-and-Go Test [36]. The time required to rise from a chair, walk to a cone, and return to the seat, all as quickly as possible, was measured. The highest score from two trials was recorded. *Aerobic endurance* was assessed by using the Two Minute Step Test [35]. During this test, the participant marched in place for two minutes while lifting the knees. The total number of times the knee was lifted was recorded.
Social network size was assessed utilizing the 6-item Lubben Social Network Scale which is a valid and reliable scale to assess perceived social support received from family and friends (α = 0.83; congruent validity *r*: 0.68 – 0.78) [37]. Higher scores indicate a more extensive social network.
Depression was measured with the Dutch version of the CES-D questionnaire. The self-report 20-item CES-D scale is valid and reliable to measure depressive symptoms and behaviors experienced during the previous week in older adults (α = 0.79 – 0.92; *r* = 0.73 – 0.83) [38]. Higher scores indicate more elevated levels of depression.

Controlling variables
Age, gender, educational level, body mass index (BMI), morbidity, frailty, and resilience level were incorporated as controlling variables of the outcome under study. *Educational level* was measured on a nine-point scale, from less educated (only primary education) to highly educated (university degree). *BMI* was calculated by dividing weight (in kilograms) by the square of height (in meters) of the participants. *Morbidity* was assessed as the total number of present chronic diseases or disorders. The presence of 26 common chronic conditions was mapped [39,40]. *Frailty* was assessed with the 15-item Groningen Frailty Indicator (GFI) [11]. *Resilience* was assessed with the Groningen Ageing Resilience Inventory (GARI) which is a 13-item questionnaire to identify the adaptive capacity of older adults [41].

Ethical issues

This study has been approved by the ethical committee of the Institute of Human Movement Sciences Groningen. All participants were informed about the goal and procedure of the study and provided written informed consent. The research was performed in compliance with the Declaration of Helsinki [42].

Statistical analyses

Descriptive statistics were used to display baseline characteristics. Data are presented as means with standard deviations (SD) for continuous data and percentages for categorical data. Differences in baseline characteristics between the intervention and reference group and between dropouts and non-dropouts were examined by an independent *t* test for

continuous data and χ^2 test for categorical data. A linear mixed-effects model based upon a restricted maximum likelihood method was used to examine the effects of the intervention program. The outcome variables included quality of life, leg strength, dynamic balance, aerobic endurance, social network size, and depression. Possible explanatory variables (including age, gender, education, morbidity, BMI, frailty and resilience) were controlled for by entering these into the analysis. With a backward deletion method, significant explanatory variables were identified [43]. Person's effects were taken as random. The interaction term group by time was included in the analyses to assess changes over time (from baseline to post-program) in the intervention group compared to the reference group. Post-test data were collected according to the 'intention to treat' principle in order to avoid overoptimistic estimates of the efficacy of an intervention due to omitting non-compliers. Analyses were performed using the statistical programming language R (version 3.0.3) and IBM SPSS statistical software (version 20.0). A value of $P < 0.05$ was considered statistically significant for all analyses.

RESULTS

Baseline characteristics

In total, 198 participants were included in the study: 150 in the intervention group and 48 in the reference group. Table 1 shows the baseline characteristics of the intervention and reference groups. The reference group included more males and participants were significantly younger, higher educated, less often living single, demonstrating higher physical fitness scores, and experiencing a higher quality of life compared to the intervention group.

In total, 124 participants (97 participants in the intervention group, 27 in the reference group) completed both baseline and post-intervention (after 12 months) measurements. In the intervention group, 64.7% of the participants completed both measurements and, in the reference group, 56.3% completed both measurements. On average, 39.5% of the participants withdrew from the study.

Compliance and dropout

In the intervention group, 63.8% fully completed the 12 month program; 15.2% participated for six to 12 months; 13.8% participated less than six months; and 7.2% never started the intervention program after the baseline measurements.

The major reasons for withdrawing were as follows. More than half of the dropout participants (61%) explained that medical issues made it impossible to complete the program. Subsequently, a lack of motivation was mentioned by 33% as a reason for withdrawing. Afterwards, participants discontinued due to ill health, decease of relatives,

Table 1 Baseline characteristics of the intervention and reference group.

	Intervention Group (n = 150)	Reference Group (n = 48)	Difference between Groups
Variables	**Mean ± SD or N (%)**	**Mean ± SD or N (%)**	**P-value[d]**
Age (years)	74.9 ± 6.7	71.8 ± 5.9	0.004*
Gender (% males)	46 (30.7%)	24 (50.0%)	0.015*
Education[a]			
low	56 (44.1%)	5 (10.6 %)	< 0.001*
medium	61 (48.0%)	35 (74.5 %)	
high	10 (7.9%)	7 (14.9%)	
Morbidity[b]	3.0 ± 1.9	2.9 ± 2.2	0.699
Body mass index (kg/m^2)	29.5 ± 4.9	29.4 ± 4.8	0.955
Marital status (% single persons)	58 (42.0%)	7 (14.9%)	< 0.001*
Quality of life	45.3 ± 7.1	47.4 ± 5.1	0.033*
Leg strength	10.6 ± 3.3	12.8 ± 2.8	< 0.001*
Balance[c]	7.1 ± 2.9	5.3 ± 1.5	< 0.001*
Endurance	71.1 ± 22.6	95.7 ± 18.3	< 0.001*
Social network size	14.9 ± 5.1	16.6 ± 5.2	0.053
Depression[c]	7.9 ± 6.4	7.0 ± 7.2	0.459

* Indicates significance $p < 0.05$.
[a] Low: primary school; Medium: advanced elementary education, occupational eductation; High: high school, university.
[b] Number of comorbid conditions.
[c] Favourable response is in the negative direction.
[d] Comparison of groups at baseline calculated using independent *t* test or χ^2 test.

or due to a removal (6%). Two participants deceased during the study period. Reasons for withdrawal in the reference group were not recorded. Analyses revealed no significant differences in baseline characteristics between dropouts and non-dropouts.

6

Analyses of the outcomes

Response variables for the intervention and reference groups at the two time points with the primary results of the analyses are summarized in Table 2. The linear mixed models analyses revealed significant increases in leg strength and aerobic endurance for the intervention group relative to the reference group over time (interaction effect). On average, participants of the intervention group experienced a 21% improvement in leg strength and 22% improvement in aerobic endurance. No significant group by time interaction effects were determined on the other outcomes, i.e., quality of life (both sum score and subscale scores), dynamic balance, social network size, and depression. Quality of life, dynamic balance, social network size, and depression remained stable over a one year period in the intervention group.

Table 2 Intervention effects on the outcome variables quality of life, physical fitness and psychosocial functioning.

	Intervention group (n=150)				Reference group (n=48)				Interaction group by time effects	
	N	Baseline (mean ± SD)	Posttest (mean ± SD)	Improvement (%)	N	Baseline (mean ± SD)	Posttest (mean ± SD)	Improvement (%)	Value (95% CI)	*P*-value
Quality of Life	98	45.3 ± 7.1	45.7 ± 6.9	0.9 %	38	47.4 ± 5.1	46.6 ± 5.0	–1.7 %	1.7 (–0.8; 4.2)	0.182
Control		8.9 ± 2.2	8.8 ± 2.2	–1.1 %		9.6 ± 1.6	9.3 ± 1.4	–3.1 %	0.1 (–0.9; 1.0)	0.915
Autonomy		11.4 ± 2.6	12.0 ± 2.4	5.3 %		12.0 ± 2.0	11.7 ± 1.8	–2.5 %	0.9 (–0.2; 2.0)	0.110
Pleasure		13.2 ± 2.1	13.2 ± 2.0	0.0 %		13.7 ± 1.4	13.5 ± 1.6	–1.5 %	0.1 (–0.7; 1.0)	0.725
Self-realization		11.4 ± 2.4	11.6 ± 2.4	1.8%		12.0 ± 1.9	12.1 ± 2.2	0.8 %	0.3 (–0.7; 1.3)	0.494
Physical Fitness										
Leg Strength	115	10.6 ± 3.3	13.0 ± 3.9	21.0 %	36	12.8 ± 2.8	13.5 ± 2.8	5.6 %	1.9 (0.7; 3.1)	0.003*
Balance[a]	117	7.1 ± 2.9	6.7 ± 3.0	5.4 %	38	5.3 ± 1.5	5.2 ± 1.2	1.9 %	0.0 (–0.4; 0.3)	0.970
Endurance	90	71.1 ± 22.6	86.8 ± 24.2	22.1 %	25	95.7 ± 18.3	102.8 ± 15.4	7.4 %	8.7 (0.1; 17.3)	0.048*
Psychosocial Functioning										
Social Network Size	103	14.9 ± 5.1	14.9 ± 5.4	–0.2 %	37	16.6 ± 5.2	16.6 ± 5.5	0.0 %	1.2 (–1.0; 3.4)	0.286
Depression[a]	90	7.94 ± 6.4	7.06 ± 6.2	11.1 %	30	7.0 ± 7.2	6.5 ± 5.7	8.0 %	–1.9 (–4.2; 0.4)	0.098

[a] Favourable response is in the negative direction.
The models are adjusted for gender, age, education, morbidity, BMI, frailty, and resilience by backward deletion method.

Table 3 reports the effects of the controlling variables in the separate models. To save space, only significant effects are reported. The significant effects from mixed model analyses for each response variable are as follows. Frailty and resilience level had a significant effect on quality of life, social network size, and depressive symptoms. In particular, quality of life (CASP score) decreases by 0.8 units when the frailty score increases by one unit, and increases by 0.5 units when the resilience score increases by one unit. Social network size (LSNS score) increases by 0.3 units when the resilience score increases by one unit. Depression (CES-D score) increases by 1.5 units when the frailty score increases by one unit, and decreases by 0.4 units when the resilience score increases by one unit. Age, gender, morbidity, and BMI had a significant effect on physical fitness outcomes. Leg strength (number of full stands within 30 seconds) decreases by 0.2 stands with an age increase of one year, decreases by 0.1 stands with a BMI increase of one kg/m^2, and decreases by 0.2 stands when the frailty score increases by one unit. Balance (required time to complete test) increases by 0.1 seconds with an age increase of one year, decreases by 0.7 seconds when the gender is male instead of female, increases by 0.1 seconds with a BMI increase of one, and increases by 0.2 seconds when the frailty score increases by one unit. Endurance (number of steps within two minutes) decreases by 0.9 steps when age increases with one year, increases by 8.6 steps when the gender is male instead of female, and decreases by 2.2 steps with one additional comorbid condition.

The mixed model analysis did not reveal main time effects. Group effects were observed for the response variables of balance and endurance. The experimental group had, on average, lower balance and lower endurance levels compared to the reference group (see Table 3).

6

DISCUSSION

Participation in a community-based lifestyle program resulted in a one-year preservation of the level of quality of life and an improvement in physical fitness in physically underactive older adults living in a deprived neighbourhood. No evidence was found for a significant enlargement in social network size or a decrease of depressive symptoms due to participation in the intervention program.

In our study, quality of life remained stable over time for participants of the intervention group compared to participants of the reference group. With our intervention program we aimed to preserve quality of life over time. Normally, without intervention, a decline in quality of life is observed during ageing in older adults [1,44]. A recent study on 4,423 Irish older adults revealed that quality of life, when measured with

Table 3 Coefficient estimates, confidence intervals, and p-values for all significant controlling variables in the analyses.

	Quality of Life Value (95% CI)	**Leg Strength** Value (95% CI)	**Balance** Value (95% CI)	**Endurance** Value (95% CI)	**Social Network** Value (95% CI)	**Depression** Value (95% CI)
Main effects						
Intercept	**47.6** (46.2; 49.1) $p < 0.001$	**11.9** (11.0; 12.8) $p < 0.001$	**6.1** (5.5; 6.6) $p < 0.001$	**92.8** (83.1; 102.5) $p < 0.001$	**16.3** (14.6; 17.9) $p < 0.001$	**7.3** (5.9; 8.8) $p < 0.001$
Group * Time	-	**1.9** (0.7; 3.1) $p = 0.003$	-	**8.7** (0.1; 17.3) $p = 0.048$	-	-
Group	-	-	**0.6** (0.0; 1.2) $p = 0.041$	**–6.9** (–25.5; –8.3) $p < 0.001$	-	-
Time	-	-	-	-	-	-
Controlling variables						
Age	-	**–0.2** (–0.3; –0.1) $p < 0.001$	**0.1** (0.1; 0.2) $p < 0.001$	**–0.9** (–1.4; –0.4) $p = 0.001$	-	-
Gender (male)	-	-	**–0.7** (–1.3; –0.2) $p = 0.008$	**8.6** (1.6; 15.5) $p = 0.016$	-	-
Morbidity	-	-	-	**–2.2** (–3.9; –0.5) $p = 0.012$	-	-
BMI	-	**–0.1** (–0.2; 0.0) $p = 0.008$	**0.1** (0.0; 0.1) $p < 0.001$	-	-	-
Education	-	-	-	-	-	-
Frailty	**–0.8** (–1.2; –0.4) $p < 0.001$	**–0.2** (–0.4; 0.0) $p = 0.019$	**0.2** (0.0; 0.3) $p = 0.012$	-	-	**1.5** (1.1; 1.9) $p < 0.001$
Resilience	**0.5** (0.4; 0.6) $p < 0.001$	-	-	-	**0.3** (0.2; 0.4) $p < 0.001$	**–0.4** (–0.5; –0.3) $p < 0.001$

Only significant controlling variables are displayed.

the CASP-19, decreases by 1.5 CASP units in persons aged 65-74 years and by 2.3 CASP units in persons aged over 75 years over a two-year follow-up interval [45]. These findings correspond with our obtained decrease in CASP score (of 0.8 units) over a one-year period in the reference group. In addition, these findings indicate that our modest increase in CASP-score of 0.4 units in the intervention group may very well represent a positive influence of the intervention program on quality of life. Therefore, a remaining level of quality of life is already of value for vulnerable underactive older adults.

Participation in the intervention program resulted in an improvement of the physical fitness components leg strength and endurance. However, the dynamic balance of the participants has not changed. These physical fitness results are consistent with earlier studies [46,47]. A recent meta-analysis indicated that exercise in community-dwelling, frail, older adults was effective for improving gait speed and leg strength but not for improving balance [47,48]. High intensity individual interventions appear to be most effective for improving physical fitness in older adults [48]. Our intervention consisted of a moderate intensity exercise program. Our results showed that, although the exercise program was of moderate intensity and given in groups, participants improved their leg strength and endurance. Based on the overload principle of exercise physiology, the program intensity was apparently high enough to enhance strength and endurance [30]. The baseline physical fitness level of the participants was relatively minimal. These lower baseline levels may contribute to the positive findings as the greatest benefits of exercise are determined in those who are most frail at baseline [49]. Overall, while the level of physical fitness declines with age [50], our finding that physical fitness is retained, and even improved, with a moderately intense program is especially relevant for older adults to preserve sufficient capacity to perform activities of daily living.

In our study, we did not find differences in depressive symptoms between the experimental and reference group over time which could incite the question whether the 'Feeling good!' module's intensity and duration were sufficient and the content appropriate to diminish depressive symptoms in the intervention group. However, our results indicated that participants in the intervention group experienced, on average, more than ten percent reduction in depressive symptoms. Another study did find significant reductions in depressive symptoms due to exercise in underactive patients with a chronic illness (without clinical diagnosis of depression) [51]. In summary, there is ambiguity in the literature on how effective exercise might be and which type of exercise and intervention are most effective in reducing depressive symptoms in older adults.

Furthermore, in both the intervention and reference groups, the social network size remained the same over time. Social network size was assessed by the Lubben Social Network Scale measuring the number of family and friend contacts. Participants of the intervention group did report that they extended their social network and that they provide and receive support from the group members. However, they did not report to

have more friends after one year. Apparently, close group relationships were not considered as friends by participants. We suggest that the way participants label relationships strongly affected the results of our study.

It is complicated to determine which specific component of the intervention program induced the preservation of quality of life in participants. Underlying mechanisms are complex, and these continue to be explored only minimally. It appears that improvements in physical fitness are not directly linked to an increase in quality of life. Findings of a recent cross-sectional study examining the relationship between quality of life, psychosocial functioning, physical function, and socioeconomic status using structural equation modelling revealed no direct effects of physical function on the quality of life [52]. Quality of life appears to be influenced by multiple interacting factors. In contrast to most other studies, frailty and resilience were included as controlling variable in our model. Both appear to be predictors of quality of life and appear to have a role in the complex interplay. In addition, it could be argued that unmeasured factors may have influenced the participants' quality of life. Participants seem to profit from participation, but we are not able to clarify underlying mechanisms with the used measurements. This implies that other, hardly quantifiable, factors may have had impact on the participants' quality of life. Further research is required to untangle mechanisms that affect quality of life in older residents of deprived neighbourhoods.

With the described approach and intervention program, a stable physical exercise program in the involved deprived neighbourhood was created. To maintain the exercise group after the intervention period, an adequate group size is imperative in order to collect sufficient subscriptions to compensate the instructor and rent the hall. From the beginning, the community association was involved in the project organization and the participants eventually ‘owned’ the project. Each exercise group elected a chairperson and a treasurer. The research group offered self-management training for the participants to support the groups in their continued independent existence. The participants took the responsibility for recruiting new participants when others withdrew and for collecting the membership fees. Four years after the beginning of the project, all seven exercise groups consisting of approximately 15-20 persons per group are still operating in the deprived neighbourhood. We succeeded in the transfer of the project responsibilities to the participants themselves after the intervention period. It appears that, once involved, the group commitment and the group responsibility to the program are very high.

A strength of our intervention program is the community-based approach and community-based recruitment strategy employed in the intervention program. All physical underactive older adults living in the involved neighbourhood were allowed to participate in the intervention program. Participants were recruited by a strategy consisting of door-to-door visits as well as recruitment by key-peers from the neighbourhood and local professional organizations. With this strategy, recruitment of almost forty percent of the

eligible target population (aged 65+, physically underactive, living in deprived neighbourhood) was achieved. This response rate is high compared to earlier studies in older adults [29,53]. Because of this community-based approach, older adults with a broad range of (age-related) physical and/or mental health problems such as diabetes, hypertension or pulmonary disease as well as feelings of loneliness or depression were included. These health problems may have influenced the manner in which these participants responded to the intervention. However, control for these health (co)morbidities was not feasible due to the broad variety of these (co)morbidities in a rather small study sample.

In our study, we used a quasi-experimental design due to the 'bottom-up' community-based approach that was used to engage inhabitants of the neighbourhood in physical exercise and to incite inhabitants to have a sense of ownership of the project. Black [54] contends that, when people need to participate in the intervention and community development is one of the intended purposes, a randomized design is self-defeating by its 'top-down' approach. We considered that true randomization in this vulnerable group of physically underactive older inhabitants of deprived neighbourhoods would have negatively influenced the community ownership of the intervention and the willingness to participate in the project and study. Therefore, in our study, a quasi-experimental design seemed to be more appropriate than a randomized design. Consequently, we recruited the intervention and reference groups separately in adjacent districts within the same neighbourhood. We increased the generalizability of our results by selecting a realistic sample (i.e., no exclusion of persons with certain (chronic) diseases) and setting (i.e., community-based, instructors from the region). However, at baseline, the intervention group differed from the reference group in age, gender, educational level, and physical fitness scores. Nonetheless, in our mixed-model analysis, we have not found indications for a controlling effect of educational level. For gender and age, we have found indications for a controlling effect on the physical fitness outcomes. Complete statistical control for all such types of variables appears to be impossible. In addition, the number of participants in this study was limited. Therefore, results of the comparison between the groups should be interpreted with some caution. A larger trial is recommended to confirm our primary findings among community-dwelling older adults living in a deprived neighbourhood.

CONCLUSIONS

In underactive, community-dwelling older adults living in a deprived neighbourhood, a community-based intervention program seems effective for retaining the level of quality of life and improving physical fitness (leg strength and endurance) over a one-year period.

Our study demonstrates that it is feasible to recruit older adults in deprived neighbourhoods and to engage them in physical exercise. The project was integrated into the social structures of the community, making it possible for the participants to actually continue the project after the study period. A community-based recruitment and intervention approach is recommended in this older population.

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Chapter 7

Summary and General Discussion

INTRODUCTION

The results of the studies presented in this thesis contribute to the knowledge about enhancing active ageing and improving the quality of life for older adults. Insight into ageing-related issues such as frailty, resilience, and quality of life are relevant for developing an appropriate approach to optimize quality of life for older adults, in general, and those living in deprived neighbourhoods. Therefore, this thesis addressed three related key issues. First, instruments to identify frailty and resilience in the elderly population were developed and evaluated (*key issue 1*, **Chapters 2 and 3**). Second, the determinants of the quality of life in older adults were investigated (*key issue 2*, **Chapter 4**). Third, ageing while residing in a deprived neighbourhood was studied with a focus on a community-based lifestyle intervention (*key issue 3*, **Chapters 5 and 6**). This chapter recapitulates on the primary findings of this thesis and will mainly reflect on this issue: How can health and quality of life be maintained or improved in community-dwelling older adults living in deprived neighbourhoods?

SUMMARY

Key issue 1: Suitable instruments to identify frailty and resilience in older adults

A cross-sectional validation study was executed to evaluate the psychometric characteristics of the 15-item Groningen Frailty Indicator (GFI) in community-dwelling, older adults (n = 1,508) (**Chapter 2**). The GFI is a self-report screening instrument that is used for identifying frailty in older adults [1]. The findings of our study supported a three-dimensional factor structure of the GFI as indicated by the subscales of Daily Activities (Items 1-4), Psychosocial Functioning (Items 11-15), and Health Problems (Items 5-10). These GFI subscales showed acceptable internal consistency (resp. α = 0.81; 0.80; 0.57), scalability (resp. H_s = 0.84; 0.35; 0.35), and criterion validity (resp. r = -0.62; -0.48; -0.48). The GFI subscales can be used to employ a multidimensional assessment of frailty in order to more specifically evaluate frailty. The subscale scores produce a more abundant assessment of frailty than that with a single overall sum score. For example, more than twenty percent of frail older adults (GFI ≥ 4) seem to experience problems solely in the psychosocial functioning domain.

Furthermore, a questionnaire was developed and evaluated to assess resilience in older adults (**Chapter 3**). Resilience refers to a dynamic process comprising positive adaptation in the context of significant adversity [2,3]. Based on a conceptual model of resilience during the ageing process, the 13-item Groningen Ageing Resilience Inventory (GARI) questionnaire was developed (n = 229). The GARI demonstrated good internal consistency (α = 0.85) and construct validity and appears to be beneficial for identifying

the internal and external resources of resilience in the elderly population. Health care providers can use the GARI to identify the adaptive capacity and internal and external resources of resilience in older adults.

Key issue 2: Determinants of quality of life in older adults

In **Chapter 4**, the relationship between quality of life, social functioning, depressive symptoms, self-efficacy, physical function, and socioeconomic status (SES) was investigated using structural equation modelling (n = 193). The path analysis indicated an indirect effect of SES on the quality of life by social functioning, depressive symptoms, and self-efficacy in community-dwelling older adults. Physical function and SES did not have a direct effect on the quality of life. The model fit indices demonstrated a reasonable model fit (χ^2 = 98.3; *df* = 48; $p < 0.001$). In addition, the model explained 55.5 % of the variance of quality of life. The results indicate potential determinants to address in order to ultimately enhance the quality of life in (relatively) low- and high-SES older adults. To improve the quality of life for this population, additional focus seems to be required on the socioeconomic psychosocial differences in the community dwelling older population and tailored interventions should be subsequently developed.

Key issue 3: Active ageing in a deprived neighbourhood

As presented in **Chapter 5**, a qualitative study was conducted to explore how community-dwelling older adults living in deprived neighbourhoods address ageing issues. In-depth interviews were conducted with twenty community-dwelling older inhabitants of a socioeconomically deprived neighbourhood in the Netherlands. Older adults differed in their awareness of dealing adequately with age-related health problems. Several participants underestimated the consequences of disorders or ignored signs of age-related decline in health due to deficits in knowledge about ageing and health. Despite these knowledge gaps, it appeared that these older adults possess an optimistic view of life, accept their situation, and are content with the capacities they still possess. These perspectives are important for developing guidance for nursing practice. Health care providers like community nurses need to recognize the coping strategies of older adults living in deprived neighbourhoods, particularly considering their deficits in health knowledge.

To conclude, an intervention study was conducted to evaluate the effects of a one-year participation in a community-based lifestyle intervention on quality of life including physical, social, and psychological functioning in physically underactive, community-dwelling older adults living in a deprived neighbourhood (n = 198) (**Chapter 6**). In this program, participants were trained to manage the project responsibilities in order to attain ownership of the project. The program comprised weekly group exercise sessions in combination with integrated, 6-week interval, lifestyle modules addressing feelings of

depression and loneliness, and physical activity in daily living. A quasi-experimental study design was used to examine the intervention effects. The intervention appeared to be effective for retaining the level of quality of life (p = 0.182) and to improve physical fitness, i.e., leg strength (p = 0.003) and endurance (p = 0.048) over a one year period in the intervention group relative to the reference group. The project illustrated that it is feasible to recruit, motivate, and engage older adults living in deprived neighbourhoods for physical exercise when using a community-based recruitment strategy.

GENERAL DISCUSSION

In this section, theoretical and methodological considerations concerning the outcomes of the studies in this thesis will be discussed. This section will mainly reflect on the issue: How can health and quality of life be maintained or improved in community-dwelling older adults living in deprived neighbourhoods?

How to establish sustainable exercise programs for older adults in deprived neighbourhoods

Results of the studies in this thesis demonstrated that it is possible to recruit sedentary older adults living in deprived neighbourhoods and engage them for physical exercise. Not only was activation of the target group achieved, but the participants also took responsibility for organizing tasks and eventually became self-supporting. To enable future realization of similar programs, several factors seem crucial: (1) the community-based approach, (2) group building, and (3) community ownership.

The involvement of community members seem an essential factor for success. Establishing a partnership between investigators, (potential) participants, and communities is an important fundament for successful recruitment of older adults and minorities in research and health projects [4-6]. Paskett et al. evaluated projects that recruited under-served populations in the United States, and their results demonstrated the importance of involving community members and reducing participant burden to achieve recruitment success [5]. Forming a partnership with communities may be difficult, but it is essential for obtaining insight into the needs and concerns of the partners [4]. When familiar individuals approach potential participants from the neighbourhood, the participants may be more likely to become involved compared to when they are approached by a stranger. It is reasonable that volunteers from the community also support the confidence of potential participants.

Group building may also be an essential ingredient for keeping participants involved. Especially older adults are at high risk of encountering some type of obstacle such as health issues or illness of relatives in the continuation of their involvement in an

exercise program. With established group roles and norms, group cohesion is stimulated, and this may support participants who are at risk of withdrawing due to, for instance, health or motivational issues. This is confirmed by the conceptual model of group cohesion by Carron et al. [7]. This model describes that cohesion has both an individual basis as well as a collective group basis on a task and on a social level. Strong group cohesiveness seems to contribute to higher attendance of the exercise sessions, less withdrawal, more resistance to disturbances in the group, and greater amounts of positive affects related to exercise [8-10]. In accordance with previous research and based on experiences in this current research, it is recommended that researchers and exercise-for-seniors instructors should be aware of the role of group dynamic mechanisms in future projects. In addition, it seems important to pay attention to the social situation and the health issues of the individual participants in order to identify possible participation barriers in good time.

Furthermore, community ownership seems effective for achieving long term maintenance of exercise programs. The experiences in the investigated intervention program (Chapter 6) support the essential role of ownership. More than 100 inhabitants participated in the investigated program, and, after four years, all seven exercise groups consisting of approximately 15–20 persons per group are still weekly physically active and function as self-supporting groups. The community association, involved researchers, and participants should take a role in this. In most self-supporting exercise programs, an adequate group size is imperative in order to collect sufficient subscriptions to remain financially independent. Therefore, in future projects, participants and the involved community members should be counseled to bear the project responsibilities and to recruit group members by themselves when others withdraw.

To enhance maintenance of the modifications in lifestyles and behavioural changes of participants, retention strategies may be supportive [11]. Currently, there is no evidence based program available to support participants of recently initiated exercise-for-elderly groups. In the investigated project, participants were counselled by the research team to maintain their active lifestyle, maintain their social network, recruit new participants, and become more socially active. This retention strategy emerged as considerably valuable for the continued existence of the exercise groups. This strategy is further developed into the ZEMBLA method, a Dutch acronym for Self-Management Maintenance of Physical Activity. In future research, the ZEMBLA method should be further developed, described, and investigated.

It is evident that a community-based approach is suitable for recruiting mainly the native Dutch inhabitants and to motivate them to become physically active. However, to recruit older non-western immigrants, a more specific approach may be necessary as this group was underrepresented in the investigated project. In future projects, it is recommended to pay additional attention to the cultural, linguistic, and social barriers

experienced by older immigrants. Possibly, immigrant volunteers and immigrant community health workers and study staff could support in the recruitment as also proposed by Verhagen et al. [12] and Carroll et al. [13].

The importance of physical fitness

A group program with weekly exercise sessions of moderate intensity is suitable to improve muscle strength and endurance in sedentary community-dwelling older adults. During a one-year intervention period, an exercise program according to the Groningen Active Living Model (GALM) method has been shown to be effective for improving muscle strength and endurance in a heterogeneous group of older adults (Chapter 6). An enhanced level of physical activity and improved physical fitness may contribute to a reduction in the risk of many adverse health conditions including non-communicable diseases such as cardiovascular disease, diabetes, and hypertension [14-16]. Furthermore, regular physical activity and participation in exercise activities are associated with delaying the onset and the progression of frailty and also with preventing and reducing disabilities [17-20]. Consequently, regular physical activity and adequate physical fitness levels seem to be very important for maintaining and enhancing independence for older adults.

Therefore, especially in deprived neighbourhoods with higher rates of physical inactivity and chronic disease, policymakers should facilitate easily accessible exercise programs for older adults. Local authorities should promote and support exercise-for-elderly groups in their municipalities and enable physical exercise in the public domain. These programs may provide for older persons who are motivated to become more physically active and who do not need or are ineligible for assistance within the health care sector. Close cooperation between primary health care providers, including general practitioners and physiotherapists, and exercise projects in the public domain is essential for the referral of patients/inhabitants to the most appropriate program or care. For proper take-over in the public domain, exercise-for-elderly instructors should be adequately trained and educated to gain expertise in exercise for older adults with chronic diseases and disabilities.

In addition to the effects on physical fitness, the effects of exercise programs on daily physical activity should be further investigated. Participants of exercise programs become more physically active because of the weekly exercise sessions. However, further research is required to investigate if these programs are useful for enhancing physical activity during the remaining days of the week. To objectively measure daily physical activity in older adults, suitable accelerometers or activity trackers should be used. The research on activity tracking has grown considerably over the past years, and multiple simple trackers have been developed. Future studies should include physical activity measurement using an activity tracker suitable for the use in older adults with limited

digital knowledge in order to study the effects of intervention programs on daily physical activity.

Effects of exercise on quality of life

Results of the studies in this thesis indicated that an improvement in physical fitness does not directly translate into an improvement in the global quality of life. A multi-factorial approach is recommended when the aim is to improve the quality of life in community-dwelling older adults. As shown in Chapter 6, a lifestyle project succeeded in retaining the level of the quality of life, however, quality of life did not improve significantly in the intervention group relative to the reference group (p = 0.182) in spite of significant improvements in physical fitness. In addition, based on cross-sectional data, physical fitness had neither a direct or an indirect effect on the quality of life in a community-dwelling older population (Chapter 4). Several explanations for these findings are possible among which (1) quality of life was measured from a needs satisfaction approach, and (2) multiple factors collectively influence quality of life.

In this thesis, the CASP-19 was utilized to assess global quality of life. This measure was derived from a model in which quality of life was conceptualized as distinct from the factors which influence it [21]. The CASP-19 measures the degree in which human needs are fulfilled and does not contain a physical health domain. Only one item reflects directly on health, ('*My health stops me from doing the things I want to do*') while several other items are related to health issues such as '*My age prevents me from doing the things I would like to*', '*I can do the things that I want to do*', '*I feel full of energy these days*', and '*I feel that the future looks good for me*'. At face value, a basic level of physical fitness may serve as a prerequisite to fulfill these indicated needs. As a result, it is plausible that this global measure of quality of life was not related to physical fitness or influenced by improved physical fitness levels in older adults without functional limitations.

Furthermore, ensuing from the WHO-definition, quality of life is affected by multiple factors to a different extent. Improvements on a single domain do not need to keep pace with improvements in other domains of quality of life due to parallel processes. For example, recent bereavement and major illnesses can have a major impact on an individual's quality of life [21]. A number of researchers contend that the human system cannot be described adequately with linear models [22-24]. They propose that the complex and dynamic nature of health status of the human body may be better described by the concept of critical transitions and tipping points. Critical transitions are the sudden shifts from a stable state to an alternative one when the system is exposed to a perturbation at a so called tipping point. Results of this thesis support the nonlinear character of the human body and quality of life in particular. Proceeding from this perspective, intervening in certain elements of the system may not affect the system in its

entirety. Further research is needed to strengthen our knowledge of quality of life as a dynamic system within the health status.

These findings and reflections can be translated into a number of recommendations for future studies on the effects of exercise programs on the quality of life in older adults. First, to capture and assess the dynamic and complex nature of quality of life, longer follow-up periods are recommended. It is interesting to measure the effects of exercise programs on quality of life over multiple years to investigate if proposed relationships maintain over time. Second, qualitative methods to evaluate intervention effects are needed to determine how participants experience their involvement and to obtain insights into the importance of the program for them.

Addressing health and ageing issues

It is notable that older adults living in deprived neighbourhoods emphasize their contentment with all they have, even when their life appeared to be troublesome to another person (Chapter 5). This finding may be called paradoxical as living in a deprived neighbourhood is commonly associated with less affluent health and well-being.

This positive attitude may reflect a coping strategy for addressing health and ageing issues. Obviously, self-perceived quality of life depends on a variety of factors, of which financial and environmental aspects are just two of them. The assumption that all individuals living in deprived neighbourhoods are at a disadvantage should be abandoned. The negative stereotyped image of inhabitants of deprived neighbourhoods and the common negative publicity about these places does not correspond with the perceptions of the inhabitants. Most older inhabitants do not identify themselves with the negative labels such as ‘low-educated’, ‘low-income’, and ‘disadvantaged’. Based on current research experiences, it is recommended to take these perceptions into account and be cautious with negatively charged labels.

In addition, gaps in knowledge of the consequences from health issues may explain the positive attitude. These gaps in knowledge are strongly related to inadequate health literacy skills. Health literacy refers to a set of cognitive and social skills to acquire, understand, and use information in order to enhance and maintain good health [25,26]. Inadequate health literacy skills influence the way older adults encounter health problems, but it may possibly also influence the way that health issues and diseases are perceived [27,28]. Health literacy enables older individuals to overcome barriers to health, and elaborated health knowledge may translate into the initiation and maintenance of healthier behaviour [29]. An awareness of possible inadequate health literacy skills in older adults is important and educational strategies must consider health literacy levels. In addition, researchers and project organizations should respond appropriately to the inadequate health literacy of potential participants in the recruitment of older adults (in

deprived neighbourhoods) for lifestyle projects, and information leaflets must be in line with the literacy skills of the target population.

Frailty and resilience

Studies in this thesis aimed to obtain increased insight into the use of the frailty screening instrument GFI. The GFI subscales are found to be adequate to assess frailty in three subscales. This insight enables improved targeting of programs for frail older adults. The GFI may be adopted by general practitioners to screen frailty in older patients and recognize early onset symptoms. The subscale scores will indicate if the frail patient requires support on a specific frailty domain. The score may function as a starting point for discussing ageing and health issues with the patient and to initiate appropriate care. Future studies should include GFI subscale analyses and must explore the use of these subscale scores.

Furthermore, this thesis contributed to the development of an instrument for assessing resilience in older adults that incorporates the multidimensional adversities of ageing. Recent research emphasizes the important role of resilience for healthy behaviour and successful ageing [30,31]. In addition, resilience is proposed as a suitable source for health promotion strategies as the focus is on addressing resources rather than deficits and risk factors [31]. Suitable resilience programs must be developed for older adults, especially in low socioeconomic status groups. The developed GARI instrument may contribute to measure possible effects of interventions on resilience. Future studies should clarify if an improvement in resilience could actually translate into healthier behaviour.

CONCLUDING REMARKS

Even in deprived neighbourhoods, it is possible to recruit sedentary, community-dwelling, older adults and engage them in physical exercise. A community-based approach, attention to group building and cohesion, and community ownership of the project seem to be essential factors. For these older adults, a group program with weekly exercise sessions of moderate intensity is suitable to improve physical fitness. Policymakers and local authorities should enable easily accessible exercise programs for older adults, especially in deprived neighbourhoods. Close cooperation between primary health care providers, including general practitioners and physiotherapists, and exercise projects in the public domain is recommended in order to refer inhabitants to the most adequate program or care.

Improvement in physical fitness does not directly translate into an improvement in global quality of life, nor did physical fitness have a direct or indirect effect on quality of

life. Therefore, a multifactorial approach is recommended to influence the quality of life in older adults. In addition, to adequately assess intervention effects on quality of life in future research, longer follow-up periods and additional qualitative evaluation methods are recommended.

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SAMENVATTING

In dit proefschrift staat onderzoek naar het bevorderen van de kwaliteit van leven van ouderen, wonend in wijken met een lage sociaaleconomische status, centraal. Kwaliteit van leven wordt gedefinieerd als het functioneren van personen op fysiek, psychisch en sociaal gebied en de subjectieve evaluatie daarvan. Veroudering gaat gepaard met een afname in meerdere fysiologische systemen, waardoor het fysiek functioneren en het vermogen om dagelijkse lichamelijke taken uit te voeren negatief worden beïnvloed. Door deze veranderingen in fysiologische systemen en veranderingen in het sociale netwerk, zijn ouderen gevoelig voor een afname in de kwaliteit van leven. Daarnaast kunnen sociaaleconomische factoren de gezondheid en kwaliteit van leven beïnvloeden. Wonen in een wijk met een lage sociaaleconomische status is geassocieerd met verschillende negatieve gezondheidsuitkomsten. Daarom is het cruciaal om juist voor ouderen in deze wijken toepasbare en effectieve strategieën te ontwikkelen om de kwaliteit van leven te behouden of te verbeteren.

In dit proefschrift zijn verschillende oudere populaties onderzocht om kennis en inzichten te verkrijgen die nodig zijn om de kwaliteit van leven van thuiswonende, kwetsbare, ouderen te kunnen beïnvloeden. In Hoofdstuk 2 en 3 staat onderzoek naar het meten van kwetsbaarheid en veerkracht bij ouderen centraal (**Thema 1**). In Hoofdstuk 4 is de relatie tussen de sociaaleconomische status en de kwaliteit van leven bij ouderen onderzocht (**Thema 2**). Hoofdstuk 5 en 6 richten zich specifiek op thuiswonende ouderen wonend in wijken met een lage sociaaleconomische status in Noord-Nederland (**Thema 3**). In Hoofdstuk 5 wordt onderzocht hoe deze ouderen omgaan met veroudering. Tot slot worden in Hoofdstuk 6 de effecten beschreven van een wijkgerichte leefstijl interventie op de fysieke fitheid, het psychosociale functioneren en de kwaliteit van leven bij ouderen wonend in wijken met een lage SES.

Thema 1 - Het vaststellen van kwetsbaarheid en veerkracht bij ouderen

In **Hoofdstuk 2** zijn de psychometrische eigenschappen van de 15-item Groningen Frailty Indicator (GFI) geëvalueerd bij thuiswonende ouderen (n = 1508). De GFI is een zelf-gerapporteerd screeningsinstrument dat wordt ingezet om kwetsbaarheid vroegtijdig te herkennen. Bevindingen van deze studie bevestigen een drie-dimensionele factor structuur van de GFI met de subschalen Dagelijkse Activiteiten (items 1 – 4), Psychosociaal Functioneren (items 11 – 15) en Gezondheidsproblemen (items 5 – 10). Deze GFI subschalen hebben een acceptabele interne consistentie (resp. α = 0,81; 0,80; 0,57), schaalbaarheid (resp. Hs = 0,84; 0,35; 0,35) en criteriumvaliditeit (resp. r = -0,62; -0,48; -0,48). De GFI subschalen maken een multi-dimensionele bepaling van kwetsbaarheid mogelijk. De subschaal scores geven een rijkere beoordeling van kwetsbaarheid dan een enkele totaalscore. Zo bleek uit de analyse dat meer dan twintig procent van de kwetsbare ouderen (GFI ≥ 4) enkel problemen ervaart in het psychosociale domein.

In **Hoofdstuk 3** is een meetinstrument ontwikkeld en geëvalueerd voor het bepalen van veerkracht bij ouderen. Veerkracht is de uitkomst van een dynamisch proces van positieve aanpassing wanneer men te maken heeft met tegenslagen. De 13-item Groningen Ageing Resilience Inventory (GARI) vragenlijst is gebaseerd op een conceptueel model van veerkracht tijdens veroudering en houdt rekening met de multi-dimensionele eigenschappen van veerkracht. De GARI blijkt een goede interne consistentie ($\alpha = 0.85$) en constructvaliditeit te hebben (n = 229). Hiermee lijkt de GARI geschikt voor het herkennen van interne bronnen van veerkracht, zoals flexibiliteit en optimisme, en externe bronnen van veerkracht, zoals nauwe contacten met de familie, in de oudere populatie. Zorgverleners kunnen de GARI inzetten om de adaptieve capaciteit en de interne en externe bronnen van veerkracht bij ouderen te meten.

Thema 2 - Determinanten van kwaliteit van leven bij ouderen

In **Hoofdstuk 4** is de relatie tussen kwaliteit van leven, sociaal functioneren, depressieve symptomen, eigen-effectiviteit, fysieke fitheid en sociaaleconomisch status (SES) bij thuiswonende ouderen onderzocht met gebruik van 'structural equation modeling' (n = 193). Resultaten van de padanalyse tonen aan dat SES een indirect effect heeft op de kwaliteit van leven via sociaal functioneren, depressieve symptomen en eigen-effectiviteit. Fysieke fitheid en SES hadden geen direct effect op de kwaliteit van leven. De model fit waarden tonen aan dat het model een acceptabele model fit heeft ($\chi2 = 98,3$; df = 48; $p < 0,001$). Daarnaast verklaart het model 55,5 % van de variantie van kwaliteit van leven. Om de kwaliteit van leven van ouderen te verbeteren, lijkt extra aandacht voor de sociaaleconomische verschillen in psychosociaal functioneren bij thuiswonende ouderen nodig.

Thema 3 - Actief ouder worden in wijken met een lage SES

In **Hoofdstuk 5** is een kwalitatieve studie beschreven waarin is onderzocht hoe thuiswonende ouderen wonend in wijken met een lage SES omgaan met verouderingsproblematiek. Diepte-interviews zijn gehouden met twintig thuiswonende oudere inwoners van een wijk met een lage SES in Nederland. Ouderen verschillen in hun besef over het adequaat omgaan met leeftijd gerelateerde gezondheidsproblemen. Meerdere deelnemers onderschatten de consequenties van ziekten of negeren tekenen van leeftijd gerelateerde afname in gezondheid door gebrek aan kennis over veroudering en gezondheid. Ondanks deze kennis tekorten blijkt dat deze ouderen een optimistische kijk op het leven hebben, hun situatie accepteren en tevreden zijn met alles wat ze nog kunnen en de mogelijkheden die ze nog hebben. Deze inzichten zijn van waarde bij het ontwikkelen van richtlijnen voor zorgprofessionals. Gezondheidszorgprofessionals, zoals de wijkverpleegkundige, zouden de coping strategieën van ouderen wonend in wijken met

een lage SES moeten herkennen en daarbij rekening moeten houden met mogelijk beperkte gezondheidsvaardigheden.

In **Hoofdstuk 6** is een interventie studie beschreven waarin de effecten van één jaar deelname aan een wijkgerichte leefstijl interventie op kwaliteit van leven, waaronder fysiek, sociaal en psychologisch functioneren, bij fysiek inactieve thuiswonende ouderen wonend in een wijk met een lage SES zijn onderzocht (n = 198). In dit leefstijlproject zijn deelnemers getraind om de project verantwoordelijkheden en het eigenaarschap te dragen, om uiteindelijk zelfstandig het project in de wijk voort te kunnen zetten. Het programma bestond uit wekelijkse beweeglessen in groepsverband met daaraan gekoppeld 6-week durende leefstijlmodules over het omgaan met somberheid en eenzaamheid en fysieke activiteit in het dagelijkse leven. Een quasi-experimenteel studie design is toegepast om de effecten van de interventie te bepalen. De interventie bleek effectief voor het behouden van de kwaliteit van leven en het verbeteren van de fysieke fitheidsmaten beenkracht en uithoudingsvermogen over een periode van één jaar in de interventie groep ten opzichte van de referentie groep. Het project illustreert dat het mogelijk is om ouderen in wijken met een lage SES te motiveren en te activeren tot een gezondere leefstijl wanneer een wijkgerichte benaderstrategie is toegepast.

Algemene discussie

Tot slot zijn in **Hoofdstuk 7** de belangrijkste bevindingen van dit proefschrift samengevat. Daarnaast wordt besproken hoe, met de inzichten uit dit proefschrift, de gezondheid en kwaliteit van leven kunnen worden behouden of verbeterd bij thuiswonende ouderen in wijken met een lage sociaaleconomische status. Dit proefschrift laat zien dat het ook in wijken met een lage sociaaleconomische status mogelijk is onvoldoende actieve thuiswonende ouderen te motiveren tot een gezondere leefstijl. Een wijkgerichte aanpak, aandacht voor groepsdynamiek en interventie eigenaarschap lijken hierbij essentiële factoren. Voor deze ouderen is een groepsprogramma met wekelijkse beweeglessen op matige intensiteit geschikt om de fysieke fitheid te verbeteren. Beleidsmakers en lokale overheden zouden beweegprojecten makkelijker toegankelijk moeten maken voor ouderen, in het bijzonder in wijken met een lagere sociaaleconomische status. Nauwe samenwerking tussen eerstelijns zorgprofessionals, waaronder de huisartsen en fysiotherapeuten, en beweegprojecten in het publieke domein zijn hierbij essentieel om bewoners het meest passende programma of zorg aan te bieden.

Verbetering in de fysieke fitheid vertaalt zich niet rechtstreeks in een verbetering in de algemene kwaliteit van leven. Ook heeft fysieke fitheid geen directe of indirecte invloed op de algemene kwaliteit van leven. Daarom is een multifactoriële aanpak aanbevolen wanneer het doel is de kwaliteit van leven van ouderen te beïnvloeden. Langere follow-up periodes en aanvullende kwalitatieve evaluatiemethoden zijn aanbevolen om de effecten van interventies op de kwaliteit van leven adequaat te meten.

CURRICULUM VITAE

Annemiek Bielderman werd geboren op 15 november 1987 in Deventer. In 2006 behaalde zij haar VWO-diploma aan De Waerdenborch te Holten. In datzelfde jaar startte zij met de opleiding Bewegingswetenschappen aan de Rijksuniversiteit Groningen. In 2009 begon zij aan de tweejarige master Bewegingswetenschappen met als afstudeerrichting 'Veroudering, bewegen en gezondheid'. Haar afstudeeronderzoek ging over de toepasbaarheid en effectiviteit van krachttraining bij ouderen met dementie. Tijdens haar studie werkte zij als onderzoeksmedewerker bij het GALM project, waar zij betrokken was bij de coördinatie van GALM beweeginterventies voor fysiek inactieve ouderen.

Na haar afstuderen in augustus 2011 is zij direct begonnen bij de Hanzehogeschool Groningen met promotieonderzoek bij het Lectoraat Healthy Ageing, Allied Health Care and Nursing. Haar onderzoek richtte zich primair op de evaluatie van gezonde leefstijlprojecten bij zelfstandig wonende ouderen in wijken met een lage sociaaleconomische status, zoals beschreven in dit proefschrift.

Naast haar werkzaamheden als promovenda was zij werkzaam als project coördinator bij de Stichting GALM. Daarnaast was zij van februari 2014 tot september 2015 als docent werkzaam bij de opleiding Logopedie van de Hanzehogeschool Groningen waar zij vol- en deeltijd studenten begeleidde bij hun afstudeerprojecten.

Sinds oktober 2014 is Annemiek deeltijd werkzaam bij het Lectoraat Healthy Ageing, Allied Health Care and Nursing als post-doc onderzoeker, waar ze werkt aan onderzoek naar de therapietrouw van eiwitrijke voeding bij patiënten met een risico op ondervoeding.

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