

# **Social relationships and healthy ageing**

Epidemiological evidence for the development of a local  
intervention programme

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Thesis

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## Abstract

### Introduction

In view of the growing number of older people in our society and the related consequences for health and well-being, research focussing on healthy ageing is essential. Already, the associations between supportive social relationships and healthy ageing have been established. However, there is as yet no consensus about whether or not it is the structure of the social network, its functioning or a combination that is most important for health, and in addition, about which aspects of structure and function are important.

### Aim

The main objective of this thesis was to investigate aspects of the structure and functioning of social relationships and their influence on mental, physical and social health in older people. This was relevant to obtain scientific evidence for practice-based research to support local policy making on healthy ageing.

### Methods

Different characteristics and functions of social relationships, such as frequency of contact, different sources of social network ties, satisfaction with relationships, positive and negative perceptions of social support and social engagement have been analysed in cross-sectional and prospective studies. Cross-sectional data are from six community health services in the eastern part of the Netherlands. The overall sample size constituted of 24,936 people aged 65 and over (response 79%). Prospective data are from the Doetinchem Cohort Study. The first examination round (1987-1991) comprised 12,448 men and women aged 20 to 59 years. The overall response rate was 62% for the baseline measurement and 79%, 75% and 78% for rounds 2, 3 and 4 respectively.

### Results

Cross-sectional analyses showed that satisfaction with the social contacts was strongly related to physical (OR 2.36; 95% CI 2.11-2.64), mental (OR 4.65; 95% CI 4.20-5.15) and self-perceived health (OR 2.52; 95% CI 2.29-2.78). Longitudinal analyses underlined this finding by showing that unfavourable levels of social support were predictive for health-compromising behaviours and poor health over a 10-year period of follow-up, and for increased mortality risk over a 15-year period of follow-up (HR 1.57; 95% CI 1.03-2.39). Furthermore, neighbours were found to be an important source of the social network ties of older people in relation to physical (OR 1.87; 95% CI 1.68-2.07), mental (OR 1.53; 95% CI 1.39-1.69) and self-perceived health (OR 1.42; 95% CI 1.30-1.54).

Further exploration of the relationship between social support and loneliness using structural equation modelling identified that social support in everyday situations may serve as a good starting point for health promotion activities to prevent loneliness. To better target health promotion activities for healthy ageing, analyses were performed to group older people into subgroups with similar social engagement activity patterns. Five clusters were identified: 1) less socially engaged

elderly; 2) less socially engaged caregivers; 3) socially engaged caregivers; 4) leisure-engaged elderly; and 5) productive-engaged elderly. Older people who were not engaged in any social activity other than the care for a sick person, were identified as a possible target group, given the relatively high share of unhealthy people among them. In this non-socially engaged target group, the prevalence of loneliness was 48%, compared to 30% in the socially engaged groups; poor self-perceived health: 41% compared to 14%; poor mental health: 25% compared to 9%; poor physical health: 27% compared to 2%.

### **Conclusion**

Well-functioning social relationships were favourably associated with health. By integrating all results, the local data have strengthened the scientific evidence-base for local policy making and have contributed to the development of an evidence-based community intervention supporting social participation among older people.

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# Chapter 1

General introduction

## The ageing society

Global ageing will put increased economic and social demands on all countries, but is nevertheless one of humanity's greatest triumphs. In every European country, the proportion of people aged 65 years and older is growing faster than any other age group as a result of both longer life expectancy and declining fertility rates. In Europe, the proportion of people aged 65 years and older is currently 17.4%, and will increase to 20.1% during the coming 10 years (1). Also in the Netherlands, there has been a sharp rise and growing share of older people in the population leading to an increasing amount of age-related health problems. This year, the proportion of older people aged 65 and over is 15.3% and it is expected to strongly increase in the coming decades to 19.8% in 2020 and to 24.1% in 2030 (1, 2).

## Healthy ageing

With the ageing population, there is increasing interest with researchers and policy makers in how to age healthy or successfully. A good understanding of the concept of successful ageing and of its determinants might contribute to the creation of opportunities for developing intervention programmes. Rowe and Kahn defined successful ageing not simply as longevity, but as the absence, or avoidance, of disease and risk factors, maintenance of physical and cognitive functioning and active engagement with life (3). According to this definition and many others, health status in older people should be regarded as an integrative concept from physical, mental and social perspectives (3-5). Therefore, operational definitions should include several domains such as physical and cognitive functioning and subjective health indicators (6).

## European, national and local policy focus regarding healthy ageing

Given the growing number of older people in our society and the consequences for health and well-being, health policies supporting healthy ageing are and will continue to be a central focus of concern at European and national level (7). On the European level, the strategy of the European Union (EU) has taken into account the importance of action in relation to physical, mental and social health of older people. In the Netherlands, the policy for the coming years is outlined in the document entitled 'Policy for older persons in the perspective of an ageing population' (8). In this document, the Dutch government emphasizes the challenge for older people to maintain a dignified and independent life, as well as participating in social and cultural activities. One of the mentioned priority areas in this document is the stimulation of activities to keep older people fit as long as possible and to stimulate them to actively participate in and contribute to the society. As a result, the Social Support Act (*Wet maatschappelijke ondersteuning - WMO*) came into force in the Netherlands on 1 January 2007 (9). The aim of the act is to promote people's participation in life and society, and to strengthen social cohesion and quality of life at the local level. The national government hands over the responsibility to implement this act to the local authorities, thereby aiming to reduce the distance between the authorities and citizens to make services fit better with the citizens' needs. To support local health-policy making, scientific research originat-

ing from local populations is considered especially useful to provide information on health status and its determinants relevant to the local interests.

## Determinants of health

The determinants of the general health of the population can be conceptualised as rainbow-like layers moving from the individual to the wider society (figure 1.1), as proposed by Dahlgren and Whitehead (10). In the centre of the figure, individual health determinants are presented, such as age, sex and hereditary factors. The first layer represents individual lifestyle factors, such as smoking, drinking, physical activity and diet. Social and community networks, which are one of the main priority areas for local policy regarding healthy ageing, are situated in the second layer. The third layer from the centre includes the influences of a person's living and working conditions, such as food supply and access to goods and services. Finally, roofing over all layers is the overall society, including socio-economic, cultural and environmental conditions.

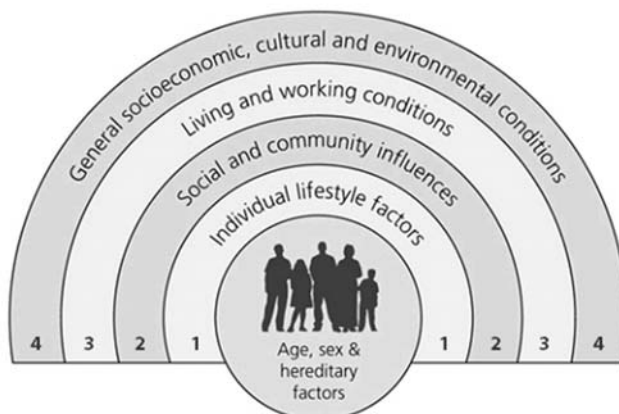


Figure 1.1: The main determinants of health

## Social relationships and healthy ageing

As a result of the Social Support Act, the current local policy focus is directed towards social relationships to enhance social support and participation in society. However, to formulate policies to promote healthy ageing, the associations between social relationships and healthy ageing need to be understood. The web of social relationships of an individual with e.g. family, friends and neighbours and the characteristics of those relationships define the social network of a person (11). Social relationships are built during life and the size of the network decreases when people are ageing (12, 13). Berkman and Glass sum up the body of evidence on the health influences of social networks (11, 14). Similar to the rainbow-like model of Dahlgren and Whitehead which was presented in figure 1.1, Berkman and Glass propose a conceptual model of how social

networks influence health (figure 1.2). Both models present social networks as a meso-influence on health; social networks are embedded in the upstream social and cultural context (macro) that may shape the network structure and function, and the social network, in turn, influences downstream social support, engagement, access to resources, and social and interpersonal behaviour on the individual level (micro). The conceptual model of Berkman and Glass provides entrances for research to support local health policy for the improvement of social support and social participation among older people to contribute to healthy ageing in the community.

Three pathways are proposed through which social network influences health (11, 14, 15). The first pathway involves behavioural processes. Supportive relationships or social pressure may either facilitate health promoting or health damaging behaviours such as smoking, drinking, physical inactivity and help-seeking behaviour. The second pathway involves psychological processes that are linked to self-esteem, coping effectiveness, perceptions of control or sense of coherence, and are thought to enhance adaptation to stressful life events. The third pathway involves physiological processes such as changes in cardiovascular, neuroendocrine, and immune function (15). The behavioural and psychological pathways may affect health, while possibly mediated through physiological processes.

Numerous researchers have studied the associations between supportive social relationships and health, including mortality, disability, depression, and well-being (11, 14-50). However, Social networks, social support and social engagement encompass different aspects that are not always clearly defined. In addition, different components of the social network, social support and social engagement are grouped together, making it difficult to interpret their influences on health. Consequently, there is as yet no complete consensus about whether or not it is the structure of the social network or its functioning that is most important for health, and in addition, which aspects of these characteristics are important.

## **Aim of the PhD thesis**

The main objective of this thesis is to investigate the associations between social relationships and health in older people, thereby taking into account different structural characteristics and functions of social relationships, and the various domains of physical, mental and social health. The results of this thesis will be used to support local policy making on healthy ageing and to provide evidence-based input for the development of a complex intervention programme for healthy ageing. For the development of specific interventions, the focus of this thesis will be on the different aspects of social relationships.

To study the health impact of social relationships data will be used from both cross-sectional and prospective studies. In the region of Gelre-IJssel, cross-sectional and longitudinal surveys are available to provide data to investigate the associations between social relationships and health: the Elderly Monitor and the Doetinchem Cohort Study (figure 1.3). These two projects focus on health status and its determinants, including both structural characteristics and functions of social relationships, as well as subjective and objective indicators of health.

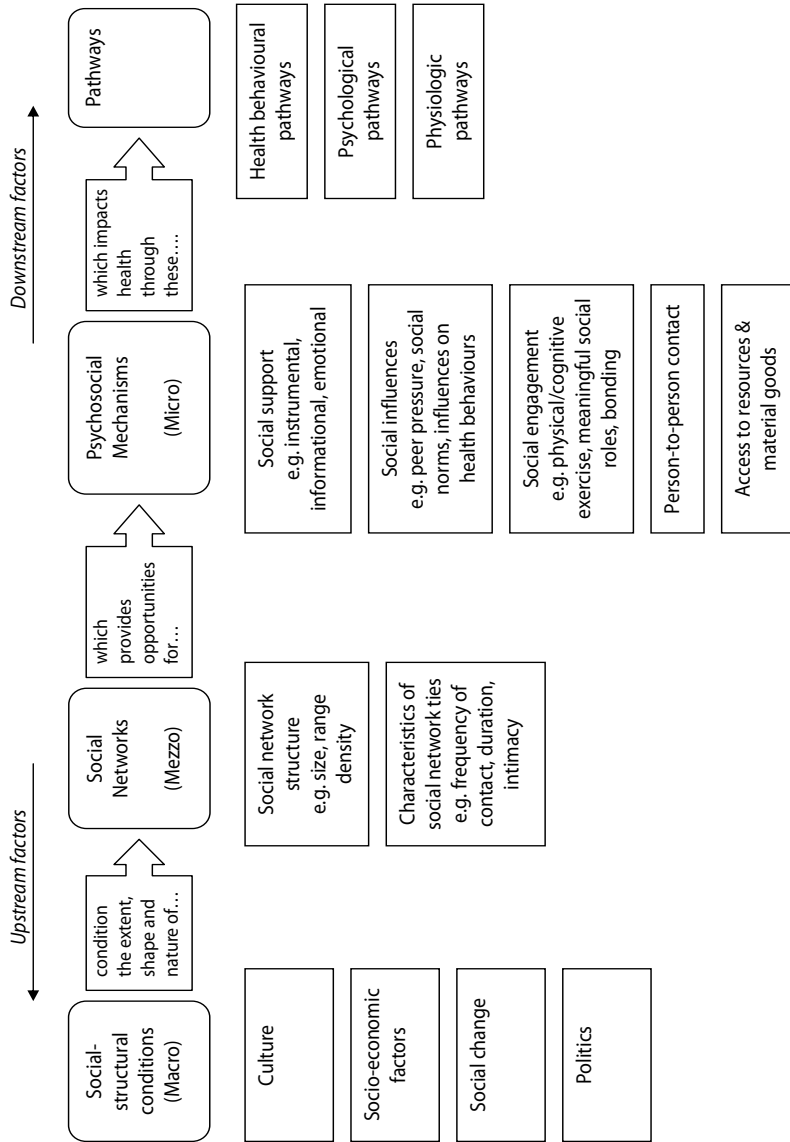


Figure 1.2: Conceptual model of how social networks impact health

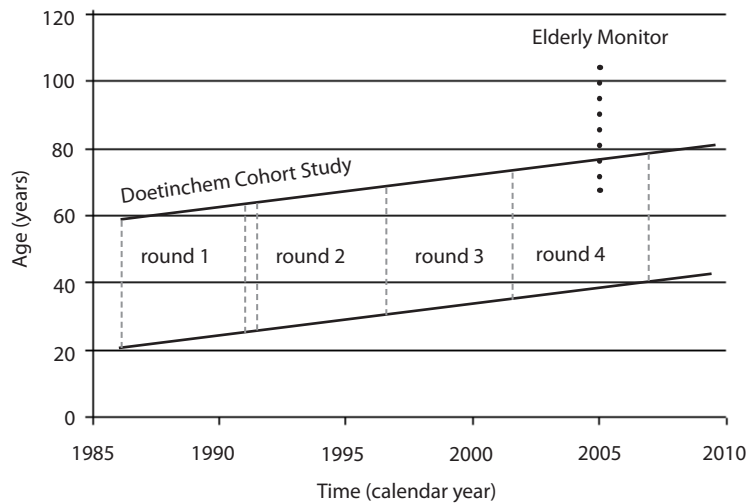


Figure 1.3: Elderly monitor Gelre-IJssel and the Doetinchem Cohort Study. Solid lines show the Doetinchem Cohort, initially aged 20-59 and ageing to 41-80, during 20 years of follow up. The vertical dashed lines within the cohort show the years in which data were collected (rounds 1 to 4). The Elderly monitor (dotted vertical line) represent a cross-sectional survey in 2005 among people aged 65 years and over in the population of the Gelre-IJssel region.

## Elderly Monitor

In 2005, the community health service of the Gelre-IJssel region conducted cross-sectional health surveys to identify the main health problems among independently living people aged 65 years and over (51). Independently-living elderly were randomly sampled out of the Municipal Databases (personal files) of the municipalities within the regions of the community health service. The random sample was stratified by two age groups; 65-74 years and 75 years and over. Questionnaires were self-administered and included approximately 100 standardised questions about health, determinants of health, health care use and health care needs. Around 500 older people living in the municipalities of the Gelre-IJssel region were selected from the municipalities' population registries (response 81%). Also in 2005, five other nearby community health services conducted local health surveys among older people, sharing similar sampling procedures and questionnaires (overall response rate of 79%). Descriptive results from these Elderly Monitors are used by the local government to support evidence-based policy making.

## Doetinchem Cohort Study

The Doetinchem Cohort Study is a prospective cohort study in the Gelre-IJssel region that was set up with a national perspective to investigate the impact of lifestyle and biological risk factors on aspects of health (52). The study started in 1987, as part of the Monitoring Project on

Cardiovascular Disease Risk Factors (MP-CVDRF). The first examination round (1987-1991) comprised 12,448 men and women aged 20 to 59 years who lived in Doetinchem. Two-thirds of those who were measured in the first round were randomly selected after five years for follow-up measurements, as part of the subsequent Monitoring Project on Chronic disease Risk Factors (MORGEN-project). This random sample is considered the base of the Doetinchem Cohort Study. The participants are examined every 5 years; each year 1/5 of the cohort is examined. Until now, three follow-up rounds of the Doetinchem Cohort Study have been completed. The overall response rate was 62% for the baseline measurement and 79%, 75% and 78% in rounds two, three and four respectively.

## Indicators of social relationships

By investigating a variety of measures for social relationships, we aim to gain insight in the specific components that influence older people's health. As measures of social relationships we used structural measures of social relationships, and their functions. The Elderly monitor provided data on frequency of contact, different sources of social network ties, satisfaction with relationships and social engagement. The Doetinchem Cohort Study provided data on positive and negative experiences of social support. Table 1.1 gives an overview of the indicators that were used in this thesis.

Table 1.1: Structural and functional characteristics of social relationships that are addressed in this thesis

	Example	Addressed in
<b>Structural</b>		
Frequency of contact	How often do you meet with your family, friends or neighbours?	Chapter 2
Source of social network ties	How often do you meet with your friends?	Chapter 2
<b>Functional</b>		
Satisfaction	How satisfied are you with your relationships?	Chapter 2
Social support	Does it ever happen to you that people invite you to a party or dinner?	Chapter 5
Positive experiences of social support	How often did you experience in your contacts with other people warmth and friendliness?	Chapters 3 & 4
Negative experiences of social support	How often did you experience in your contacts with other people that someone belittled you?	Chapters 3 & 4
Social engagement	How often are you engaged in voluntary work?	Chapter 6

## Outline of the PhD thesis

In figure 1.4 the outline of this thesis concerning chapters 2-6 is presented. In chapters 2, 3 and 4, the associations between social relationships and health in older people are described, using cross-sectional and longitudinal data including different aspects of social relationships and different health outcomes. First, we explored if structural and functional characteristics of social relationships were cross-sectionally associated with physical functioning, mental health and self-perceived health (chapter 2). We differentiated between the frequency of contact, different sources of social network ties, and the satisfaction with these relationships. In chapter 3, cross-sectional and prospective analyses were carried out to investigate the association between social support and a variety of intermediate and long-term health-related outcomes over a period of 10 years. The influences on health of both positive and negative perceptions of social support were investigated. Using the same social support measurement as in chapter 3, the effects of positive and negative experiences of social support on long-term mortality were investigated in chapter 4. We used two strategies to explore the relationship between positive and negative experiences of social support and mortality. First, we analysed the association between a single measurement of social support at baseline and mortality after 20 years of follow-up. Since a single measurement of social support might be more prone to random measurement error than repeated measurements, we also examined the association between those with a stable level of social support over five years and subsequent mortality.

As the results of this thesis will be used to provide evidence-based input for the development of a complex intervention programme for healthy ageing, chapters 5 and 6 describe the research on specific leads and potential target groups for health promotion activities. To identify specific leads for health promotion activities regarding social support, the associations of three domains of social support concerning different situations with social and emotional loneliness were explored in chapter 5 using structural equation modelling (SEM). In chapter 6, older people were clustered into subgroups with similar activity patterns regarding social engagement. The subgroups were characterised by socio-demographic factors and health indicators, to identify possible target groups for health promotion activities.

Chapter 7 demonstrates how the findings of the previous chapters jointly can contribute to the agenda setting and programme development of policy making to support local policy on healthy ageing. Finally, the main findings of the PhD research are summarised and a reflection on methodological issues is given in the general discussion (chapter 8).



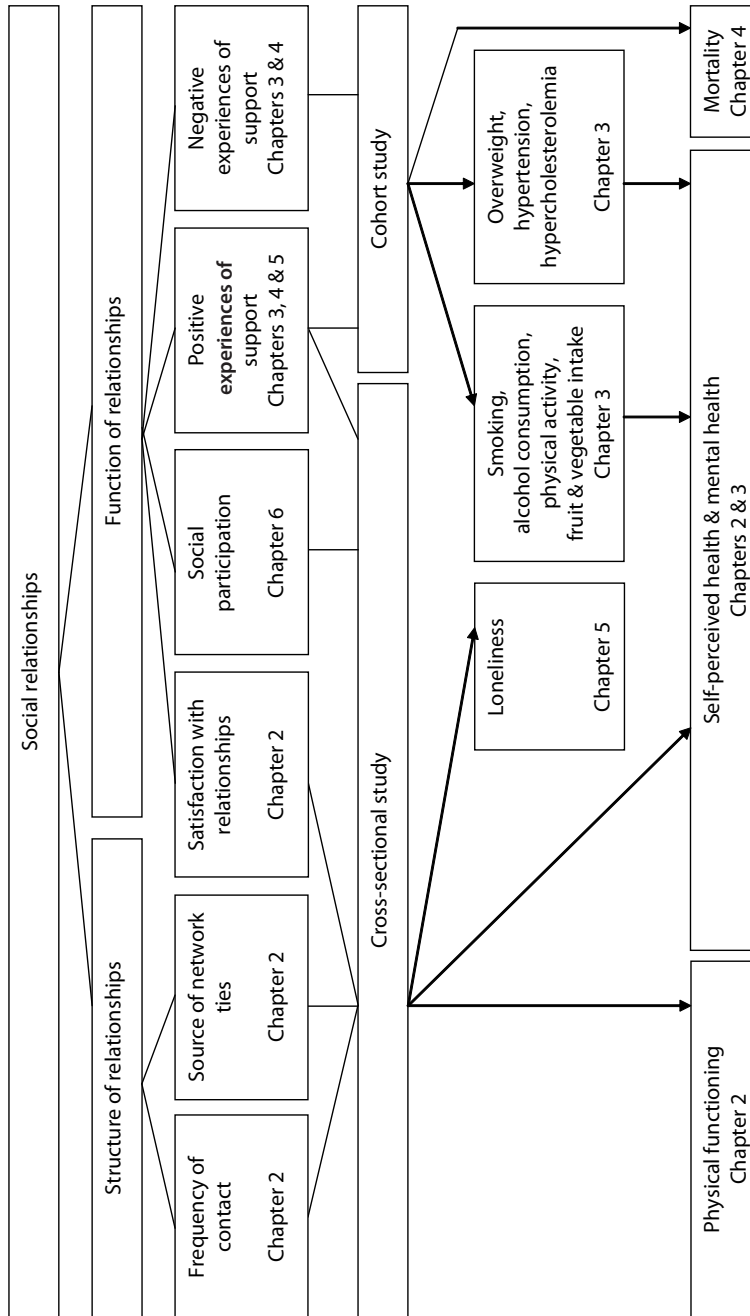


Figure 1.4: Outline of this thesis (chapters 2-6)

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# Chapter 2

Social network ties in relation to self-perceived health, physical functioning and mental health in independently-living older people

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## Abstract

**Objective:** The objective of this study was to investigate the associations of the frequency of contacts with the social network ties, different sources of social network ties, and the satisfaction with these contacts with self-perceived health, physical functioning and mental health in older people.

**Methods:** Cross-sectional data of 22,149 independently-living people aged 65 and over were collected in 2005 via Dutch community health services (response 79%). Contact frequency with family, friends, or neighbours, and being satisfied with these contacts were used to characterise social network ties.

**Results:** Neighbours were found to be an important source in the social network ties with regard to health as was shown by the adjusted odds ratios with 95% confidence intervals for self-perceived health: 1.42 (1.30-1.54), physical functioning: 1.87 (1.68-2.07) and mental health: 1.53 (1.39-1.69). Contact frequency and satisfaction were both beneficially associated with health. The odds ratio's for having a good health when being satisfied with the social network contacts ranged from 2.36 to 4.65.

**Discussion:** The source of the social network ties and the satisfaction with them seems to be of great importance to health. Insight into the different aspects of the network might help tailoring health promotion activities.

## Introduction

In addition to individual characteristics, there is a rapidly growing interest in social environmental determinants of health (1-4). One of the aspects of the social environment is the social network, which can be defined as the web of social relationships of an individual with family, friends and neighbours and the characteristics of those relationships (2). A social network is built up during life, and the size and characteristics of the network change when growing old (5-7). Maintaining a good social network is of special importance for older people. When health decreases over time, it is likely that there will be a greater need for support from social network ties (5, 8, 9). It is therefore important to investigate characteristics of the social network in relation to health. Social networks encompass different aspects that are not always clearly defined. Different components of the social network ties are often grouped together, making it difficult to identify their separate influences on health (10, 11). More insight into the role of different aspects of the social relationships such as frequency of contacts, sources of contacts and satisfaction with contacts is necessary.

Therefore, the objective of this study is to investigate the associations of the frequency of contacts, different sources of social network ties, and the satisfaction with these contacts with health status in independently living older people. To reflect both the physical and mental components of health status, the different aspects of social relationships will be investigated with self-perceived health, physical functioning and mental health.

## Methods

### Study population

In 2005, six community health services in the eastern part of the Netherlands monitored health status, determinants of health, health care use and health care needs of independently living older people aged 65 years and over by means of a standardised questionnaire with around 100 questions. From the population registries in the towns, a sample was drawn stratified by age (65-74 years and 75 years and older). In October 2005, the questionnaires were sent by mail to 32,980 older people in total. Within a period of ten weeks, two reminders were sent to the non-respondents, which resulted in an overall response rate of 79%. From this sample, 967 participants were excluded because of missing values on identification codes, date of birth or gender. Eventually, 24,936 older people were included in this study.

### Variables

Social networks were determined by both structural and functional aspects. Social network structure was assessed by frequency of contact with family, friends and relatives, and with neighbours. The answer categories for frequency of contact were (almost) daily, weekly, a few times a month, (almost) never or I don't have family or friends. The quality of the network was measured by the satisfaction the participants had with these contacts, by asking the question: 'How satisfied or dissatisfied are you with the contacts you have?' with 5 answer categories ranging from very satisfied to very unsatisfied.

Categorisation of the values of the health variables and general characteristics was done based on the standardised procedures of the community health services. Self-perceived health was questioned by 'how would you classify your health in general?', using a 5-point scale ranging from excellent to poor. It is known that this indicator predicts mortality (12). Good self-perceived health was defined as having a good, very good, or excellent health. Physical functioning was assessed by means of a 10-item questionnaire on Activities of Daily Living (ADL). Good physical functioning was considered as having no difficulties with the ADL items (13). The ten ADL-items were 'eating and drinking', 'sit down in and stand up from chair', 'getting in and out of bed', 'dressing and undressing', 'transferring between rooms', 'ascend and descend stairs', 'entering and leaving the house', 'transferring outdoors', 'washing hands and face', and 'taking a bath or a shower'. The Mental Health Index (MHI-5) was used to measure general mental health. It consisted of the following five questions "How much of the time in the previous 4 weeks: have you been a very nervous person?, have you felt so down in the dumps that nothing could cheer you up?, have you felt calm and peaceful?, have you felt downhearted and blue?, have you been a happy person?". The six response categories (all, most, often, some, a little, or none of the time) were transformed into standardised MHI-5 scores ranging from 0 (poor) to 100 (excellent). Good mental health was determined as having a score above 60 (14-16).

The general characteristics of the participants included age, sex, country of birth, household composition, educational level, income, and presence of chronic diseases. Country of birth was divided into 'the Netherlands' and 'other', since only 3.4% of the participants were from a non-Dutch origin. Household composition included one-person households, and households of two or more persons. Educational level was categorised into no/primary education, low education, intermediate education, and high education. Classes of income were established as above or below the average net household income of €1,750 per month. To retain the participants who refused to report their income, an additional category was created for unknown values. Furthermore, having difficulties with managing on income was assessed and was classified into having 'difficulties' or 'no difficulties' with managing on household income.

### Statistical analysis

Participants were excluded from the analyses if data were missing on contact frequency with family, friends or neighbours, and satisfaction with these contacts (n=444; 1.8%), as well as participants with missing values on one of the general characteristics (n=2,571; 10.3%). The analytical sample size included 22,149 older people. To evaluate the associations of social network with self-perceived health, functioning and mental health, odds ratios (OR) with 95% confidence intervals (CI) were calculated using logistic regression analyses. The variables age, sex, country of birth, household composition, educational level, household income, managing on household income, and having one or more chronic diseases were investigated for potential effect modification and confounding. Crude and adjusted odds ratios were computed to control for present confounding. Statistical analyses were performed using the SPSS for Windows software program, version 12.0.1.



## Results

The mean age of the study population was 74.2 (SD 6.5), and the proportion of women (57%) was higher than men (43%) (table 1). Within males, 84% shared a household with one or more other persons, whereas 56% of the females was living with others. Most participants were not or lower educated (78%) and reported to have an income below the average net household income of €1,750 per month (42%). Nevertheless, only 12% of the older people reported to have difficulties with managing on their household income. Although 72% of the participants suffered from one or more chronic diseases, the majority of the participants rated their own health status as good to excellent (71%), and was in good physical and mental health (84% and 83% respectively).

Older people who had frequent contact with their family, friends or neighbours were in better health than older people who had less contact (table 2). When looking into the source of the network contact, the strongest relations with good health were found for contacts with neighbours. Frequent contact with neighbours was associated with increased odds ratios for self-perceived health (OR 1.42; 95% CI 1.30-1.54), physical functioning (OR 1.87; 95% CI 1.68-2.07), and mental health (OR 1.53; 95% CI 1.39-1.69). The associations between social network and health status were in particular substantial for contact satisfaction. The adjusted odds ratios for having a good health when being satisfied with the social contacts of a network were 2.52 (95% CI 2.29-2.78) for self-perceived health, 2.36 (95% CI 2.11-2.64) for physical functioning and 4.65 (95% CI 4.20-5.15) for mental health. Additional adjustment for presence of chronic diseases did not alter the estimates.

## Discussion

This study showed that contact with social network ties is associated with a good self-perceived health, physical functioning and mental health in non-institutionalised Dutch people, aged 65 years and over. Neighbours appeared to be an important source in the social network ties with regard to health. Furthermore, we found that satisfaction with the contacts of the social network appeared to be of great importance to health.

All six community health services collected their data in the same period by means of standardised questionnaires, following a uniform protocol about procedures concerning data collection and processing. With respect to the data collection, older people aged 75 years and over were over-sampled. We therefore reran the analyses using sample-weighting factors based on the age and sex distribution of the older population living in the eastern part of the Netherlands. However, the use of weighting factors did not affect the estimates of the associations. The high initial response rate in our study (79%) might indicate that our study population was a good representative sample of non-institutionalised older people living in the eastern part of the Netherlands. Although our community health service database served a considerably large region in the Netherlands, we have a relatively rural study population which under-represents older people who do not originate from the Netherlands (17). Therefore, extrapolation of the results to the rest of the

Netherlands might not be accepted. Besides the issues of the initial response rate, 11% of the eligible older people had missing data due to item-specific non-response on items concerning the social network or social-demographic characteristics. Among the excluded people, the mean age was 1.6 years older and more people were not educated. Although the proportion of older people who suffered from one or more chronic diseases did not differ, less people reported to have a good health. Investigating possible effect modification by socio-demographic variables did not reveal differences with the original associations. This may indicate that item-specific non-response bias is unlikely to account for our findings.

In this study, we simultaneously determined three characteristics of social network ties: frequency of contacts with social network ties, sources of social network ties and contact satisfaction. Our results show that all these three characteristics of the social network were positively associated with good self-perceived health, physical functioning and mental health in older people. These results were supportive to the already existing evidence that quantity and quality of social network contacts affect health (1). In our study, being satisfied with the social contacts appeared to be more important for older people in relation to their health status than the frequency of social contact. Similar results were obtained by Melchior et al, who found that after a 12-month follow-up period among employees of a French national gas and electricity company, satisfaction with social relations were better predictors of self-perceived health than structural measures of the social network (18).

According to the source of contact, we found that frequent social contact with neighbours was more strongly associated with having good health than frequent contact with friends or family. Relationships with family were not unambiguously related to health in this study. There are some other studies that showed that relationships with friends may be more strongly associated with health status than relationships with family (19, 20). However, in these studies, neighbours were not included as a source of contact. Family, friends and neighbours clearly perform different functions in the lives of older adults, as for instance has been shown among Dutch adults aged between 55 and 89 years (8). The partner and children are preferred in the social support system, followed by friends and neighbours, and eventually professionals (8, 21). In our study, frequent contacts with family members were not significantly related to favourable levels of self-perceived health and physical health. A possible explanation for this can be that with decreasing health and increasing need of support, the frequency of contact with family members is less likely to decrease compared to contact with neighbours (22).

For older people to have a good social network may positively affect health status, but it is also possible that under influence of a poor health status, the social network will weaken. Although according to Tijhuis et al (1998), the duration of diseases hardly has any effect on social network characteristics in a general Dutch population, we cannot rule out the possibility that changes in health altered the frequency of and satisfaction with social contacts (23). Furthermore, bias could arise from dependent errors, since the reporting of the social network characteristics and the health status were both measured as the perceptions of the participants (24). Hence, more prospective research and intervention studies with separate measurements for social network and health are needed to give more insight into the causality of the associations that were found in our population. Nevertheless, if the objective change in the social network by an intervention is

not perceived beneficial by the recipients, it is possible that the expected health benefits will not materialise (25).

Table 2.1: Socio-demographic and health characteristics of the 22,149 participants

	N	Men n=9,587	Women n=12,562
Mean age (mean, SD)	22,149	73.5 (6.2)	74.8 (6.7)
Born in the Netherlands (%)	21,400	96.5	96.7
Household composition of 2 or more persons (%)	15,143	84.3	56.2
Educational level (%)			
None / primary school	7,195	25.5	37.8
Lower education	10,009	43.8	46.3
Intermediate	2,585	14.3	9.6
High	2,360	16.4	6.3
Household income (%)			
Above average	3,968	23.8	13.4
Below average	9,361	38.7	45.0
Unknown	8,820	37.6	41.6
Difficulties with managing on income (%)	2,718	12.3	12.3
One ore more chronic diseases (%)	10,614	67.9	75.9
Self-perceived health (%)			
Excellent	1,071	5.5	4.5
Very good	2,373	13.2	9.3
Good	11,772	55.6	53.7
Moderate	5,791	23.0	29.8
Bad	573	2.6	2.7
Physical functioning (%)			
No ADL limitations	18,199	88.1	77.7
1 ADL limitation	1,477	4.3	8.5
2 ADL limitations	729	2.0	4.3
3 or more ADL limitations	1,172	3.8	6.7
Mental health (%)			
MHI-5 score 61-100	17,499	88.6	79.1
MHI-5 score 45-60	2,554	8.7	14.9
MHI-5 score 33-44	608	1.8	3.7
MHI-5 score 0-32	343	0.9	2.2

In conclusion, although both the frequency of contacts and contact satisfaction were related to health status, the satisfaction with contacts of the social network seems to be of greater importance. Since 2007, when the Dutch Social Support Act came into force, more focus is directed towards promoting social cohesion and participation of older people in mainstream society. This study offers a lead for health policy making for older people by providing insight in the different aspect of the social network. The role of neighbours should be further investigated in this part, as neighbours may be a valuable source of contact in the social network of older people.

Table 2.2: Frequency of contact, source of contact and contact satisfaction associated with self-perceived health, physical functioning, and mental health

	Good self-perceived health <sup>a</sup>			Good physical functioning <sup>b</sup>			Good mental health <sup>c</sup>		
	N	OR	95% CI	N	OR	95% CI	N	OR	95% CI
At least once per week contact with family <sup>d</sup>	20,392	1.04	0.94-1.14	20,430	0.86	0.76-0.98	20,033	1.22	1.09-1.36
At least once per week contact with friends <sup>e</sup>	20,392	1.22	1.13-1.31	20,430	1.24	1.12-1.36	20,033	1.31	1.20-1.43
At least once per week contact with neighbours <sup>f</sup>	20,392	1.42	1.30-1.54	20,430	1.87	1.68-2.07	20,033	1.53	1.39-1.69
Satisfied with contact <sup>g</sup>	21,471	2.52	2.29-2.78	21,477	2.36	2.11-2.64	20,925	4.65	4.20-5.15

<sup>a</sup> good to excellent self perceived health; <sup>b</sup> no ADL limitations; <sup>c</sup> MHI-5 score  $\geq 61$

<sup>d</sup> adjusted for age, sex, country of birth, household composition, educational level, income, managing on income, contact with friends and neighbours

<sup>e</sup> adjusted for age, sex, country of birth, household composition, educational level, income, managing on income, contact with family and neighbours

<sup>f</sup> adjusted for age, sex, country of birth, household composition, educational level, income, managing on income, contact with family and friends

<sup>g</sup> adjusted for age, sex, country of birth, household composition, educational level, income, managing on income

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# Chapter 3

Positive and negative experiences of social support in relation to lifestyle, biological factors and health in the Doetinchem Cohort Study

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## Abstract

**Background:** Cross-sectional studies have reported associations between social support and health, but prospective evidence is less conclusive. This study aims to study both the cross-sectional and the prospective association between positive and negative experiences of social support and lifestyle, biological factors, self-perceived health, and mental health.

**Methods:** Data were used from 4,724 Dutch men and women aged 26-65 years who participated in the second (1993-1997), third (1998-2002), and fourth (2003-2007) study round of the Doetinchem Cohort Study. Positive and negative experiences of social support were assessed using the Social Experiences Checklist in the second study round. The lowest tertile of positive experiences and the highest tertile of negative experiences of support were associated with repeated measurements of intermediate and long-term health outcomes in the second, third and fourth study round using generalised estimating equations (GEE) .

**Results:** Both positive and negative experiences of support were cross-sectionally and prospectively associated with mental health. The prospective odds ratio was 1.86 (95% CI 1.39-2.49) for positive experiences and 1.60 (95% CI 1.21-2.12) for negative experiences of support. Consistent cross-sectional and prospective associations were also found for negative experiences of support and physical inactivity (OR 1.27; 95% CI 1.02-1.57) and poor self-perceived health (OR 1.36; 95% CI 1.01-1.82).

**Conclusions:** Mental health was affected by both positive and negative experiences of social support. Furthermore, lifestyle factors and health appeared to be more affected by negative experiences of support than by positive experiences of support.



## Introduction

Supportive social ties help to buffer stress, enhance mental and self-perceived well-being, and prevent and/or delay declines in health (1-6). Individuals who report higher levels of social support, show less decline in physical functioning over time and have a greater chance of recovering following a period of disability (7, 8). Although the relationship between social support and health is well established in cross-sectional studies, longitudinal finding as yet failed to demonstrate a protective effect on changes in health, or only found a prospective association in certain subgroups (9-11).

Behavioural pathways may mediate between social support and health (12). Supportive social relationships may facilitate health promoting behaviours, such as non-smoking, non-excessive drinking, a healthy diet and physical activity. The relationships between these behavioural processes and health are mediated by biological processes, such as changes in cardiovascular, neuroendocrine, and immune function. For instance, several studies demonstrated that social support is associated with lower blood pressure during everyday life (13, 14). Although social support is intended to be helpful, being in relationships with others can also give rise to negative exchanges. Network ties may serve as potential sources of stress or can set a negative example and/or promote unhealthy behaviours. Recently, we demonstrated that positive and negative experiences of social support have different effects on long-term mortality (15). Positive experiences of support were related with decreased mortality over a 20-year period, whereas no effect on mortality was found for negative experiences of support.

To explore the influence of both positive and negative experiences of social support on a variety of intermediate and long-term health-related outcomes, we investigated the cross-sectional and prospective associations of positively and negatively experienced social support on lifestyle factors, biological risk factors of health, self-perceived health and mental health over a period of 10 years among participants of the Doetinchem Cohort Study.

## Methods

### Design

The Doetinchem Cohort Study is a prospective cohort study set up to investigate the impact of lifestyle factors and biological risk factors on aspects of health (16). During the first examination round (1987-1991) 12,405 men and women aged 20 to 59 years living in Doetinchem, a town in the eastern part of the Netherlands, were examined (response rate 62%). Since then, three subsequent examination rounds have been completed in 1993-1997, 1998-2002, and 2003-2007. For round two, a random two-third of those who were measured in round one were invited. For rounds three and four, people who participated in the previous study round were invited, excluding those who emigrated, actively withdrew from the study or had died. Response rates were 79% for round two, 75% for round three, and 78% for round four. For 4,998 participants a baseline measurement and at least one follow-up measurement after 5 or 10 years were available.

Participants received a general and a dietary questionnaire to complete at home, and were invited to attend a medical examination at the Community Health Service, where blood samples were collected, blood pressure was measured, and anthropometric measurements were taken. Since a number of variables of interest for the present analyses were collected from round 2 onwards, we only considered data from round two, three and four. Therefore, data collected during the years 1993-1997 of round two will be considered as the baseline measurement in this study.

## Measurements

### *Social Support*

Perceived social support was measured by the Social Experiences Checklist (SEC) at baseline (17, 18). The Social Experiences Checklist consists of 16 items, of which 8 items correspond to positive experiences and 8 items correspond to negative experiences of social support. Responses to these questions are formulated on a four-point Likert-type scale, indicating “never”, “sometimes”, “regularly”, or “often”. If participants had one or more missing items of positive experiences or negative experiences of social support, they were excluded. Levels of positive and negative experiences of social support were determined by creating tertiles of the sum scores (15).

### *Socio-demographics*

The baseline socio-demographic characteristics sex, age, ethnicity, marital status, educational level, and employment status were collected using a general questionnaire. Marital status was assessed as being married or not married. Educational level was divided into three categories: low (primary school, lower vocational education or less); medium (medium vocational education, higher secondary level education); high (higher vocational education, university). Finally, employment status was dichotomised into having a paid job, yes or no.

### *Lifestyle*

Smoking, alcohol consumption, physical activity and fruit and vegetable intake were assessed by means of a questionnaire at baseline and after 5 and 10 years of follow-up. Physical activity was measured with the same questionnaire from 1994 onwards. Smoking was categorised into current, former, and never smoking, and alcohol consumption was dichotomised into drinking less than 2 glasses a day and drinking at least 2 glasses a day. Data on physical activity were collected by use of a validated questionnaire on physical activity developed by the EPIC study (19), extended with questions on sports and other strenuous leisure-time activities. People were considered physically active if they were active with moderate intensity (4 to 6.5 MET) for at least 2,5 hours per week. Total fruit and vegetable intake was assessed using a validated semi-quantitative food-frequency questionnaire (20). Having a total fruit and vegetable intake less than 400 grams per day was categorised as “low”.

### *Biological factors*

In each round, biological risk factors were measured. Height and weight were measured to the nearest 0.1 kg and 0.5 cm, respectively. The respondents were weighed wearing indoor clothing after removing their shoes and emptying their pockets. Accordingly, 1 kg was subtracted from the measured weights to take light indoor clothing into account. Body mass index (BMI) was calculated from measured weight and height ( $\text{kg}/\text{m}^2$ ), and based on this respondents were allocated to one of the following categories: normal weight ( $<25 \text{ kg}/\text{m}^2$ ), overweight ( $25\text{-}29.9 \text{ kg}/$

m<sup>2</sup>), and obese ( $\geq 30$  kg/m<sup>2</sup>) (21). Blood pressure was measured twice on participants in a seated position according to a standardised procedure. Hypertension was defined as having a mean systolic blood pressure  $\geq 140$  mmHg and/or diastolic blood pressure  $\geq 90$  mmHg and/or use of anti-hypertensive drugs (22). Cholesterol values were determined in non-fasting blood serum, which was stored at  $-20^{\circ}\text{C}$  for a maximum of three weeks. Hypercholesterolemia was defined as having a total cholesterol level of  $\geq 6.5$  mmol/L and/or use of cholesterol-lowering medication.

#### *Self-perceived health and mental health*

Self-perceived health and mental health were included in the study with similar questionnaires from 1995 onwards. Self-perceived health was ascertained by asking: “how would you rate your health in general?”, using a 5-point scale ranging from poor to excellent. Good self-perceived health was defined as having good, very good, or excellent health. The Mental Health Index (MHI-5) was used to measure general mental health. It consisted of the following five questions “How much of the time in the previous 4 weeks: have you been a very nervous person?, have you felt so down in the dumps that nothing could cheer you up?, have you felt calm and peaceful?, have you felt downhearted and blue?, have you been a happy person?”. The six response categories (all, most, often, some, a little, or none of the time) were transformed into standardised MHI-5 scores ranging from 0 (poor mental health) to 100 (excellent mental health). Good mental health was determined as having a score above 60 (23-25).

#### **Statistical analyses**

Participants with complete data on all items of the SEC ( $n=4,714$ ; 94.3% for the positive items, and  $n=4,741$ ; 94.9% for the negative items) and the socio-demographic variables ( $n=4,860$ ; 97.2%) were included in the analyses, resulting in an analytical sample of 4,724 participants. We conducted logistic regression analysis using Generalised Estimating Equations (GEE) to estimate the association between social support and the prevalence or incidence of different health indicators over 10 years of follow-up. The GEE analyses reported here were carried out with an exchangeable correlation structure. The advantage of using GEE over traditional cross-sectional logistic regression analysis is that GEE accounts for the dependency between the repeated measurements (26). The odds ratios derived from the GEE analysis following the cross-sectional approach indicate whether the probability of belonging to a group of interest, e.g. prevalent poor self-perceived health, between baseline and the subsequent 10-year follow-up period is related to social support at baseline. To investigate the prospective association between social support and the incidence of the health characteristic, participants were excluded if the outcome of interest was already prevalent at baseline. All cross-sectional and prospective models included the socio-demographic characteristics sex, age, educational level and marital status as confounding factors. Time was represented in the models by the categorical variable “study round”. Sex was considered an effect modifier, but the interaction terms with positive and negative experiences of social support were not statistically significant ( $p < 0.05$ ). Ethnicity was not included in the models, since only 1.1% of the participants were from a non-Dutch origin. In addition, when analysing lifestyle factors as outcomes, the models were additionally adjusted for the other lifestyle factors. In the same manner the models for biological factors were additionally adjusted for other biological factors, and the models for self-perceived health were additionally adjusted for mental health and vice versa. The statistical analyses of the data were carried out using version 9.1 of the SAS software program. In all analyses,  $P$ -values  $< 0.05$  were considered to be statistically significant.

## Results

The mean age of the study population at baseline, 1993 until 1997, was 45 years (standard deviation (SD): 10). About half of the participants were female (52%), 82% were married and 64% were employed. One fifth of the participants were higher educated. This group perceived higher levels of positive support than the lower educated participants. Further characteristics of the participants by tertiles of SEC-scores are shown in table 3.1.

Table 3.1: Baseline characteristics in percentages or means by tertile of experiences of social support

	Positive experiences of social support (n=4,592)			Negative experiences of social support (n=4,616)		
	T1 (low) (8-21)	T2 (22-24)	T3 (high) (25-32)	T1 (low) (8-11)	T2 (12-13)	T3 (high) (14-32)
Sex (%)						
Men	52.6	48.8	43.1	43.6	47.8	52.7
Women	47.4	51.2	56.9	56.4	52.2	47.3
Age, years (mean, SD)	46.4 (9.6)	45.4 (10.1)	44.2 (10.0)	46.3 (10.3)	45.1 (9.9)	44.7 (9.6)
Marital status (%)						
Married	81.9	84.0	80.1	83.2	83.2	79.8
Unmarried	18.1	16.0	19.9	16.8	16.8	20.2
Educational level (%)						
Low	58.5	50.2	48.8	55.1	48.6	52.8
Medium	25.4	28.1	28.2	24.0	29.7	28.2
High	16.1	21.7	23.0	20.8	21.7	19.0
Employment status (%)						
Employed	61.6	65.8	66.8	58.9	66.7	68.4
Unemployed	38.4	34.2	33.2	41.1	33.3	31.6

N: Number of participants; SD: Standard Deviation; T: Tertile

Over the 10-year period of follow-up, the proportion of current smokers decreased from 30% to 21%, whereas the proportion of people with an alcohol intake of at least 2 glasses a day did not change considerably (table 3.2). Although the proportion of inactive people remained low, the proportion of overweight and hypertensive participants increased from 50% to 62% and from 23% to 52%, respectively. Furthermore, prevalence of poor mental health slightly decreased from 16% to 14%, whereas poor self-perceived health slightly increased from 10% to 14% during the follow-up period.

The cross-sectional and prospective associations between experiences of social support at baseline and the different lifestyle characteristics during follow-up are presented in table 3.3 and table

3.4. The results show a consistent effect of both positive and negative experiences of support on mental health. The prevalence odds ratio for low levels of positive support and poor mental health was 2.74 (95% CI 2.32-3.23) and the incidence odds ratio was 1.86 (95% CI 1.39-2.49). Concerning negative experiences of support, these odds ratios were 3.28 (95% CI 2.78-3.87) and 1.60 (95% CI 1.21-2.12), respectively.

Table 3.2: Prevalence of different lifestyle indicators, biological risk factors for health, and health status indicators of the Doetinchem Cohort Study participants at baseline, after 5 years and after 10 years of follow-up

	Baseline (1993-1997)		5 years of follow-up		5 years of follow-up	
	N total	(%)	N total	(%)	N total	(%)
Lifestyle characteristics						
Current smoking	4,723	29.7	4,408	25.8	4,111	21.3
Excessive alcohol consumption	4,724	22.1	4,410	22.4	4,125	22.5
Physically inactive <sup>1</sup>	3,859	21.7	4,410	22.3	4,126	20.4
Low fruit and vegetable intake	4,717	81.5	4,402	80.6	4,117	78.3
Biological factors						
Overweight	4,719	50.2	4,392	58.5	4,119	61.7
Hypertension	4,718	24.9	4,393	34.7	4,124	52.4
Hypercholesterolemia	4,712	15.4	4,390	21.3	4,123	17.5
Health indicators						
Poor self-perceived health <sup>2</sup>	2,865	10.5	4,403	13.2	4,121	14.2
Poor mental health <sup>2</sup>	2,868	16.5	4,401	15.3	4,046	14.3

<sup>1</sup> included from 1994 onwards

<sup>2</sup> included from 1995 onwards

Positive experiences of social support were further associated with one lifestyle factor only. An increased risk was found in the prevalence of low fruit and vegetable intake (OR 1.30; 95% CI 1.12-1.50), but not in the incidence (OR 1.04; 95% CI 0.78-1.40). Negative experiences of social support on the other hand, were cross-sectionally associated with four other outcomes besides mental health. Lower levels of negative experiences of support were associated with prevalent smoking (OR 1.39; 95% CI 1.20-1.61), physical inactivity (OR 1.24; 95% CI 1.08-1.41), overweight (OR 1.23; 95% CI 1.09-1.40) and poor self-perceived health (OR 2.17; 95% CI 1.81-2.60). The cross-sectional association with overweight was independent of lifestyle, since the strength of this association was not attenuated after additionally adjustment for lifestyle variables as potential mediators (data not shown). Moreover, besides the cross-sectional associations with physical inactivity and poor-self perceived health, prospective associations were found. Negative experiences of support were related with increased incident physical inactivity (OR 1.27; 95% CI 1.02-1.57) and poor self-perceived health (OR 1.36; 95% CI 1.01-1.82).

Table 3.3: Cross-sectional associations between positive and negative experiences of social support in tertiles and the prevalence of different lifestyle characteristics, biological factors, self-perceived health, and mental health over 10 years in the Doetinchem Cohort Study

	Positive experiences of social support						Negative experiences of social support						
	T1 (high)		T2		T3 (low)		T1 (low)		T2		T3 (high)		
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	
Lifestyle characteristics <sup>1</sup>													
Current smoking	1	0.92	0.79-1.07	1.01	0.87-1.17	1	1.18	1.01-1.39	1.39	1.20-1.61	1	1.06	0.91-1.24
Excessive alcohol consumption	1	0.94	0.80-1.10	0.92	0.78-1.08	1	1.07	0.90-1.26	1.06	0.91-1.24	1	1.18	1.03-1.36
Physically inactive	1	0.93	0.81-1.07	1.01	0.88-1.16	1	1.18	1.03-1.36	1.24	1.08-1.41	1	0.97	0.83-1.12
Low fruit and vegetable intake	1	1.23	1.06-1.42	1.30	1.12-1.50	1	1.04	0.90-1.19	1.23	1.09-1.40	1	0.97	0.85-1.11
Biological factors <sup>2</sup>													
Overweight	1	0.95	0.84-1.09	0.93	0.81-1.06	1	1.04	0.90-1.19	1.23	1.09-1.40	1	0.97	0.85-1.11
Hypertension	1	1.07	0.94-1.22	1.00	0.88-1.13	1	1.03	0.89-1.20	1.06	0.92-1.22	1	1.04	0.90-1.19
Hypercholesterolemia	1	0.90	0.77-1.05	1.09	0.94-1.27	1	1.03	0.89-1.20	1.06	0.92-1.22	1	1.04	0.90-1.19
Health indicators <sup>3</sup>													
Poor self-perceived health	1	1.04	0.87-1.25	1.13	0.94-1.35	1	1.49	1.21-1.82	2.17	1.81-2.60	1	1.49	1.23-1.80
Poor mental health	1	1.30	1.09-1.55	2.74	2.32-3.23	1	1.49	1.23-1.80	3.28	2.78-3.87	1	1.49	1.23-1.80

<sup>1</sup> models included sex, age, educational level, marital status, employment status, study round, smoking, alcohol consumption, physical activity, and fruit and vegetable intake

<sup>2</sup> models included sex, age, educational level, marital status, employment status, study round, overweight, hypertension and hypercholesterolemia

<sup>3</sup> models included sex, age, educational level, marital status, employment status, study round, self-perceived health and mental health

Table 3.4: Prospective associations between positive and negative experiences of social support in tertiles and the incidence of different lifestyle characteristics, biological factors, self-perceived health, and mental health over ten years in the Doetinchem Cohort Study

	Positive experiences of social support						Negative experiences of social support								
	T1 (high)		T2		T3 (low)		T1 (low)		T2		T3 (high)				
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI			
Lifestyle characteristics <sup>1</sup>															
Current smoking	1	1.12	0.74-1.69	1.32	0.87-2.02	1	1.23	0.82-1.86	1.06	0.71-1.58	1	1.23	0.82-1.86	1.06	0.71-1.58
Excessive alcohol consumption	1	1.05	0.80-1.37	1.01	0.77-1.33	1	1.20	0.90-1.60	1.42	1.09-1.83	1	1.20	0.90-1.60	1.42	1.09-1.83
Physically inactive	1	0.90	0.72-1.11	1.05	0.85-1.30	1	1.39	1.11-1.73	1.27	1.02-1.57	1	1.39	1.11-1.73	1.27	1.02-1.57
Low fruit and vegetable intake	1	0.95	0.71-1.26	1.04	0.78-1.40	1	1.08	0.80-1.46	1.15	0.87-1.53	1	1.08	0.80-1.46	1.15	0.87-1.53
Biological factors <sup>2</sup>															
Overweight	1	0.96	0.78-1.18	1.04	0.85-1.29	1	0.82	0.66-1.01	1.04	0.86-1.27	1	0.82	0.66-1.01	1.04	0.86-1.27
Hypertension	1	1.04	0.89-1.22	1.08	0.92-1.26	1	0.98	0.83-1.16	1.05	0.91-1.23	1	0.98	0.83-1.16	1.05	0.91-1.23
Hypercholesterolemia	1	1.02	0.83-1.26	1.19	0.97-1.46	1	0.93	0.76-1.14	0.90	0.74-1.10	1	0.93	0.76-1.14	0.90	0.74-1.10
Health indicators <sup>3</sup>															
Poor self-perceived health	1	0.95	0.71-1.28	0.81	0.59-1.11	1	1.05	0.76-1.45	1.36	1.01-1.82	1	1.05	0.76-1.45	1.36	1.01-1.82
Poor mental health	1	1.17	0.87-1.58	1.86	1.39-2.49	1	0.94	0.69-1.28	1.60	1.21-2.12	1	0.94	0.69-1.28	1.60	1.21-2.12

<sup>1</sup> models included sex, age, educational level, marital status, employment status, study round, smoking, alcohol consumption, physical activity, and fruit and vegetable intake

<sup>2</sup> models included sex, age, educational level, marital status, employment status, study round, overweight, hypertension and hypercholesterolemia

<sup>3</sup> models included sex, age, educational level, marital status, employment status, study round, self-perceived health and mental health

## Discussion

This study showed that positive and negative experiences of social support differ in their associations with health, indicated by lifestyle, biological factors, self-perceived health and mental health. Low levels of positive experiences of social support were associated with lower prevalence of fruit and vegetable intake over a 10-year period. On the other hand, high levels of negative experiences of social support were associated with higher prevalence of smoking and overweight, higher incidence of high alcohol consumption, and higher prevalence and incidence of physical inactivity and poor self-perceived health. Consistent cross-sectional and prospective effects were shown of both positive and negative experiences of support on mental health.

The initial response rate of the Doetinchem Cohort Study was 62%, which is reasonable for a general survey in the Netherlands. Higher response rates were present among women and older people than among men and the younger age groups. When comparing the study population with the general Dutch population, non-Dutch, lower educated and smoking participants appeared to be underrepresented in our cohort. For the analysis in this study, the second, third and fourth study round of the Doetinchem Cohort Study were used. Although the response rates were generally good throughout these three subsequent rounds (79%, 75% and 78% respectively), we cannot completely rule out the possibility that attrition due to drop-outs or intermittent missing data in the outcome variables might have influenced our results. Nevertheless, this possible selection bias would mainly affect the prevalence estimates, and much less the estimated magnitudes of the associations (16).

The assessment of social support that we used in this study, was based on measuring the positive and negative experiences of social support, and did not include distinctive information on different domains of social support, such as emotional support, appreciation, informational or instrumental support. The SEC was validated among middle-aged Dutch adults by Van Oostrom et al (1995), who tested and confirmed two hypotheses: 1) a negative correlation of neuroticism with positive experiences of social support and a positive correlation with negative experiences of social support, and 2) positively experienced social support related to active coping (18). The SEC was earlier used to investigate the association of positive and negative experiences of social support and mortality in the original population of the Doetinchem Cohort Study (15). In present study, participants were excluded if they had one or more missing items on the SEC. These excluded participants were older, lower educated and/or more often unemployed than the included participants. However, the group of people who were excluded for both the positive and negative analysis because of at least one missing value was small (2.9%); this is because at the community health services the questionnaire was checked by a trained research assistant for item-non-response. Furthermore, the influence on the risk estimates of age, education level and employment status was not larger than the effects of social support on the different health indicators. Therefore, we believe that any attenuation of the effects of social support on the different health outcomes caused by information bias is minimal.

One of the strengths of our study was that we used positive and negative experiences of social support separately, identifying different associations with health. Besides mental health, positive experiences of support were further associated with fruit and vegetable intake only, whereas



negative experiences of support were further associated with smoking, physical inactivity, overweight and poor self-perceived health. Newsom et al (2005), who studied the relative importance of positive and negative exchanges, found that positive exchanges only related to well-being, whereas negative exchanges additionally related to psychological distress (27). This could indicate that outcome variables such as smoking, drinking and physical inactivity are correlated with psychological distress. More research that includes both positive and negative experiences of support is necessary to confirm our findings, and to give insight into the different mechanisms of how these distinct experiences of support influence health.

Furthermore, we related social support to health outcomes that were assessed on different levels, such as lifestyle factors, biomedical health risk factors, self-perceived health and mental health. Using prospective analyses next to cross-sectional analyses enabled us to estimate the associations between social support and the onset of different intermediate and long-term health-related outcomes over a 10-year period. By applying the GEE method, we were able to account for the within-subject correlation of repeated measurements. The results of our study add to the growing evidence that social support is associated with health (1-6). One of the studies that used a comparable analytical strategy is the study of Melchior et al (2003), who investigated the cross-sectional and prospective association between social relations and self-perceived health over a one-year period (5). Their results are consistent with our finding that low levels of positively experienced social support were predictive of poor health status. However, more studies that differentiate between the positive and negative experiences of support should be performed to confirm our findings. Although we used a prospective analytical approach, we cannot provide evidence that improving the quality of social support might lead to a more beneficial lifestyle and health status, since we have no information about changes in social support prior to our measurement. Longitudinal studies using repeated measurements of social support are necessary to give more insight in the influence of changes in social support on lifestyle and health.

This study indicates that mental health was affected by both positive and negative experiences of social support. However, lifestyle factors and health appeared to be more affected by negative experiences of support than by positive experiences of support. Therefore, future intervention strategies focusing on lifestyle and health might consider tackling negative experiences of social support, next to increasing positive experiences of social support.

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# Chapter 4

Positive and negative experiences of social support and long-term mortality among middle-aged Dutch people

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## Abstract

This study investigates the relationship between positive and negative experiences of social support and mortality in a population-based sample. Data are from 11,163 Dutch men and women aged 20-59 years who participated in the Doetinchem Cohort Study in 1987-1991. Social support was measured at baseline and after five years of follow-up using the Social Experience Checklist. Mortality data were obtained from 1987 until 2008. Cox proportional hazards regression models, adjusted for age and sex, showed that low positive experiences of support at baseline were associated with an increased mortality risk after, on average, 19 years of follow-up (hazard ratio 1.26; 95% confidence interval 1.04-1.52). Even after additionally adjustment for socio-economic factors, lifestyle factors and indicators of health status, the increased mortality risk remained statistically significant (hazard ratio 1.23; 95% confidence interval 1.01-1.49). In participants with repeated measurements of social support at five year intervals, a stable low level of positive experiences of social support was associated with a stronger increase in age and sex adjusted mortality risk (hazard ratio 1.57; 95% confidence interval 1.03-2.39). Negative experiences of social support were not related to mortality.

## Introduction

Social support has been associated with decreased mortality and morbidity in numerous studies (1-12). It can be viewed as one of the functions of the social network structure, and refers to the qualitative aspects of social relations (11). Some researchers use structural characteristics, such as the number of people who provide support in certain situations, as a measure of social support, whereas others use a more functional characteristic of social support, such as the appreciation of relationships with others. Although social support is intended to be helpful, it can sometimes result in negative experiences (13). Support that is unwanted or that conflicts with the needs of the recipient may threaten perceptions of autonomy, sense of coherence, and well-being (14). Until now, only a few studies distinguish between positive and negative experiences of social support (15-19), and to our knowledge, no information is available on the independent effects of positive and negative experiences of social support on long-term mortality.

Therefore, we used 2 strategies to explore the relation between positive and negative experiences of social support and mortality in a population-based sample of men and women. First, we analysed the relation between a single measurement of social support at baseline and mortality after 20 years of follow-up. Since a single measurement of social support might be more prone to random measurement error than repeated measurements, we also examined the relationship of those with a stable level of social support over five years and subsequent mortality. In both analyses we expected that unfavourable levels of social support would be associated with an increased risk of mortality.

## Methods

### Study design

The Doetinchem Cohort Study is a prospective cohort study set up to investigate the impact of lifestyle factors and biological risk factors on health (20). The first examination round (1987-1991) comprised 12,448 men and women aged 20 to 59 years who lived in Doetinchem, a town in the eastern Netherlands. Two-thirds of those who were measured in round 1 were randomly selected after 5 years (between 1993-1997) for the first follow-up measurements. Until now, 3 follow-up rounds of the Doetinchem Cohort Study have been completed. All participants were asked to fill out a questionnaire at home about lifestyle and diseases. Thereafter, the participants were invited to return the questionnaire to the community health service, where it was checked by a trained research assistant for completeness and consistency, and where measurements of biological factors were collected. The overall response rates were 62% for the baseline measurement and 79% (n=6,114) for the first follow-up measurement 5 years later.

### Mortality

Vital status was obtained through the municipal population registries and was complete up to November 2008.

### Experiences of social support

Experiences of social support were assessed by the Social Experiences Checklist at baseline and after 5 years of follow-up (21, 22). The checklist was initially developed to study the quality of life in cancer patients. However, Van Oostrom et al showed that the SEC could also be used in a general population by demonstrating that the psychometric qualities of the SEC were similar in both populations (21). The Social Experiences Checklist reflects experiences in social relations, and consists of 16 items: 8 items correspond to positive experiences of social support, such as warmth and friendliness, esteem, and help; and 8 items correspond to negative experiences, such as incomprehension, belittlement, and avoidance. Responses to these questions are formulated on a Likert-type scale, indicating “never”, “sometimes”, “regularly”, or “often”. Levels of positive and negative experiences of social support at baseline were determined by creating tertiles of the sum scores. To assess levels of social support over time, the participants were classified into 5 groups: 1) stable high levels of experienced social support, when scoring in the highest tertile in both replicate measurements; 2) stable medium level of support, when scoring in the mid tertile in both measurements; 3) stable low level of support, when scoring in the lowest tertile in both measurements; 4) increasing levels of support, when scoring in a higher tertile at the follow-up measurement compared to the baseline measurement; 5) decreasing levels of support, when scoring in a lower tertile at the follow-up measurement compared to the baseline measurement.

### Socioeconomic conditions

Ethnicity was dichotomised into Dutch or non-Dutch. Marital status was categorised into married or unmarried. Education was based on the highest level of education completed by respondents and was divided into 3 categories: low (primary school, lower vocational education or less), medium (medium vocational education, high school), and high (higher vocational education, university). Employment status was dichotomised into currently employed or currently unemployed.

### Health behaviours

Lifestyle variables included smoking behaviour (current smoker, former smoker, never-smoker), alcohol consumption (frequency and number of alcoholic drinks), and physical activity (perceived frequency and intensity of activities). Alcohol consumption was calculated as average drinks per day and was categorised into 0-1 or 2 or more drinks per day. Physical activity was assessed with a single question on physical activity during leisure time. Participants who reported no or little physical activity were classified as inactive, and those who reported themselves to be active regularly were classified as active.

### Health status

Health status included biomedical measures, self-reported chronic diseases, and self-perceived health. Weight and height were measured to the nearest 0.1 kg and 0.5 cm, respectively. The respondents were weighed wearing indoor clothing after they had removed their shoes and emptied their pockets. Accordingly, 1 kg was subtracted from their weight to take clothing into account. Body mass index was calculated by using measured height and weight ( $\text{kg}/\text{m}^2$ ), and based on this respondents were allocated to one of the following categories: normal weight ( $<25 \text{ kg}/\text{m}^2$ ), overweight ( $25\text{-}29.9 \text{ kg}/\text{m}^2$ ), and obese ( $\geq 30 \text{ kg}/\text{m}^2$ ) (23). Blood pressure was measured twice, with participants in a seated position, by using a random zero sphygmomanometer according



to a standardised procedure. Hypertension was defined as a mean systolic blood pressure of  $\geq 140$  mmHg and/or a diastolic blood pressure of  $\geq 90$  mmHg and/or use of anti-hypertensive drugs (24). Cholesterol values were determined in non-fasting blood plasma, which was stored at  $-20^{\circ}\text{C}$  for a maximum of 3 weeks. Hypercholesterolemia was defined as having a total cholesterol level of  $\geq 6.5$  mmol/L. The presence of chronic diseases was measured by asking the participants whether they had diabetes, cardiovascular disease, or cancer. Self-perceived health was ascertained by asking 'how would you rate your health in general?', using a five-point scale ranging from excellent to poor. Good self-perceived health was defined as having good or excellent health.

### Statistical Analyses

According to the first analytical strategy, we investigated the relation between a single measurement of social support at baseline and mortality after 20 years of follow-up. In this analysis, 90% of the baseline participants of the Doetinchem Cohort Study had complete data on the positive items of the SEC ( $n=11,163$ ), or on the negative items of the Social Experiences Checklist ( $n=11,161$ ). We also analysed the relation between social support and mortality among participants with follow-up measurements, according to the second strategy. In this group of 6,114 participants, 86% had complete data on the Social Experiences Checklist at baseline and after 5 years. The additional analysis allowed us to ascertain the association between stable levels of social support and subsequent mortality with less measurement error. Survival analyses were used to investigate the relation between social support and subsequent mortality using both analytical strategies. The Cox proportional hazard model was used to calculate hazard ratios with 95% confidence intervals for the relation between experiences of social support and mortality, with the most favourable tertile of support as the reference group. We adjusted for baseline age and sex (model 1), socioeconomic factors (model 2), health behaviours (model 3), and health status (model 4) to explore their roles as potential confounders. Ethnicity was not included in the model since only 1.5% of the participants were of non-Dutch origin. Sex was considered as an effect modifier, but the interaction terms with positive and negative experiences of social support were not statistically significant ( $p < 0.05$ ). All statistical analyses were carried out using version 9.1 of the SAS software programme (SAS Institute, Inc., Cary, North Carolina).

### Results

From 1987 to 2008, approximately 7.2% of the eligible participants died after an average of 18.7 years of follow-up. The general characteristics of the participants according to levels of social support are described in table 4.1. The mean age of the study population at baseline was 39.1 years (standard deviation, 10.7), and 47% were males. For both positive and negative experiences of support, the proportion of unmarried people increased with increasing tertiles of social support. Opposite patterns for positive and negative experiences of support were observed with regard to education level. A high educational level was more prevalent among the participants who experienced high levels of positive support (19%). Correspondingly, higher levels of negative support were associated with having a lower educational level (63%). Most of the participants were in good health (76%) and adhered to a healthy lifestyle characterised by non-smoking (62%), no/moderate drinking (81%) and sufficient physical activity (67%).

Table 4.1: Baseline characteristics in percentages or means by tertile of experiences of social support, Doetinchem Cohort Study, 1987-1991

	Positive experiences of social support			Negative experiences of social support				
	Total N	T1 (low) (8-20)	T2 (21-24)	T3 (high) (25-32)	Total N	T1 (low) (8-10)	T2 (11-13)	T3 (high) (14-32)
Male (%)	11,163				11,161			
Men		54.2	48.0	39.6		45.1	45.9	51.5
Women		45.8	52.0	60.4		54.9	54.1	48.5
Age, years (mean, SD)	11,163	40.7 (10.2)	39.2 (10.7)	37.0 (10.7)	11,161	39.3 (10.7)	38.8 (10.6)	39.0 (10.7)
Marital status (%)	11,161				11,159			
Married		74.4	74.4	68.2		75.4	73.3	69.6
Unmarried		25.6	25.6	31.8		24.6	26.7	30.4
Educational level (%)	11,143				11,139			
Low		68.0	58.1	54.5		60.4	57.8	62.8
Medium		19.1	24.2	26.4		22.9	24.0	23.0
High		12.9	17.7	19.2		16.7	18.2	14.2
Employment status (%)	11,156				11,154			
Employed		61.0	64.7	64.2		58.7	65.3	65.2
Unemployed		39.0	35.3	35.8		41.3	34.7	34.8
Smoking (%)	11,132				11,129			
Never		32.7	33.9	35.5		38.2	34.2	30.9
Former		27.8	28.6	26.3		27.0	28.4	26.8
Current		39.5	37.5	38.2		34.8	37.4	42.3
Alcohol consumption (%)	11,163				11,161			
0-1 glass a day		79.7	81.0	83.6		83.9	80.8	79.8
2 or more glasses a day		20.3	19.0	16.4		16.1	19.2	20.2

Table 4.1: continued

	Positive experiences of social support			Negative experiences of social support				
	Total N	T1 (low) (8-20)	T2 (21-24)	T3 (high) (25-32)	Total N	T1 (low) (8-10)	T2 (11-13)	T3 (high) (14-32)
Physical activity (%)	11,159				11,157			
Active		63.4	69.5	67.9		68.1	67.4	66.5
Inactive		36.6	30.5	32.1		31.9	32.6	33.5
Body mass index (%)	11,157				11,155			
Normal weight		58.2	59.5	62.3		62.2	60.4	58.0
Overweight		34.5	33.9	30.3		31.7	32.7	34.3
Obese		7.3	6.6	7.4		6.1	6.9	7.7
Presence of diseases (%)								
Hypercholesterolemia	11,139	17.1	16.2	13.9	11,136	16.6	15.3	16.0
Hypertension	11,161	19.0	19.1	16.1	11,159	18.0	17.7	18.1
Diabetes	11,142	1.0	0.8	1.1	11,140	0.9	1.0	0.8
Cardiovascular diseases	11,161	3.7	3.1	2.7	11,159	1.8	2.7	4.8
Cancer	11,163	1.5	1.4	1.1	11,161	1.2	1.3	1.5
Self-perceived health (%)	11,100				11,098			
(Very) good		66.3	78.4	82.1		85.3	78.6	65.3
Fair/poor		33.7	21.6	17.9		14.7	21.4	34.7

N: Number of participants; SD: Standard Deviation; T: Tertile

Table 4.2 shows hazard ratios and 95% confidence intervals for all-cause mortality according to tertiles of experienced social support in the population at baseline. The hazard ratio was 1.26 (95% CI 1.04-1.52) for those with low levels of positive experiences of social support compared to those with the highest level of social support. Adjustment for socio-economic factors, health behaviours (smoking, alcohol consumption, and physical activity) and indicators of health status slightly attenuated the results (HR 1.23; 95% CI 1.01-1.49). Negative experiences of social support were not associated with mortality. Compared to the lowest tertile of social support, the age and sex adjusted hazard ratios were 1.01 (95% CI 0.85-1.20) for the mid tertile, and 1.04 (95% CI 0.87-1.25) for the highest tertile.

Table 4.2: Hazard ratio of mortality by tertiles of baseline level of positive and negative experiences of social support, Doetinchem Cohort Study, 1987-1991

Positive experiences of support										
			Model 1 (n=11,163)		Model 2 (n=11,136)		Model 3 (n=11,101)		Model 4 (n=10,989)	
	N total	N deaths (%)	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI
T3 (high)	3,179	170 (5.3)	1.00		1.00		1.00		1.00	
T2	4,686	330 (7.0)	1.06	0.88-1.28	1.07	0.89-1.29	1.08	0.89-1.30	1.10	0.91-1.32
T1 (low)	3,298	306 (9.3)	1.26	1.04-1.52	1.23	1.02-1.49	1.21	1.00-1.46	1.23	1.01-1.49
Negative experiences of support										
			Model 1 (n=11,161)		Model 2 (n=11,132)		Model 3 (n=11,096)		Model 4 (n=10,983)	
	N total	N deaths (%)	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI
T1 (low)	2,982	217 (7.3)	1.00		1.00		1.00		1.00	
T2	4,465	310 (6.9)	1.01	0.85-1.20	1.02	0.86-1.22	0.99	0.83-1.17	0.92	0.77-1.10
T3 (high)	3,714	276 (7.4)	1.04	0.87-1.25	1.02	0.86-1.23	0.95	0.79-1.13	0.88	0.73-1.06

95% CI: 95% Confidence Interval; HR: Hazard ratio; N: Number of participants; T: Tertile

model 1: adjusted for age and sex

model 2: additionally adjusted for socio-economic factors; marital status, educational level, employment status

model 3: additionally adjusted for health behaviours: smoking, alcohol consumption, physical activity

model 4: additionally adjusted for morbidity and disability: body mass index, hypercholesterolemia, hypertension, diabetes, cardiovascular disease, cancer, self-perceived health

Analyses in the follow-up group with repeated measurements of social support showed that participants who had stable low levels of positive social support over a five-year period had a stronger increase in mortality risk (HR 1.57; 95% CI 1.03-2.39) (table 4.3). This association was attenuated after adjustments were made for socio-economic and lifestyle factors and health status (HR 1.42; 95% CI 0.92-2.19). Again, negative experiences of social support were not related to mortality.

Table 4.3: Hazard ratio of mortality by repeated measurements of positive and negative experiences of social support in a sub-sample, Doetinchem Cohort Study, 1987-1991; 1993-1997

Positive experiences of support										
	N total	N deaths (%)	Model 1 (n=5,267)		Model 2 (n=5,255)		Model 3 (n=5,234)		Model 4 (n=5,187)	
			HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI
Stable high support	873	31 (3.6)	1.00		1.00		1.00		1.00	
Stable medium support	909	55 (6.1)	1.27	0.82-1.98	1.26	0.81-1.96	1.26	0.81-1.97	1.28	0.82-2.00
Stable low support	918	71 (7.7)	1.57	1.03-2.39	1.51	0.98-2.31	1.47	0.96-2.25	1.42	0.92-2.19
Increasing support	1,310	71 (5.4)	1.18	0.77-1.80	1.16	0.76-1.77	1.18	0.77-1.80	1.19	0.78-1.83
Decreasing support	1,257	63 (5.0)	1.19	0.78-1.83	1.17	0.76-1.80	1.18	0.76-1.81	1.12	0.73-1.73
Negative experiences of support										
	N total	N deaths (%)	Model 1 (n=5,268)		Model 2 (n=5,255)		Model 3 (n=5,233)		Model 4 (n=5,184)	
			HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI
Stable low support	898	54 (6.0)	1.00		1.00		1.00		1.00	
Stable medium support	689	27 (3.9)	0.76	0.48-1.21	0.77	0.49-1.23	0.75	0.47-1.20	0.70	0.43-1.12
Stable high support	1,033	53 (5.1)	1.03	0.70-1.50	0.99	0.68-1.46	0.92	0.63-1.36	0.85	0.58-1.27
Increasing support	1,277	59 (4.6)	1.00	0.69-1.45	0.99	0.68-1.44	0.96	0.66-1.39	0.92	0.63-1.34
Decreasing support	1,371	86 (6.3)	1.05	0.75-1.48	1.02	0.72-1.44	1.00	0.71-1.40	0.96	0.68-1.36

95% CI: 95% Confidence Interval; HR: Hazard ratio; N: Number of participants; T: Tertile

model 1: adjusted for age and sex

model 2: additionally adjusted for socio-economic factors: marital status, educational level, employment status

model 3: additionally adjusted for health behaviours: smoking, alcohol consumption, physical activity

model 4: additionally adjusted for morbidity and disability: body mass index, hypercholesterolemia, hypertension, diabetes, cardiovascular disease, cancer, self-perceived health

## Discussion

This study of Dutch men and women showed that low levels of positive experiences of social support were related to an increased probability of mortality after a long-term period. Using repeated measurements of social support to determine stable high levels of support yielded stronger associations for positive experiences of social support with mortality. Adjustment for socio-economic and lifestyle factors, and indicators of health status did not attenuate the original associations considerably, indicating a direct effect of positive experiences of social support on mortality. Negative experiences of social support, however, were not related to mortality in this study.

The primary strength of the present study was that 2 analytical strategies were utilised to overcome the problem of measurement error and longer-term fluctuations or changes within individuals. We accounted for the possibility that measuring social support only once at baseline might not be a reliable indicator of the 'usual' level of social support (25, 26). By following a second strategy – analysing stable levels of social support over five years in participants with repeated measurements – we were able to limit this possible regression dilution bias. Indeed, stable low levels of positive experiences of social support were more strongly associated with increased mortality. To support the suggestion that measurement error or changes within individuals account for the attenuation of the associations in the baseline sample, we found a test-retest correlation coefficient of 0.49 for positive as well as for negative experiences of support between the 2 measurements, which indicates that a single measurement is a moderate indicator for long-term social support. Moreover, there were some differences between the 2 analytical strategies according to follow-up time, population, and classification of exposure. Differences in follow-up time from the time of the social support measurements might have influenced the associations in this study, since the follow-up time for mortality in the group with repeated measurements of social support was, on average, 5 years shorter than in the baseline population. Based on the survival curves, the difference in survival between the tertiles of social support accumulates over time (results not shown). Consequently, we might have expected even more profound results with increasing follow-up time. Another factor that could have influenced our findings was the possible selection bias due to follow-up. The response rate of the follow-up measurement was 79%, which is quite reasonable. However, the mortality in the population at baseline was somewhat higher (7.2%) than the mortality in the follow-up population (5.5%), which might indicate that the unhealthy participants at baseline were more likely to drop out of the study. Excluding the first 2 years of follow-up did not affect the results, which underscores the predictive effect of social support at baseline, and rules out the possibility of reverse causation (results not shown). Using repeated measurements for which participants were classified as having stable high positive or negative experiences of social support when scoring in the highest tertile at both measurements might reflect more extreme groups of exposure. However, the median scores of the tertiles when the single measurement of social support was used did not differ from the median scores of the tertiles when both measurements were used. Following all the findings we discussed above, we assumed that the difference in results between the 2 analytical strategies we used might be caused by regression dilution bias, rather than by differences in follow-up time, selection of study population, reverse causation, or classification of exposure.

The assessment of social support that we used was based on measuring the positive and negative

experiences of social support, and did not include distinctive information on different domains of social support such as emotional support, appreciation, informational or instrumental support, or presence of social ties. The Social Experiences Checklist was validated among middle-aged Dutch adults by Van Oostrom et al, who tested and confirmed two hypotheses: 1) a negative correlation of neuroticism with positive experiences of social support and a positive correlation with negative experiences of social support, and 2) positively experienced social support related to active coping (21). No cut-off points for high or low levels of social support according to the checklist were available, and sum scores were classified into tertiles. To investigate the classification of the tertiles, we reran the analyses using quintiles of the scores. This different way of ranking showed similar results and did not affect the interpretation of the original results.

General non-response or item non-response might have affected our findings. The initial response rate of the Doetinchem Cohort Study was 62%, which is reasonable for a general survey in the Netherlands. Higher response rates were present among women and older people than in men and the younger age groups. When comparing the study population with the general Dutch population, we see, for example, that the non-Dutch, lower educated, and smokers are underrepresented in our cohort. Although selection bias could be an issue in our population, it would mainly affect the prevalence estimates, and much less the estimated magnitudes of the associations (20). Besides the aforementioned selection bias, there could be selection bias due to item-non-response on the Social Experiences Checklist. Participants with missing items, whether accidental or deliberate, were excluded from the analysis. Within these excluded participants, a higher proportion of people died (13.0%) compared to the included participants (7.2%). Furthermore, they were older, lower educated, more often unemployed and/or unmarried, lived a more health-compromising lifestyle, and had worse health status. However, we believe that any attenuation of the effects of social support on mortality caused by this bias is minimal. The group of people who were excluded for both the positive and negative analysis because of at least one missing value was small (7.6%) because the questionnaire was checked for item-non-response at the community health services by a trained research assistant, and the influence of the confounding variables on the hazard ratios was not larger than the effect of social support on mortality.

The finding that high positive experiences of social support are directly associated with reduced mortality risk adds to the literature on social networks being predictive of health status and mortality (4, 6, 7, 9, 11, 12, 16, 27-32). Most studies included an elderly population, whereas in the last ten years, only two studies have been known to investigate the association between social relationships and mortality in a general adult population (29, 30). Both studies found that structural aspects of the social network directly influenced mortality in a Danish adult population. Penninx et al, however, demonstrated that functional and perceived aspects of support might be more important predictors of mortality than structural aspects of social support in Dutch elderly people (28). These authors found that receiving emotional support and having fewer feelings of loneliness increased survival time, whereas a high level of instrumental support was associated with an increased risk of death.

Two different pathways are proposed through which social support may affect health and ultimately influence mortality (33). The first pathway involves behavioural processes. Supportive relationships or social pressure may either facilitate health promoting or health damaging behav-

ious such as smoking, drinking and physical inactivity. The other pathway involves psychological processes that are linked to appraisals, emotions or moods, perceptions of control or sense of coherence and well being, and are thought to enhance adaptation to stressful life events. These behavioural and psychological processes may affect morbidity and mortality, and in turn, these associations may be mediated through physiological processes such as changes in cardiovascular, neuroendocrine, and immune function.

Contrary to positive experiences of support, negative experiences of support seem to have no association with mortality in this study. This finding was contradictory to our hypothesis that higher levels of negative support would be associated with increased mortality, which was partly based on the study of Newsom et al (16), who found that higher levels of stable negative aspects of social exchanges were associated with a lower health status over a 2-year period. More studies that differentiate between the positive and negative experiences of support should be performed to confirm our finding and to give more insight into the different mechanisms of how these distinct experiences of support influence health and mortality.

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# Chapter 5

Exploring the relationship between social support and loneliness using structural equation modelling

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## Abstract

**Objective:** The objective of this study was to explore the relationship between different dimensions of social support and loneliness in a sample of people aged 65 and over to identify specific leads for health promotion activities.

**Methods:** Data are from 2,405 non-institutionalised people aged 65 years and over (response 74%). Social and emotional loneliness were assessed by 11 items of the De Jong-Gierveld loneliness scale. Three different constructs of social support were assessed using the SSL12-I. The associations between the latent social support variables and the latent loneliness variables were analysed using structural equation modelling. Structural models also included age, sex, education level, income management and self-perceived health.

**Results:** Everyday support, support in problem situations and esteem support were associated with decreased social and emotional loneliness in univariate models. In multivariate models, only a strong beneficial influence of everyday support on social loneliness (standardised regression coefficient -0.75; 95% CI -0.84, -0.65) and emotional loneliness (standardised regression coefficient -0.71; 95% CI -0.80, -0.61) remained.

**Conclusion:** The beneficial effects of social support on social and emotional loneliness are mainly an effect of everyday support. The strong association between everyday support and loneliness suggests that loneliness prevention activities should focus on increasing the levels of social support in everyday situations in older people.

## Introduction

Loneliness is associated with adverse mental and physical health (1). Loneliness tends to increase with advancing age, since the size of the social network may decrease due to the absence of a partner, close relative, or friends (2). Since the proportion of people aged 65 and over is currently growing faster than any other age group, the overall prevalence of loneliness and its adverse health effects might also increase (3, 4). This requires an increased focus on initiating intervention strategies targeting loneliness. Loneliness is described as the negative experience of a discrepancy between the desired and realized social contacts of an individual (5). Loneliness is a complex problem, its causes may be internal or external, or a combination of both (6). Partly, the development of loneliness can be associated with personality characteristics, since people can react to a situation of experienced relational discrepancies in different ways. This is also referred to as emotional loneliness. Additionally, the likelihood of experiencing loneliness can be influenced by others, which is reflected by social loneliness (7). Several studies confirm that emotional loneliness is a separate concept from social loneliness (8, 9).

One of the key determinants of loneliness is social support. Social support refers to the social interactions with members of the social network (10). Most researchers divide social support into different subtypes which include emotional, instrumental, appraisal and informational support (10, 11). Closely linked to this typology, Kempen et al, used a three-dimensional classification in their study in Dutch older people by dividing social support into 1) everyday support, referring to social companionship and daily emotional support; 2) support in problem situations, referring to instrumental support, informative support and emotional support in times of trouble; 3) esteem support, referring to support resulting in self-esteem and approval (12).

Since emotional and loneliness are viewed as separate concepts, it is likely that they are influenced by different aspects of social support. Therefore, the objective of this study was to explore the relationship between different dimensions of social support and loneliness in a sample of people aged 65 and over to identify specific leads for health promotion activities.

## Methods

### Study design and population

Data for this study are from older people who participated in a baseline measurement for the evaluation of an intervention study on loneliness (13). In total, 4,050 non-institutionalised people aged 65 years and over were randomly selected from the registration systems of three municipalities. People aged 75 years or over were oversampled to constitute half of the study population. Data were collected by means of a 20-page, 60-item, self-administered questionnaire. In August 2008, the questionnaires were sent by mail to the selected elderly people. Within a period of eleven weeks, two reminders were sent to the non-respondents, which resulted in an overall response rate of 74%. From this sample, 292 participants were excluded because of missing values on identification codes, date of birth or gender. Eventually, data were available from 2,705 older people.

### Loneliness

Emotional and social loneliness were assessed according to the loneliness scale of De Jong-Gierveld (14, 15). The scale consists of 11 items; six are formulated negatively and five are formulated positively. Emotional loneliness is reflected by the negative items, these apply to aspects of emotional abandonment and missing companionship. Social loneliness is reflected by the positive items, indicating feelings of sociability and having meaningful relationships. Response options are “yes”, “more or less” and “no”. The appropriateness of the loneliness scale to distinguish between emotional and social loneliness was confirmed by a qualitative study using face-to-face interviews in older adults (8).

### Social support

Social support was measured using the short version of the Social Support List-Interactions (SSL12-I) by which the extent of received social support by means of social interactions with members of the primary social network was assessed (12). The SSL12-I consists of 12 items or which 4 items correspond to support in everyday situations, 4 items correspond to support in problem situations and four items correspond to esteem support. Responses to these questions are formulated on a 4-point Likert-scale indicating “seldom or never”, “now and then”, “regularly” and “very often”. The psychometric properties of the SSL12-I were found to be rather satisfactory, when tested in an elderly sample (12).

### Background variables

Besides age and sex, information was included about educational level, management on income and self-perceived health. Educational level was based on the highest level of education completed by respondents, and was divided in four categories: no/primary (no education or primary school), low (lower vocational education), medium (medium vocational education, high school), and high (higher vocational education, university). Management on income was classified into having “difficulties” or “no difficulties” with managing on household income. Self-perceived health was questioned by ‘how would you classify your health in general?’ using a 5-point scale ranging from excellent to poor.

### Statistical Analysis

Associations between the different social support constructs and social and emotional loneliness were analysed using structural equation modelling (SEM) (16). The three constructs capturing social support (everyday support, support in problem situation and esteem support) and the two constructs capturing loneliness (social loneliness and emotional loneliness) were analysed as five latent variables. First, the factor loadings for the items capturing each latent variable were examined. Next, a structural equation model was used to assess the association between each social support construct and the two loneliness constructs. Age, sex, educational level, income management and self-perceived health were included in the model as potential confounders. The analysis was carried out using Mplus version 5.21 (17). Missing values in the latent variables were treated as pair-wise missing values by the Mplus programme to include all available data.

Figure 5.1 presents the model used to estimate the associations between the three latent social support constructs and the two latent constructs of loneliness. Paths d-i represent the influence of social support on loneliness. The Maximum Likelihood estimator was used in the analysis,

taking social and emotional loneliness into account as continuous data. However, the observed variables of social support and loneliness could also be considered as ordered categorical data. Therefore, we reran the analyses deriving the Weighted Least Square parameter. As this yielded similar results, we present the data using the Maximum Likelihood estimator. Model fit was assessed using the Comparative Fit Index (CFI), the Tucker-Lewis index (18) and the Root Mean Square Error of Approximation (RMSEA). A cut-off value close to 0.95 for the CFI and TLI is used as an indication for a relatively good fit between the hypothesized model and the observed data. For RMSEA a cut-off value close to 0.06 is used (19). The chi-square statistic was not used to assess the fit of the model, because it is overly sensitive to model misspecification when the sample sizes are large.

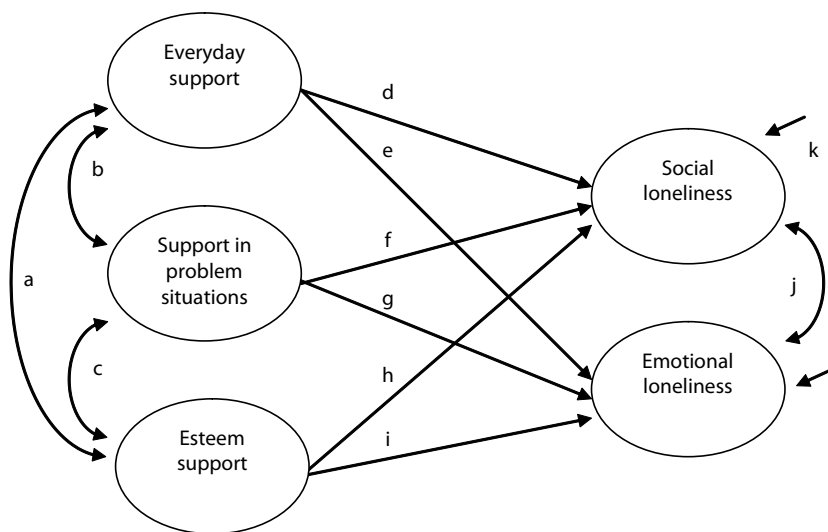


Figure 5.1: Model used for structural equation modelling. The three latent constructs of social support are depicted at the left; social and emotional loneliness are depicted at the right side of the model. a, b, c and j represent the correlation between the latent constructs; d-i represent standardised regression coefficients; k and l represent the residual error terms of the dependent latent variables. Age, sex, education level, management on income and self-perceived health were included in the structural model as covariates, although not presented here.

## Results

Of the 2,705 participants, 171 participants (6.3%) had missing values on all twelve items of the social support scale or on all eleven items of the loneliness scale. These participants with complete missing data were older and had lower educational attainment than the participants with available data on social support and loneliness. There were no differences in sex, income management and self-perceived health. In addition, complete data on age, sex, educational level, income management and self-perceived health were available for 2,405 participants. Table 5.1 summarises the demographic characteristics and self-perceived health for included participants.

The age of the participants ranged between 65 and 101 years. Just over half of them were between 65 and 74 years old (52%). The study population included more women than men. Participants in the higher age group had more often not completed a secondary education (28%) than the younger participants (14%). Only 13% of the younger age group and 11% of the older age group experienced difficulties with managing on their incomes. Good to excellent self-perceived health was prevalent among 81% of the younger participants and among 66% of the older participants.

Table 5.1: General characteristics of study population by age group in percentages, n=2,405

	65-74 years of age n=1,242	75+ years of age n=1,163
Sex		
Male	48.0	39.7
Female	52.0	60.3
Educational level (%)		
None / primary school	14.2	27.6
Lower education	50.2	43.7
Intermediate	15.5	14.8
High	20.2	13.9
Managing on income (%)		
Difficulties	12.7	11.1
No difficulties	87.3	88.9
Self-perceived health (%)		
Excellent	6.8	4.8
Very good	20.0	12.1
Good	54.2	48.8
Moderate	17.0	30.2
Poor	2.0	4.1

### Measurement model

Factor loadings and goodness of fit measures for each latent variable separately are described in table 5.2. Both unstandardised and standardised factor loadings were calculated. Each of the observed variables loaded on their allocated factor, as was hypothesised before. According to the goodness of fit measures, the single order factor capturing everyday support showed a poor fit of the data (CFI 0.93, TLI 0.80, RMSEA 0.184). Contrary, the factor capturing support in problem situations fitted the data well (CFI 1.00, TLI 1.00, RMSEA <0.001). As reflected by the CFI (0.97), good model fit was shown for the factor capturing esteem support, whereas the TLI (0.92) and RMSEA (0.139) reflected poor model fit for this factor. Good model fit by CFI (0.96)



and poor fit by TLI (0.92) and RMSEA (0.102) was also shown for the factor capturing social loneliness. The factor capturing emotional loneliness had a general good fit of the data (CFI 0.98, TLI 0.96, RMSEA 0.075). After examination of all parameter estimates, fit indexes and residuals, model modifications to increase the fit of the models suggested by the software programme were examined. Because there was no theoretical sense to modify the models according to the suggested modifications, we continued the analysis with the original hypothesised models.

When analysing the three latent variables for social support simultaneously, it was shown that they were highly correlated. The correlation was 0.80 between everyday support and esteem support; 0.68 between everyday support and support in problem situations; and 0.75 between support in problem situations and esteem support. The correlation between social loneliness and emotional loneliness was 0.60.

### Structural equation model

Unstandardised and standardised regression coefficients describing the influence of social support on loneliness, adjusted for age, sex educational level, management on income and self-perceived health are presented in table 5.3. When analysing the influence of each of the three constructs of social support separately using a univariate model, the results indicated that an increase in each separate construct of social support is associated with a decrease in loneliness. An increase of one standard deviation in everyday support is associated with decrease in 0.62 of a standard deviation in social loneliness and with a decrease in 0.42 of a standard deviation in emotional loneliness. Similarly, increases in support in problem situations or in esteem support were associated with an increase in social and emotional loneliness.

Because of the high correlation between the social support constructs as indicated before in the measurement model, it is likely that influences of the separate constructs of social support on loneliness are influenced by the other constructs of social support. Therefore, the latent constructs of social support were analysed simultaneously using a multivariate model (figure 5.2). The multivariate model adequately fitted the data (CFI 0.91, TLI 0.89 and RMSEA 0.054). Overall, the predictors accounted for approximately 45% of the variance in social loneliness ( $R^2=1-0.55$ ) and 36% of the variance in emotional loneliness ( $R^2=1-0.64$ ). The beneficial influences of support in problem situations and esteem support appear to be captured through everyday support, leaving a beneficial influence only of everyday support on social loneliness (standardised regression coefficient -0.75; 95% CI -0.84, -0.65) and emotional loneliness (standardised regression coefficient -0.71; 95% CI -0.80, -0.61). Similar effects of social support on social loneliness and emotional loneliness were found.

Furthermore, an increase in social loneliness was significantly influenced by female sex (standardised regression coefficient 0.12), higher educational level (standardised regression coefficient 0.08), more difficulties with managing on income (standardised regression coefficient 0.15), and poorer self-perceived health (standardised regression coefficient 0.14). An increase in emotional loneliness was significantly influenced by higher age (standardised regression coefficient 0.13) female sex (standardised regression coefficient 0.31), more difficulties with managing on income (standardised regression coefficient 0.22), and poorer self-perceived health (standardised regression coefficient 0.11).

Table 5.2: Measurement models for the three latent variables of social support and the two latent variables of loneliness.

	Unstandardised factor loading (95% CI)	Standardised factor loading	CFI	TLI	RMSEA
Everyday support			0.93	0.80	0.184
inviting you	1.00	0.60			
dropping in for a visit	1.14 (1.05-1.23)	0.69			
show they're fond of you	1.29 (1.18-1.41)	0.75			
interested in you	1.13 (1.03-1.23)	0.67			
Support in problem situations			1.00	1.00	<0.001
comforting you	1.00	0.66			
providing you with help	0.94 (0.87-1.01)	0.61			
reassuring you	1.31 (1.23-1.39)	0.89			
giving you advice	1.09 (1.02-1.16)	0.78			
Esteem support			0.97	0.92	0.139
paying compliment	1.00	0.62			
confide in you	1.38 (1.29-1.48)	0.79			
asking for help or advice	1.38 (1.28-1.48)	0.80			
emphasising strong points	1.27 (1.18-1.36)	0.74			
Social loneliness			0.96	0.92	0.102
always someone I can talk to	1.00	0.55			
plenty of people I can lean on	1.28 (1.17-1.39)	0.66			
many people I can trust completely	1.69 (1.55-1.84)	0.74			
enough people I feel close to	1.54 (1.41-1.67)	0.71			
call friends whenever I need	1.40 (1.29-1.52)	0.67			
Emotional loneliness			0.98	0.96	0.075
miss having a really close friend	1.00	0.64			
experience sense of emptiness	1.02 (0.96-1.10)	0.74			
miss pleasure of company others	1.15 (1.08-1.22)	0.78			
circle of friends is too limited	0.96 (0.89-1.03)	0.61			
miss having people around me	1.13 (1.05-1.20)	0.79			
I often feel rejected	0.68 (0.62-0.73)	0.60			

Table 5.3: Unstandardised and standardised regression coefficients of the effects of social support on social loneliness and emotional loneliness.

	Each social support construct modelled seperately <sup>1</sup>		All social support constructs modelled simultaneously <sup>2</sup>	
	unstandardised (95% CI)	standardised (95% CI)	unstandardised (95% CI)	standardised (95% CI)
<b>Social loneliness regressed on:</b>				
Everyday support (d)	-0.53 (-0.58; -0.47)	-0.62 (-0.66; -0.59)	-0.64 (-0.74; -0.54)	-0.75 (-0.84; -0.65)
Support in problem situations (f)	-0.29 (-0.33; -0.26)	-0.49 (-0.53; -0.45)	-0.03 (-0.08; 0.02)	-0.05 (-0.14; 0.04)
Esteem support (h)	-0.35 (-0.39; -0.31)	-0.52 (-0.56; -0.48)	0.13 (0.05; 0.21)	0.19 (0.07; 0.30)
<b>Emotional loneliness regressed on:</b>				
Everyday support (e)	-0.46 (-0.52; -0.41)	-0.42 (-0.46; -0.38)	-0.78 (-0.91; -0.66)	-0.71 (-0.80; -0.61)
Support in problem situations (g)	-0.20 (-0.24; -0.16)	-0.26 (-0.30; -0.22)	0.11 (0.04; 0.18)	0.14 (0.05; 0.23)
Esteem support (i)	-0.27 (-0.32; -0.23)	-0.31 (-0.35; -0.27)	0.17 (0.07; 0.28)	0.19 (0.07; 0.31)

<sup>1</sup> Model fit measures for everyday support were CFI=0.90, TLI=0.89, RMSEA=0.055; for support in problem situations were CFI=0.89, TLI=0.87, RMSEA=0.059; for esteem support were CFI=0.89, TLI=0.88, RMSEA=0.058

<sup>2</sup> Model fit measures were CFI=0.91, TLI=0.89, RMSEA=0.054

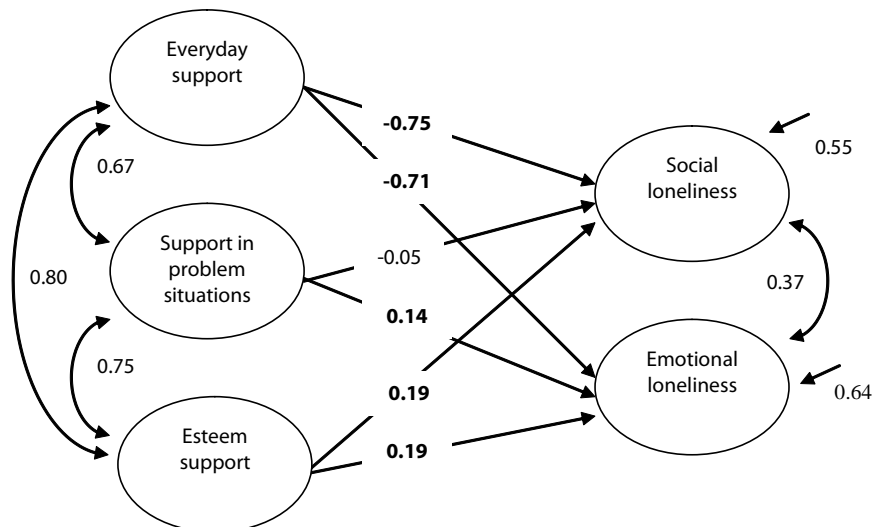


Figure 5.2: Structural model linking social support to loneliness, presenting standardised results. Age, sex, education level, management on income and self-perceived health were included in the model as covariates, although not presented here. Regression coefficients presented in bold indicate statistical significance at the 5% level.

## Discussion

In this study we examined the different constructs of social support in relation to social loneliness and emotional loneliness in older adults aged 65 years and over. Although all latent social support constructs were related with increased social and emotional loneliness in univariate models, only a strong beneficial influence of everyday support on social loneliness and emotional loneliness remained in multivariate models. No substantial differences were found between social loneliness and emotional loneliness when regressed on the different latent social support variables.

The validity of the latent variables of social support and loneliness were explored using confirmatory factor analysis. This analysis showed that the hypothesised models did not fit the data well with regard to the latent constructs of everyday social support, esteem support and social loneliness as was indicated by the goodness of fit measures. This suggest that the observed items of the SSL12-I and the items of the De Jong-Gierveld loneliness scale seem to be not sufficient to cover all latent constructs of social support and loneliness, respectively. After examination of all parameter estimates, fit indexes and residuals, model modifications were conducted to increase the fit of the models. For instance, by allowing the observed items “inviting you” and “dropping in for a visit” to be correlated, the model fit for everyday support increased (CFI 1.00, TLI 1.00, RMSEA 0.045). However, the suggested modifications were not supported by theoretical sense. Furthermore, to prevent the factor analysis to become exploratory rather than confirmatory, we continued the analysis with the original hypothesized models. The fit of the structural equation model including the latent social support variables, the latent loneliness variables and the possible confounders, was however adequate.

The influences of social support on loneliness were investigated using cross-sectional data. Therefore, it was not possible to evaluate the time order of the associations we found. Presumably, some of the obtained effects operated in the opposite direction as well. It can be imagined that the associations between social support and loneliness are bidirectional: a decrease in the social network size because of deaths of good friends and relatives may cause loneliness, whereas loneliness may cause a neglect of maintaining social relationships. Longitudinal research using structural equation modelling would be helpful to investigate the prospective association between social support and loneliness.

Despite some aforementioned methodological shortcomings, this study offers important advantages. The distinction between the different constructs of social support yielded useful information regarding the effectiveness of interventions. The strong association between everyday support and loneliness suggests that loneliness prevention activities should focus on increasing the levels of social support in everyday situations in older people. These intervention activities should refer to social companionship and daily emotional support to increase everyday social support. Particularly, neighbours could play an important role in these intervention activities, as was concluded in one of our previous studies (20). The role of neighbours for providing everyday social support should be further investigated in this part.

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# Chapter 6

Characterisation of different groups of elderly according to social engagement activity patterns

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## Abstract

**Objective:** The aim of this research was to segment older people in subgroups with similar social engagement activity patterns in order to better target public health interventions.

**Design:** Cross-sectional data, collected in 2005 by Dutch community health services (response 79%), from 22026 independently living elderly aged 65 or older were used. Cluster analysis was performed to derive subgroups with common social engagement activity patterns, which were compared for their self-perceived health, mental health, physical health, and loneliness.

**Results:** Among the independently living older people, five subgroups were identified with different patterns of social engagement activities: less socially engaged elderly, less socially engaged caregivers, socially engaged caregivers, leisure-engaged elderly, and productive-engaged elderly. The subgroups differed significantly in social engagement activities, socio-demographics, and health ( $p < 0.001$ ). The groups with the highest relative numbers of older people who were frequently engaged in leisure and productive-related activities, also included relatively more elderly with a good self-perceived health (85.8% versus 58.8%), mental health (91.3% versus 74.6%), physical health (97.7% versus 73.0%), and elderly who were not lonely (70.0% versus 52.0%) when compared to the least healthy subgroup.

**Conclusion:** Older people could be segmented in subgroups based on similar social engagement patterns. Groups with elderly who were less socially engaged demonstrate to be possible target groups for public health interventions, given the relatively high shares of unhealthy older people among them.



## Introduction

Social support is considered an important factor contributing to functioning and well-being of older people within the concept of successful ageing as described by Rowe and Kahn (1). In numerous studies, social network, social support, and social engagement have been associated with better health and health outcomes (2-5). Active engagement in society can help modify the effects due to age-related changes in health status by providing a greater sense of purpose and control, and overall self-efficacy (6).

In order to improve older people's health it is important to develop targeted health promotion activities. In most research, target groups are often defined based on demographic characteristics. However, demographics alone are of limited use in describing health-related behaviours. By using the concept of 'audience segmentation', the elderly population can be divided into several relatively homogenous groups with similar interests, needs and desires (7). Audience segmentation is widely used in marketing research, but also more and more in public health communication (8-10). Hence, identifying subgroups of elderly that have similar patterns of social engagement activities might be useful to better target health promotion intervention strategies. Therefore, the aim of this research was to group elderly according to different social engagement activity patterns and to describe the derived subgroups further by self-perceived health, mental health, physical health, and loneliness.

## Methods

### Study Population

In 2005, six community health services in the eastern part of the Netherlands collaborated to monitor the health status, health determinants, and health care use and needs in free-living elderly aged 65 years and older. The name of this monitoring project was the Elderly Monitoring Project. All six community health services collected their data in the same period by means of standardised questionnaires with validated questions, following a uniform protocol concerning procedures regarding data collection and processing (unpublished communication: Haitsma O, de Rover C. Community Health Services GGD Regio Twente, GGD Gelre-IJssel. Elderly Monitoring Project, region East). Subjects were randomly sampled from the Municipal Databases (personal files) after stratification by age (65-74 years and 75 years and older). In October 2005, the questionnaires were sent by mail to 32,980 elderly in total. Within a period of ten weeks, two reminders were sent to non-respondents, which resulted in 25,903 returned questionnaires and an overall response rate of 79%. Subjects were excluded immediately if data of age or gender (942 subjects) or codes of questionnaire (25 subjects) were missing.

### Social engagement activity patterns

Social engagement activity patterns were determined by 17 variables on different types of activities (table 6.1). The frequency of being involved in these activities was assessed by a 5-points scoring scale that ranged from (almost) daily to (almost) never. Subjects who answered at least 12 out of the 17 questions were included in the analyses (n=22,026). Remaining missing values were

replaced with the population mean of the concerning variable. Principal component analysis with Varimax rotation was used to reduce the 17 variables representing social engagement into a more useful set of variables. Based on the eigenvalues, the scree-plot, and the interpretability of the derived components, we retained a solution with six components, which accounted for 53% of the total variance. The following six patterns of social engagement were identified: voluntary, physical, visiting, hobby, work, and care.

Table 6.1: Component scores for the six patterns of social engagement activities, n=22,026

	1 'Voluntary'	2 'Physical'	3 'Visiting'	4 'Hobby'	5 'Work'	6 'Care'
Participating in social club	<b>0.614</b>	0.181	0.113	0.246	-0.067	-0.041
Voluntary work	<b>0.761</b>	0.118	0.037	0.133	0.187	0.063
Work for church	<b>0.770</b>	0.012	0.016	-0.021	0.117	0.011
Walking	-0.073	<b>0.451</b>	0.211	0.247	0.236	0.021
Cycling	0.165	<b>0.523</b>	0.085	0.121	0.404	0.006
Elderly sports	0.164	<b>0.708</b>	0.019	-0.137	-0.204	0.003
Other sports	0.087	<b>0.620</b>	-0.065	0.195	0.077	-0.014
Visiting	0.143	0.170	<b>0.799</b>	0.080	0.130	-0.012
Receiving visitors	0.011	-0.080	<b>0.864</b>	-0.036	-0.013	0.019
Hobbies/ courses	0.230	0.004	0.097	<b>0.607</b>	0.207	-0.011
Visiting the library	0.009	0.272	0.030	<b>0.581</b>	-0.177	0.052
Internet/ E-mail	0.097	0.027	-0.069	<b>0.743</b>	0.153	-0.011
Paid work	0.000	-0.123	-0.116	0.171	<b>0.477</b>	-0.059
Baby-sit grandchildren	0.064	0.254	0.161	-0.078	<b>0.618</b>	-0.023
Jobs at others	0.165	0.033	0.091	0.052	<b>0.660</b>	0.122
Care for sick partner	-0.061	-0.009	-0.031	0.014	-0.074	<b>0.753</b>
Care for other sick person	0.088	0.011	0.038	0.002	0.104	<b>0.716</b>

### Socio-demographics

Categorisation of the variable values related to the general characteristics of the participants such as sex, age, country of birth, household composition, educational level, and income, was done based on the standardised procedures of the community health services. Country of birth was divided into 'the Netherlands' and 'other', as only 3.5% of the elderly were from a non-Dutch origin. Educational level was categorised into no/primary education, low education, intermediate education, and high education level. Classes of income were established as above or below

the average net household income of 1,750 Euro's per month. To retain subjects who refused to report income, a separate category was created for unknown values. Furthermore, having difficulties with managing on income was assessed; this was classified as having 'difficulties' or 'no difficulties' with managing on household income.

### Health variables

Self-perceived health was questioned by 'how would you classify your health in general?', using a 5-point scale ranging from excellent to poor. It is known that this indicator is a good predictor of mortality (11). Good self-perceived health was defined as having a good, very good, or excellent health. Physical functioning was assessed by means of a 10-item questionnaire on Activities of Daily Living (ADL). Good physical functioning was considered as having no difficulties with the ADL items (12). The ten ADL-items were 'eating and drinking', 'sit down in and stand up from chair', 'getting in and out of bed', 'dressing and undressing', 'transferring between rooms', 'ascend and descend stairs', 'entering and leaving the house', 'transferring outdoors', 'washing hands and face', and 'taking a bath or a shower'. The Mental Health Index (MHI-5) was used to measure general mental health. The MHI-5 consisted of the following five questions "How much of the time in the previous 4 weeks: have you been a very nervous person?, have you felt so down in the dumps that nothing could cheer you up?, have you felt calm and peaceful?, have you felt downhearted and blue?, have you been a happy person?". The six response categories (all, most, often, some, a little, or none of the time) were transformed into standardised MHI-5 scores ranging from 0 (poor) to 100 (excellent). Good mental health was determined as having a score above 60 (13-15). Loneliness was measured by a loneliness score according to De Jong-Gierveld (16, 17). The scale of de Jong-Gierveld was obtained from 11 questions on loneliness. A person was rated as not lonely when the score was 0-2. A score of 3-8 represented moderate loneliness, a score of 9 or 10 represented severe loneliness, and a score of 11 represented very severe loneliness. Two categories were computed; no loneliness and moderate to very severe loneliness. Loneliness was assessed only in a subsample of our study population (n=15,871).

### Statistical Analysis

Cluster analysis was carried out to derive subgroups with common social engagement activity patterns. The resulting clusters should have high within-cluster homogeneity and high between-cluster heterogeneity (18). Cluster analysis using the K-means method is the most suitable method when there are a large number of subjects. However, when using the K-means method, the number of clusters needs to be decided beforehand. Therefore, we first conducted hierarchical cluster analysis in a random 1% of the population sample to identify a preliminary set of cluster solutions ranging from two to ten clusters. To generate the final cluster solution, we used nonhierarchical cluster analyses using K-means with the Euclidean distance as similarity measure in the total analytical sample. The derived clusters were described according to social engagement activities, socio-demographics, and health. Differences between clusters were established using Chi-square tests, and were considered significant when reaching a level of  $p < 0.05$ . Statistical analyses were performed using the SPSS for Windows software program, version 15.0.1.

## Results

More women (55.2%) than men were present in the study population (table 6.2). The women in our study were somewhat older and were more often living alone than men were. The majority of the participants was born in the Netherlands (95%) and was lower educated or had received no education (73.6%). Although more than one third of the older people had a net household income below average, only 12% reported to encounter difficulties with managing on their incomes.

Table 6.2: General characteristics of the subjects in the Elderly Monitor

	N	Men n=9,869	Women n=12,157
Age (%)	22,026		
65-74 years		59.0	51.6
75 years and older		41.0	48.4
Country of birth (%)	21,789		
The Netherlands		96.5	96.4
Other		3.5	3.6
Household composition (%)	21,675		
1 person		15.5	43.0
2 or more persons		84.5	57.0
Educational level (%)	21,142		
None / primary school		24.5	36.6
Lower education		43.9	46.7
Intermediate		14.7	10.0
High		16.9	6.7
Household income (%)	16,207 <sup>1</sup>		
Below average		52.6	62.2
Above average		33.1	19.2
Unknown		14.4	18.7
Managing on income (%)	21,556		
Difficulties		12.4	12.3
No difficulties		87.6	87.7

<sup>1</sup> Household income was available from a subsample of our study population

Of all social engagement activities, older people were most frequently engaged in visiting (more than once per month: 82.8%) and receiving visitors (more than once per month: 89.2%). When grouping older people with similar patterns of social engagement activities, five clusters were derived. All differences between clusters by social engagement activities (table 6.3), socio-demographics (table 6.4), and health (table 6.5) were statistically significant ( $p < 0.001$ ). Approximately 50% of the participants were grouped in the first cluster ( $n=11,001$ ). In this cluster, there were lower proportions of people who were at least two times per month involved in social engagement activities compared to the other clusters. Therefore, we named the elderly in this cluster “less engaged” elderly. Less engaged elderly could be further described as being relatively old, living alone, and being lower educated. Its high proportions of elderly who reported to have mental health problems, physical limitations, and who were classified as being in moderate or poor health and moderate to very severe lonely, further characterised this cluster. Care activities were most profound in clusters 2 and 3. Over 86% of the older people in cluster 2 were frequently taking care of their sick partner, and 88% of the elderly in cluster 3 were frequently taking care of sick persons, other than their own partner. Differences between clusters 2 and 3 were that elderly in cluster 3 were also frequently engaged in voluntary, fitness, visit, hobby, and work-related activities, whereas elderly in cluster 2 were not frequently engaged in other activities. Therefore, we named these clusters the “engaged caregivers” and the “less engaged caregivers” respectively. Furthermore, less engaged caregivers encountered difficulties with managing on their incomes, rated their own health relatively low, and were considered lonely. A common characteristic of both caregiver clusters was their high share of elderly with mental health problems: over 22% of the elderly in these clusters had mental health problems. Although elderly in all clusters were engaged in physical activities such as walking and cycling, older people who were frequently involved in sports were mainly grouped in cluster 4, that we named the “leisure-engaged” group. The leisure-engaged elderly were primarily women, had a higher educational level, and reported more frequently to have a good self-perceived, mental, and physical health. Older people in the fifth cluster were mainly characterised by engagement in visit, hobby, and work-related activities. This cluster was therefore named the “productive-engaged” group. More than half of the productive-engaged elderly were frequently engaged in a hobby or a course. Productive engaged elderly were mostly men with a relatively young age and a high educational level. Furthermore, this cluster included the highest percentage of elderly with a good self-perceived, mental, and physical health, and the highest percentage of elderly who were classified as not being lonely.

## Discussion

In this research, we identified five subpopulations of independently living older people with similar patterns of social engagement activities: less socially engaged elderly, less socially engaged caregivers, socially engaged caregivers, leisure engaged elderly, and productive engaged elderly. The clusters with the highest shares of elderly, who were frequently engaged in voluntary, fitness, hobby, and work-related activities, also included relatively more healthy elderly. The less socially engaged elderly and the less socially engaged caregivers demonstrate to be possible target groups for health promotion activities, given the relatively high shares of unhealthy older people among them.

Table 6.3: Cluster characterisation of the Elderly Monitor participants, according to frequent social engagement (more than once per month), n=22,026

	Cluster 1 less socially engaged n=11,001	Cluster 2 less socially engaged caregivers n=1,024	Cluster 3 socially engaged care givers n=359	Cluster 4 leisure- engaged n=4,514	Cluster 5 productive- engaged n=5,128
Voluntary (%)					
Participating in social club	19.3	23.7	32.3	48.5	30.8
Voluntary work	9.9	17.6	47.4	33.8	35.0
Work for church	5.5	7.1	21.4	16.4	18.6
Fitness (%)					
Walking	42.4	59.7	75.5	86.9	89.8
Cycling	1.5	13.5	18.4	60.7	3.4
Elderly sports	1.5	12.3	24.2	52.3	14.2
Other sports	54.4	66.7	80.2	86.4	84.1
Visit (%)					
Receiving visitors	87.9	87.6	93.6	88.9	92.2
Visiting	76.3	75.4	91.1	89.8	91.5
Hobby (%)					
Visiting the library	12.3	20.5	13.1	35.4	11.9
Hobbies/ courses	25.8	34.8	48.5	43.7	54.6
Internet/ E-mail	12.1	20.7	23.4	26.3	29.8
Work (%)					
Paid work	0.1	1.7	7.5	0.5	15.2
Doing jobs at others	0.4	4.8	41.5	4.8	33.9
Baby-sit grandchildren	7.9	19.1	44.8	30.0	66.0
Care (%)					
Care for sick partner	0.2	86.4	34.0	0.3	0.4
Care for others	0.0	11.8	88.0	0.0	0.1

Table 6.4: Cluster characterisation of the Elderly Monitor participants, according to socio-demographic characteristics

	N	Cluster 1 less socially engaged	Cluster 2 less socially engaged caregivers	Cluster 3 socially engaged care givers	Cluster 4 leisure- engaged	Cluster 5 productive- engaged
Sex (%)	22,026					
Male		39.8	46.8	44.3	34.7	64.2
Female		60.2	53.2	55.7	65.3	35.8
Age (%)	22,026					
65-74 years		39.1	50.6	71.0	65.0	79.6
75 years and older		60.9	49.4	29.0	35.0	20.4
Country of birth (%)	21,789					
The Netherlands		95.9	94.9	94.6	97.0	97.5
Other		4.1	5.1	5.4	3.0	2.5
Household composition (%)	21,675					
1 person		38.5	11.6	23.1	31.6	17.5
2 or more persons		61.5	88.4	76.9	68.4	82.5
Educational level (%)	21,142					
None / primary school		40.3	30.8	22.9	21.9	20.8
Lower education		41.0	46.5	49.3	49.1	51.2
Intermediate		10.0	11.8	14.8	14.1	14.7
High		8.7	10.9	13.0	14.9	13.4
Household income (%)	16,207 <sup>1</sup>					
Below average		62.7	58.6	60.1	50.4	54.1
Above average		19.8	25.5	26.8	32.9	30.0
Don't want to say		17.5	15.8	13.1	16.7	15.9
Managing on income (%)	21,556					
Difficulties		13.5	18.2	13.3	9.1	11.5
No difficulties		86.5	81.8	86.7	90.9	88.5

<sup>1</sup>Household income was available from a subsample of our study population

Table 6.5: Cluster characterisation of the Elderly Monitor participants, according to self-perceived health, mental health, physical health and loneliness

	N	Cluster 1 less socially engaged	Cluster 2 less socially engaged caregivers	Cluster 3 socially engaged care givers	Cluster 4 leisure- engaged	Cluster 5 productive- engaged
Self perceived health (%)	21,423					
Moderate/Poor		41.2	34.7	22.5	16.1	14.2
Good-Excellent		58.8	65.3	77.5	83.9	85.8
Mental health (%)	21,486					
mental health problems (MHI-5 score $\leq 60$ )		21.1	25.4	23.2	11.6	8.7
no mental health problems (MHI-5 score $>60$ )		78.9	74.6	76.8	88.4	91.3
Physical health (%)	21,653					
1 or more ADL limitations		27.0	14.8	6.5	5.2	2.3
no ADL limitations		73.0	85.2	93.5	94.8	97.7
Loneliness (%)	15,871 <sup>1</sup>					
Moderate to very severe loneliness		48.0	45.9	38.9	39.1	30.0
No loneliness		52.0	54.1	61.1	60.9	70.0

<sup>1</sup> Loneliness was available from a subsample of our study population

To assess predictive validity of the cluster solutions, we used socio-demographic variables to examine differences between clusters. These socio-demographic variables were not included in the cluster analysis but were expected to vary across the clusters. Because of our large sample size, significant differences between clusters were obtained rather easy and we were cautious to fully depend on statistical significance solely. As a second validity check for stability of the cluster solution, an additional cluster analysis was performed with all cases sorted in a different random order, to determine the degree of consistency between the two solutions, even though they were based on different sets of starting points for each cluster (18). The results of the additional cluster analysis did not alter the interpretation of the original cluster solution. Furthermore, we were able to replicate the cluster structure with five clusters within sub-samples. We randomly selected two halves of the total population sample. The clusters derived with the total sample were highly similar to the clusters derived with the sub-samples. Thus, given the predictive validity of our cluster solution and the stability of the results between the specified starting points and the random selection, we feel confident that true differences exist among older people in terms of their patterns of social engagement activities.

Because of more than five missing response values on the questions about social engagement activities, 2,910 subjects were excluded from the analyses. When comparing the elderly who



were excluded, with the elderly in our analytical sample, we found considerable differences in gender and age. In the elderly who were excluded, more women (68.9%) and elderly aged 75 or older (61.0%) were present compared to our analytical sample (55.2% and 45.1% respectively). Despite the exclusion, the oldest elderly were not underrepresented in our analytical sample compared to the actual elderly population living in the eastern part of the Netherlands because of the stratified sampling procedure we used in our study. In fact, the proportion of subjects aged 75 or older was still somewhat higher in our study population (45.1%), compared to the actual proportion (44.5%) in the elderly population (19).

Another strength of our study is the large sample size ( $n=22,026$ ), which considerably increased the chance that small groups were represented by enough older people to be identified in the cluster analysis. Together with the high response rate of 79%, we believe that our study population was a representative sample of non-institutionalised elderly living in the eastern part of the Netherlands. Hence, besides only identifying target groups with common social engagement activity patterns, we were able to provide actual estimates of the relative population size of each subgroup. Nevertheless, we should be cautious to extrapolate our results to the total elderly population, since in 2005, 5-6% of the Dutch elderly population were institutionalised (19), and may have had other social engagement activity patterns than the patterns we included in this study.

Besides the differences between clusters in social engagement activity patterns, this study shows that elderly in different groups also differ in socio-demographic characteristics and in health status. Two relatively healthy clusters counting 44% of the elderly could be discriminated from the cluster solution. The groups representing leisure engaged elderly and productive engaged elderly, included the highest proportions of elderly who were aged 65-74 years, high educated, and who were in good health. Bath & Deeg, who reviewed different cross-sectional and longitudinal studies on the relation between social participation and health, confirmed this potential association between frequent engagement in activities and good health; they concluded that social participation in later life is related to improved physical health (5).

Although only 17% of the productive engaged elderly were engaged in sports activities, they scored best on all health measures. Productive engaged elderly scored relatively high on activities with a combination of social, mental, and physical components such as hobbies and voluntary activities. The results of our study might indicate that physical components, which were mainly included in sports activities, may not be an exclusive guarantee for good health, which was shown by the longitudinal results of Glass and colleagues among elderly during 13 years of follow-up (20). They demonstrate that social and productive oriented activities could be equally beneficial to survival compared with fitness activities. Around 50% of all elderly were grouped in the least healthy cluster and were less engaged in any of the activities. In this cluster, more than 60% of the elderly were over 75 years of age. The relatively high proportions of less engaged or unhealthy people could not just be caused by high age, since this cluster did not score better on health when analysed for elderly aged 65-74 years and elderly aged 75 years and older separately. Concerning mental health only, the clusters representing caregivers scored somewhat worse on mental health compared to the other clusters. Elderly who were frequently involved in care-related activities might be lacking a sense of satisfaction, if a high effort and low reward are present, as shown by

Wahrendorf and colleagues who investigated the quality of care for a person and its association with well-being in European people aged 50 years and older (21).

Our results suggest tailoring public health interventions to the characteristics of each group. Since 50% of the elderly who were least engaged in society and who were least healthy were grouped in the same cluster, it is most important to address this group in public health interventions. Efforts to stimulate this group to be more active, should meet the demands of elderly above the age of 75 years and who are lower educated. Besides the use of the clusters in actual health promotion planning and development, it is also important to assess if social engagement activities may be modifiable and what factors can contribute to this change in order for an intervention to be successful. Although the number of older people who were represented by the caregiver clusters was not high ( $n=1,383$ ; 6.3%), it is noteworthy to address them in health promoting activities. Assuming that providing care to a sick person is only a temporarily activity, it is necessary that former caregivers receive individual support and respectful treatment by the local government and general practitioners to facilitate transfer to a 'healthy cluster'.

Our goal was to determine target groups of health-related behaviours for tailoring public health interventions with the use of cluster analysis. The present research provides clues to possible tailoring of public health interventions as to contribute to well-being in old age.

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# Chapter 4

Applying local health data to health-policy making, illustrated  
by an integrated research approach on social relationships in  
healthy ageing

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## **Abstract**

Decentralisation in policy making requires decentralisation of applying research to local policy making. The programme 'healthy ageing' illustrates how to benefit from local research in the agenda setting and programme development in public health practice. Local data from cross-sectional and longitudinal surveys and interviews were used to gain insight in social relationships in healthy ageing. By integrating all results, the local data contributed to the priority setting in local policy making which resulted in the development of an evidence-based community intervention supporting social participation among older people.

## Introduction

In Europe, local health policy decisions are commonly driven by national research and policies. Even when the process of policy making is more decentralised, there is often a centralised approach to the application of research to policy (1). In order to support local health-policy making, more local research to provide information on health status and needs is necessary.

An example of decentralisation in policy making in the Netherlands is the Social Support Act, which came into force in 2007 (2). This act allows the municipalities to set their own policy agenda concerning for example the promotion of social cohesion and enhancement of participation of older people in mainstream society. In the Gelre-IJssel region in the east of the Netherlands, several surveys and qualitative studies have been conducted, each with its own objective. By integrating the findings of the different studies, this paper demonstrates how local health data jointly can contribute to the agenda setting and programme development of local policy making.

## Methods

### Cross-sectional surveys

In 1996/97 and in 2005, the community health service of the Gelre-IJssel region conducted local health surveys to identify the main health problems among independently living people aged 65 years and over. Self-administered questionnaires included standardised questions about health, determinants of health, health care use and needs. Around 500 older people living in the municipalities of the Gelre-IJssel region were selected from the municipalities' population registries (response 81%). Nine-year trends in loneliness for different subgroups were analysed (3).

At the same time, five other nearby community health services conducted local health surveys among older people, sharing similar sampling procedures and questionnaires. After pooling the data of the six health surveys with an overall response rate of 79%, the overall sample size constituted of 24,936 older people. Associations between social network characteristics and health were explored using logistic regression analysis (4). Furthermore, subgroups of people with common social activity patterns were derived by cluster analysis (5).

### Longitudinal survey

The Doetinchem Cohort Study is a prospective cohort study in the Gelre-IJssel region that was set up with a national perspective to investigate the impact of lifestyle and biological risk factors on aspects of health (6). The first examination round (1987-1991) comprised 12,448 men and women aged 20 to 59 years who lived in Doetinchem. Two-thirds of those who were measured in the first round were randomly selected after five years for follow-up measurements. Until now, three follow-up rounds of the Doetinchem Cohort Study have been completed. The overall response rate was 62% for the baseline measurement and 79%, 75% and 78% in rounds two, three and four respectively. Longitudinal logistic regression analyses using Generalised Estimating Equations (GEE) were performed to estimate the associations between perceptions of social support at baseline and repeated measures of self-perceived health and mental health (7). In

addition, survival analyses were performed to estimate the association between perceptions of social support and mortality until 2008, using Cox proportional hazards regression models (8).

### Qualitative studies

As part of a collaboration project between the community health service and Wageningen University, two qualitative studies were carried out in the Gelre-IJssel region. Both studies were using in-depth open-ended face-to-face interviews, guided by a topic list. All interviews were audio taped, transcribed and coded for content using the software package Atlas.ti. The first study was carried out in 2007, to generate insight in different experiences about healthy ageing (9). The study included 79 people from three different municipalities and age groups (55-64; 65-74; 75 years and older). In 2008, the second study was carried out in ten older people aged 65 years living in one of the municipalities to increase understanding of social relationships in healthy ageing. Participants received a photo camera to take pictures of their social contacts and activities, which were discussed during the interviews.

## Results

Different types of data and data sources were used to obtain an integrated framework for describing and analysing social relationships in healthy ageing to support the agenda setting and programme development of local health policy-making (table 7.1). Loneliness prevention was identified as a policy priority area in many municipalities within the Gelre-IJssel region, since 41% of the older people were lonely. Trend analysis using repeated cross-sectional surveys underlined the importance of loneliness prevention in older people's health, since loneliness increased from 32% in 1996/1997 to 41% in 2005 (3).

Examination of the associations between health and its determinants resulted in two main findings informative for programme development. First, cross-sectional analyses showed that satisfaction with social contacts was strongly related to health (4). This finding was underlined by the longitudinal analyses, showing that unfavourable levels of social support were predictive for poor health and reduced survival time (7, 8). Second, neighbours were found to be an important source in the social network ties of older people, which confirmed the earlier outcome of the first qualitative study that familiarity and closeness are important assets of resources (4, 9).

Insight in the importance of social participation among elderly people provided further clues for the development of the healthy ageing programme. Older people who were not engaged in any social activity other than the care for a sick person were identified as a possible target group, given the relatively high shares of unhealthy people among them (5). Analysis of the interviews from the second qualitative study showed that social activities could be distinguished into four dimensions relating to private activities, shared activities, organised activities and community activities. When developing interventions it is important to offer activities including different meaningful aspects covering all four dimensions of the activities. Further results of the first qualitative research indicated that healthy ageing is perceived within the context of everyday life (9). Often, intervention strategies are not in line with this mindset of the elderly. Therefore, more attention



for the framing of interventions within the contexts of everyday life, for instance by target group participation, might increase their effectiveness.

## Discussion

The programme 'healthy ageing' serves as an illustration of how local quantitative and qualitative data can be integrated and translated for being used in public health practice by supporting local policy makers. The research findings presented in this paper led to the local attention for social relationships and participation in society. In some municipalities, policy priorities were given to increase social cohesion. This resulted in the development of a community-based intervention, supporting the active elderly to organise social activities for their less active elderly neighbours, facilitated by practical and financial support from the community health service and elderly welfare organisations (10).

To develop and implement programmes for complex public health problems tailored to the local setting, local authorities need support from practice and research. Local health surveys are a rich source of information and can be a powerful tool in public health practice. Moreover, when combining these health surveys with qualitative research, a more complete picture of the health situation can be obtained as to better support the decision making process. Off course, in addition to the integration of scientific evidence, a great deal of attention is required for presentation and communication of the research findings, and the interaction with policy makers to support them in the processes of agenda setting and programme development.

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Table 7.1: Summary of the translation of the different results into the agenda setting and programme development in local health-policy making

Quantitative evidence		Qualitative evidence
Description	Prevalence/ risk estimate (95% confidence interval)	
<b>Agenda setting</b>		
	Loneliness is a major health problem (3)	41% of the older people were lonely; increase from 32% in 1996/1997 to 41% in 2005
<b>Programme development</b>		
Social network (4, 9)	Frequent contact with family was positively associated with mental health.	mental health: 1.22 (1.09-1.36)
	Frequent contact with friends was positively associated with self-perceived health, mental health, and physical health.	self-perceived health: 1.22 (1.13-1.31); mental health 1.31 (1.20-1.43); physical health: 1.24 (1.12-1.36)
	Frequent contact with neighbours was positively associated with self-perceived health, mental health and physical health.	self-perceived health: 1.42 (1.30-1.54); mental health: 1.53 (1.39-1.69); physical health: 1.87 (1.68-2.07)
	Satisfaction with the social contacts was positively associated with self-perceived health, mental health and physical health.	self-perceived health: 2.52 (2.29-2.78); mental health: 4.65 (4.20-5.15); physical health: 2.36 (2.11-2.64)
Social support (7,8)	Low levels of positive perceptions of social support were associated with poor mental health and with an increased mortality risk.	Positive perceptions of support poor mental health: 2.74 (2.32-3.23); mortality risk: 1.57 (1.03-2.39)
	Negative perceptions of social support were associated with poor mental health and poor self-perceived health.	Negative perceptions of support poor mental health: 3.28 (2.78-3.87); poor self-perceived health: 2.17 (1.81-2.60)
Social participation (5)	Potential target groups are: • Older people who were generally less socially engaged. • Older people who took care for a sick person and were less engaged in other activities.	Prevalence of loneliness and poor health in target groups versus non-target groups: • loneliness: 48% vs. 30% • poor self-perceived health: 41% vs. 14% • poor mental health: 25% vs. 9% • poor physical health: 27% vs. 2%
		Four types of social activities are important: 1) solitary activities, to disengage from the social network and spend time on private hobbies; 2) activities with friends and relatives, for emotional bonding; 3) organised activities, to participate in the community; 4) community activities, to feel meaningful in the society





# Chapter 8

General discussion

The main objective of this thesis was to investigate the associations between social relationships and health in older people. Different structural characteristics and functions of social relationships have been analysed in cross-sectional and longitudinal studies. Structural characteristics included frequency of contact and sources of social network ties, whereas functions of social relationships included satisfaction with relationships, positive and negative perceptions of social support and social engagement. The results of this thesis will provide scientific evidence for practice-based research, by supporting local policy making on healthy ageing and by providing evidence-based input for the development of a local complex intervention programme for healthy ageing.

## **Main findings**

The main findings described in this thesis are presented in table 8.1. Chapters 2-4 present evidence on associations between social relationships and health; chapters 5 and 6 report on exploring possibilities for tailoring interventions to the local context.

Examination of the associations between social relationships and health resulted in two main findings, relating to both the functional aspects and the structural characteristics of social relationships. First, well-functioning social relationships were favourably associated with health. This was demonstrated by our cross-sectional analyses showing that satisfaction with social contacts was strongly related to physical, mental and self-perceived health (chapter 2). This finding was underlined by the longitudinal analyses, which showed that unfavourable levels of social support were predictive for health-compromising lifestyle behaviour, poor health and reduced survival time (chapters 3 & 4). Second, with regard to structural characteristics of social relationship, neighbours appeared important sources of the social network ties of older people in relation to physical, mental and self-perceived health (chapter 2).

Further exploration of the relationship between social support and loneliness using structural equation modelling identified specific leads for health promotion activities, such as increasing the levels of social support in everyday situations to target social and emotional loneliness (chapter 5). Insight in the importance of social participation among older people identified target groups for an intervention programme for healthy ageing: i.e. older people who were not engaged in any social activity other than the care for a sick person. This group included a high share of mentally and physically unhealthy people (chapter 6).

In Chapter 7, the results of chapters 2-4 and 6 are integrated and combined with additional qualitative research to demonstrate how these results jointly can contribute to the agenda setting and programme development of local policy making.

Table 8.1: Main findings of the studies described in this thesis

Chapter	Study	Study type	Population	Social network component	Results
Chapter 7	2	Elderly Monitor, 2005	Cross-sectional 22,149 older people, aged 65+ yrs	Frequency and source of contacts, satisfaction with contacts	Strong positive associations between satisfaction with social contacts and physical, mental and self-perceived health. Contact with neighbours showed stronger positive associations with health than friends and family.
	3	Doetinchem Cohort Study, rounds 2, 3 and 4	Prospective cohort, 10 years of follow-up 4,724 adults, aged 26-65 yrs	Positive and negative perceptions of social support	Mental health was negatively affected by low positive perceptions and high negative perceptions of social support. Low positive perceptions of social support further affected low fruit and vegetable intake. High negative perceptions of social support further affected smoking, high alcohol consumption, physical inactivity, overweight and poor self-perceived health.
	4	Doetinchem Cohort Study, rounds 1 and 2	Prospective cohort, 20 years of follow-up 11,163 adults, aged 20-59 yrs	Positive and negative perceptions of social support	Low levels of positive perceptions of social support were associated with an increased mortality risk. No effect of negative perceptions of social support on mortality was found.
	5	Baseline measurement Loneliness intervention, 2008	Cross-sectional 2,405 older people, aged 65+ yrs	Social support	The latent construct of everyday support showed strong beneficial associations with social and emotional loneliness. Support in problem situations and esteem support only showed beneficial influences in a univariate model, indicating that these effects were captured through everyday support.
6	Elderly Monitor, 2005	Cross-sectional 22,026 older people, aged 65+ yrs	Social engagement	Five clusters were identified based on social engagement activities: 1) less socially engaged elderly; 2) less socially engaged caregivers; 3) socially engaged caregivers; 4) leisure-engaged elderly; and 5) productive-engaged elderly, of which clusters 1 and 2 were identified as a possible target groups.	



## Methodological considerations

The Dutch Social Support Act that came into force in the Netherlands on 1 January 2007 set the course for this PhD thesis. The aim of this act is to promote people's participation in both life and society, and to strengthen social cohesion and quality of life at the local level (1). Since it is only recently that this act was implemented, not much is known about the effects of its implementation in local practice. By identifying a range of potential measures of social relationships, the results of this thesis may well provide opportunities to contribute to effective implementation of local policies based on the Social Support Act. To investigate the associations between social relationships and health, cross-sectional and prospective study designs were applied and different analytical methods were used, such as logistic regression analysis, generalised estimating equations, survival analysis, structural equation modelling, and cluster analysis.

### The assessment of social relationships

In this thesis different characteristics and functions of social relationships were measured using cross-sectional and prospective data. As measures of social relationships we used frequency of contact, different sources of social network ties, satisfaction with relationships, positive and negative perceptions of social support and social engagement. By investigating this variety of measures, we aimed to gain insight in the specific components that influence older people's health. Our results indicated that both structural characteristics of social relationships (frequency, sources), as its functioning (satisfaction, support, engagement) were associated with health. Still, due attention to the validity and reliability of these measures should be considered.

The validation of measures concerning perceptions of social relationships is difficult, as there is no objective gold standard for them. The quantitative questionnaire we used in chapter 2 assessed the frequency of contact and the satisfaction with social relationships. This type of assessment gives an overview of the habitual social relationships, but more in-depth short-term assessments may provide further insight in the quality of social relationships and they may help identifying intervention possibilities. In this respect, qualitative research might be a way to assess the participants' meaning of and perceptions about social relationships. To gain this insight, we conducted additional in-depth interviews among ten people aged 65 and over (2). The participants received a photo camera to take pictures of their social contacts and activities, which were discussed during the interviews. The results of these interviews showed that with regard to the source of social network ties, different sources such as family, friends and neighbours each fulfil a specific role in the social network of older people. For family and friends in particular, it is not so much the frequency of contact, but the quality of contact that makes these relationships valuable, since they are mostly based on emotional involvement. This is reflected in emotional support. In literature, there is a strong association between support given and received (3, 4). People tend to evaluate their relationships constantly for a balance between giving and receiving. So if the need for support is increased due to a poorer health status and support cannot be given, the social network concerning family and friends is likely to decrease. The specific role of neighbours that was described in chapter 2 was confirmed by our qualitative research. Contact with neighbours has a symbolic as well as a functional meaning. A good relationship with neighbours will reside in living in a trusted and secure neighbourhood with a high social cohesion. The functional significance of having good relationships with neighbours is reflected in giving and receiving



instrumental and informative support. Good relationships with neighbours become more important with decreasing physical functioning. These relationships contribute to the independency of older people, as they can continue to live longer in a trusted environment.

As validation is often difficult, because of the lack of a gold standard, the reliability is commonly used as a proxy measure for quality of the measurements. The reliability of social network measurements is influenced by measurement error and longer-term fluctuations within individuals. In chapter 4, the reliability of the social support measurement is explored by accounting for the possibility that measuring social support only once at baseline might not be a reliable indicator of the 'usual' level of social support (5, 6). If the reliability is low, this might be reflected in attenuation of the hazard ratios. By analysing stable levels of social support over five years in a subgroup of participants with repeated measurements, we were able to limit this possible regression dilution bias. Indeed, stable low levels of positive experiences of social support were more strongly associated with increased mortality than single measurements of social support. To support the suggestion that measurement error or fluctuations within individuals account for the attenuation of the associations in the baseline sample, we found a test-retest correlation coefficient of 0.49 for positive as well as for negative experiences of support between the two measurements, which indicates that a single measurement is only a moderate indicator of long-term social support. Furthermore, it must be kept in mind, that test-retest correlations may provide a too favourable impression of reliability because of correlated measurement errors in replicates (see next paragraph). So, the classification of the social support measurement might even be worse than is suggested by the test-retest correlation coefficient. Therefore, future studies assessing the influences of social relationships and health should strive to repeatedly measure indicators of social relationships to increase their reliability.

#### Potential biases in the associations between social relationships and health

If both the exposure and the outcome have the same sources of measurement errors, the measurement errors are most probably correlated (7). This correlation between measurement errors will result in bias in the association of interest. Especially in research on social relationships and self-reported health correlated measurement error is to be expected, as in addition to the common source of measurement error by self-reporting, both measures are subjective perceptions of the participants. As mentioned before, the associations between social relationships and health were investigated in chapters 2, 3 and 4. In these chapters, the possibility of correlated measurement error ranged from very likely to not possible (table 8.2). In chapter 2, social relationships were assessed as self-reported frequency of contact, as different sources of social network ties and as satisfaction with relationships. The health outcomes that were used were self-reported physical functioning, mental health and self-perceived health. Since both the exposure and outcome were based on self-reporting and the subjective interpretation of the participants, the measurement errors are most likely correlated. This might have contributed to high risk estimations, as illustrated by the OR between satisfaction with relationships and mental health (OR 4.65; 95% CI 4.20-5.15). As the measurement of satisfaction with relationships is more prone to subjectivity than the measurement of frequency of contact, these odds ratios are likely to be more affected by bias caused by correlated measurement error. With regard to the analysis about sources of network ties, we believe that the relative importance of neighbours maintains essential despite the possible bias caused by correlated measurement errors, as it is not expected that differences between the sources of social network ties account for differences in levels of bias.

To partially overcome the problem of correlated measurement errors, associations between social relationships and health have been analysed in a prospective study. In chapter 3, the self-reported health outcomes have been repeatedly measured at 5 years apart, which diminishes the bias of correlated measurement errors. Furthermore, outcomes with different levels of subjectivity were included, ranging from subjective outcomes (mental health and self-perceived health), to less subjective outcomes (lifestyle factors) and ultimately to objective outcomes (clinically measured factors). Finally, in chapter 4 the association between social support and mortality was investigated. By choosing mortality as a health outcome, no correlation of measurement errors could have occurred. Table 8.2 summarises the possibility and likeliness of correlated measurement error in the associations between social relationships and health.

Table 8.2: Possibility and likeliness of correlated measurement error in the associations between social relationships and health, chapters 2-4

Chapter	Study design	Social relationships	Health	Correlated measurement error?
2	cross-sectional	self-reported	self-reported	possible and very likely
3	prospective	self-reported	self-reported or measured	possible but not very likely
4	prospective	self-reported	registered	not possible

Reverse causation is another phenomenon that might have biased our results. Reverse causation is allowing the effect to occur before its cause, which practically means that health influences social relationships. An example of this is that poor physical health may reduce someone's ability to go out and therefore may weaken his/her social relationships (8). We aimed to overcome the possibility of reverse causation in chapters 3 and 4 by excluding the prevalent cases of poor health at baseline in the prospective analysis (chapter 3) and by excluding the first two years of follow-up of mortality (chapter 4). Results of both chapters underscored the predictive effect of social support at baseline, and ruled out major effects of reverse causation. Hence, since the prospective results from chapters 3 and 4 showed significant associations between social support and health, true influences of social relationships on health seem to be present, independent of the possible bias caused by correlated measurement error or by reverse causation.

#### External validity

The populations represented in the prospective Doetinchem Cohort Study and in the Elderly monitor differed in age (9, 10). The Doetinchem Cohort Study included an adult population aging from 20-59 years at baseline to 41-80 years in the fourth round of follow-up, whereas the Elderly monitor included only elderly people aged 65 years and over. Since the results in both populations are similar, we believe that the results we found in the elderly population are a confirmation of the associations we found in adults. This underlines the robustness of the associations we found that social relationships are beneficially influencing health.

Since the results in each of our study populations were reproduced in the other study population, we might expect the results might also be relevant to other Dutch populations outside the Gelre-IJssel region. The first round of the Doetinchem Cohort Study (1987-1991) was part of the Monitoring Project on Cardiovascular Disease Risk Factors, which also included the cities Maastricht and Amsterdam (11). When reanalysing the associations between social support and mortality, as described in chapter 4 for the complete population including the three cities, no differences were found in the results as compared the analysis for the Doetinchem population only. Furthermore, the towns where the participants are residing in, was not modifying or confounding the relationship between social support and mortality. These additional results underline the potential generalisation of our results to other Dutch cities or even European cities.

Nevertheless, we should be cautious to extrapolate our results blindly to large cities. Although our community health service database served a considerably large region in the Netherlands, we have a relatively rural study population and an under-representation of older people who do not originate from the Netherlands (12). Furthermore, the response rate of the Amsterdam cohort in 1987-1991 was only 45%, whereas the response in Doetinchem was 62%. Therefore, extrapolation of our results to the general population of large cities such as Amsterdam or Rotterdam might not be accepted. The presence or absence of co-factors such as different ethnic backgrounds might be reflected in variation of strength of the association in different populations (13). This could be particularly applicable to research on social relationships, since social relationships partly depend on the local social infrastructure of places. Therefore, research in local populations is necessary to provide a good insight in the specific local health situation, and eventually to support local health-policy.

### Analytical considerations

Cross-sectional and prospective analyses were used to assess the association between social relationships and health. In chapter 3, we included both types of analyses, using Generalised Estimating Equations (GEE) (figures 8.1a/b). Therefore, the results of this chapter are particularly very useful to compare the cross-sectional and prospective results in the same study population. In figure 8.1a the cross-sectional analytical design is presented. The advantage of using the GEE method rather than the average results of three separate cross-sectional logistic regression analyses, is that by using GEE we take the correlation between repeated measurements within persons over time into account. Figure 8.1b present the prospective analytical design. By excluding the prevalent cases at baseline, we were able to analyse the incidence of the health outcomes occurring in rounds 3 and 4. When looking at the cross-sectional results, we see associations of social support with six of the in total nine health outcomes. Of these six health outcomes, three of them (physical activity, self-perceived health and mental health) were still significantly influenced by social support in round 2 in the prospective analysis. We therefore concluded that social support predicts health over time.

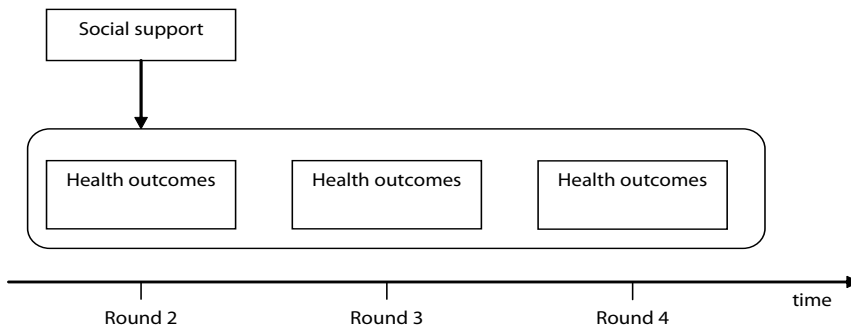


Figure 8.1a: Cross-sectional analysis. Social support measured in round 2 is associated with the prevalence of health outcomes in rounds 2, 3 and 4. All participants are included.

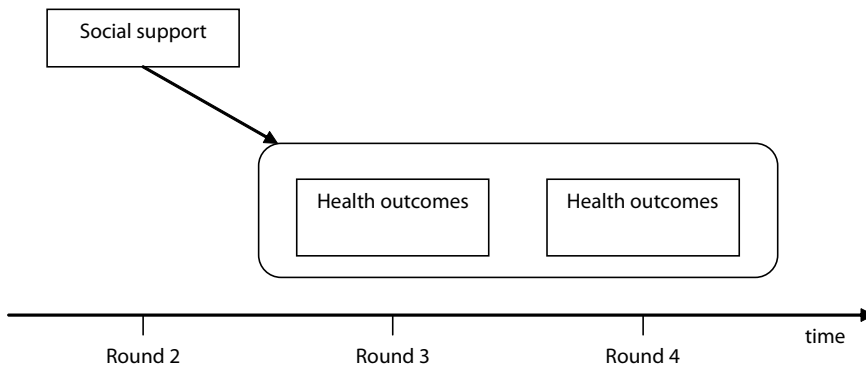


Figure 8.1b: Prospective analysis. Social support measured in round 2 is associated with the occurrence of health outcomes in rounds 3 and 4. Only participants are included who do not show the outcome of interest in round 2.

Social relationships as determinants of health are complex and interwoven with other factors, including socio-economic, cultural, and psychosocial factors. It is most important to acknowledge these interrelationships and address them. However, traditional epidemiological analyses only allow for simplified scenarios involving selected determinants and their associations with health. A more complex way of analysis is necessary to investigate determinant – health associations in a more holistic view. Structural equation modelling (SEM) is a promising analytical method for complex analyses, since it can be used for testing and estimating effects of observed (measured) and unobserved (latent) variables on health (measured or latent) (14). Because social support and loneliness are latent constructs, we used the SEM technique to analyse the associations between social support and loneliness (chapter 5). Another promising research approach is to combine traditional epidemiological methods with qualitative research, as described earlier in this chapter. The use of qualitative research methods allowed us to explore social relationships in more depth

and detail in the context of everyday life. Hence, investigating the associations between social relationships and health requires flexibility concerning data analysis, and may require the use of complementary approaches as described above.

## **Implications for local public health practice**

As the subtitle of this thesis suggests, the epidemiological research that was conducted for this thesis was used as evidence for the development of a local intervention programme. In chapter 7, we already illustrated how local research, when integrated and combined with additional qualitative research, jointly can contribute to the agenda setting and programme development of local policy making. It is important to consider that determinants of health are complex and interwoven with each other, as was already introduced by the model of Dahlgren and Whitehead in chapter 1 (15). In practice, this resulted in the development of a complex intervention programme concerning healthy ageing. A complex intervention is defined as an intervention consisting of several interacting components (16). Furthermore, for most of the intervention components, the entire elderly community will be exposed to the intervention activities and not only a high-risk population in order to be most effective (17). Based on our results, the local government will be supported to develop a policy document to embed the newly developed intervention activities in the regular activities of public health practitioners.

8

The epidemiological evidence on social relationships and healthy ageing that was provided by this thesis was used in the development of a logic model for a local intervention to reduce the prevalence of loneliness among older people (18). A logic model focuses on the causal chain between intervention activities and the expected outcomes. This model will be used to guide both the evaluation of the overall complex intervention as well as the evaluation of the individual intervention components. Different characteristics of social relationships were integrated in this logic model, such as network quality. To assess network quality, structural characteristics of social relationships and experienced social support were used as indicators. Currently, the complex intervention programme concerning healthy ageing is implemented in two municipalities. By the end of 2010, the first results are expected.

Intervention components that were developed included a mass medial campaign increase awareness of loneliness among older people. Furthermore, professionals and volunteers were trained to diagnose early symptoms of loneliness. One of the intervention components that were developed for older people, was 'Elderly Connected' (19). Elderly Connected is a community-based intervention, supporting the active older people to organise social activities for their less active older neighbours. These organised activities are facilitated by practical and financial support from the local community health service and elderly welfare organisations. The aim of this intervention is to improve and sustain social participation and engagement of older people. Another goal is to build an infrastructure that facilitates elderly people to be active in the community and creates greater awareness of health promoting resources for the older people within their municipality. Elderly Connected was partly based on a combination of the evidence that was provided by chapters 2 and 6; neighbours are an important source of social network ties, and engagement in social activities is a way to enhance healthy ageing in the community.

## Implications for scientific research

The main objective of this thesis was to investigate the associations between social relationships and health in older people. Thereby taking into account different structural characteristics and functions of social relationships, and the various domains of physical, mental and social health. Overall, the results of the analyses show that each of the positively formulated characteristic of social relationships shows a beneficial association with health. We would like to emphasize the specific role of neighbours as social network ties. Neighbours are a valuable source of everyday support, and could provide older people with social companionship, daily emotional support, and instrumental support in times of trouble. Most current research on social relationships only considers the role of family and friends, therefore, further research needs to incorporate the role of neighbours to confirm our findings. Furthermore, we would like to stress that although social support is intended to be helpful, it can give rise to negative exchanges. Therefore, more research that differentiates between the positive and negative experiences of social support should be conducted to gain more insight in their influences on health.

Although we used a prospective analytical approach in addition to a cross-sectional approach, we cannot provide evidence that improving the quality of social support leads to a more beneficial lifestyle and improves health status. This is because we have no information about changes in social support prior to our measurement. In our prospective analyses in chapter 3, we only had one measurement of social support. Therefore, we did not have the ability to investigate the effects of changes in social support on health. Longitudinal studies using repeated measurements of social relationships are necessary to give more insight in the influence of changes in social relationships on lifestyle and health.

When conducting such a longitudinal study, there are a number of issues that should be considered as discussed earlier in this chapter including correlated measurement error and reverse causation (20). Furthermore, the length of the period between repeated measurements should be considered. This period should not be too long to differentiate between real changes in social relationships and changes due to measurement error. On the other hand, it should not be too short to avoid memory bias since earlier reported values are partially reproduced from memory. Finally, a more objective measurement of social relationships should be developed. With regard to assessment of structural characteristics of social relationships, it is worthwhile to explore the possibilities of sophisticated techniques, such as mobile phones, social networks including Facebook, and videophone techniques including Skype (21).

## Conclusion

This thesis contributes to the growing evidence that well-functioning social relationships are favourably associated with health. We demonstrated this both in cross-sectional and in prospective studies. This thesis emphasizes on that both the structural characteristics of social relationships and their functioning are important to health in older people, independent of lifestyle characteristics. Special attention should be given to the role of neighbours, as they appeared to be

a valuable community resource for older people's health. By integrating all our results, our local data have strengthened the scientific evidence-base for local policy making and have contributed to the development of an evidence-based community intervention supporting social participation among older people.

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Summary

04

Given the growing number of older people in our society and the related consequences for health and well-being, health policies supporting healthy ageing are a central focus of concern at the national and European level. In the Netherlands, one of the current priority areas is the promotion of social support and participation of older people in mainstream society at the local level. However, to formulate policies to promote healthy ageing, the associations between social relationships and healthy ageing need to be understood. Although numerous researchers have already studied the associations between supportive social relationships and healthy ageing, there is as yet no consensus about which aspects of structure and function of social relationships are important.

In this thesis we investigated the associations between social relationships and health in older people. Different characteristics and functions of social relationships have been analysed to gain knowledge about which aspects of social relationships are important with respect to health. The results of this thesis provided scientific evidence for practice-based research, by supporting local policy making on healthy ageing and by providing evidence-based input for the development of a local complex intervention programme for healthy ageing.

In chapters 2, 3 and 4, the associations between social relationships and health in older people were investigated, using cross-sectional and longitudinal data including different aspect of social relationships and different health outcomes. In chapters 5 and 6 we explored possibilities for tailoring interventions to the local context. In Chapter 7, we integrated the results of chapters 2-4 and 6 and combined them with additional qualitative research to demonstrate how these results jointly can contribute to the agenda setting and programme development of local policy making.

First, we explored if structural and functional characteristics of social relationships were cross-sectionally associated with physical functioning, mental health and self-perceived health (chapter 2). Data of 22,149 independently-living people aged 65 and older were collected in 2005 via Dutch community health services. Contact frequency with family, friends, or neighbours, and being satisfied with these contacts were used to characterise social network ties. Both the frequency of contacts and contact satisfaction were beneficially related to health status. Neighbours were found to be an important source of the social network ties of older people in relation to physical (OR 1.87; 95% CI 1.68-2.07), mental (OR 1.53; 95% CI 1.39-1.69) and self-perceived health (OR 1.42; 95% CI 1.30-1.54).

In chapter 3, cross-sectional and prospective analyses were carried out to investigate the association between social support and a variety of intermediate and long-term health-related outcomes over a period of 10 years. Data were used from 4,724 Dutch men and women aged 26-65 years who participated in the second (1993-1997), third (1998-2002), and fourth (2003-2007) study round of the Doetinchem Cohort Study. Positive and negative experiences of social support were assessed using the Social Experiences Checklist in the second study round. Mental health was negatively affected by low positive experiences and high negative experiences of social support. The prospective odds ratio was 1.86 (95% CI 1.39-2.49) for positive experiences and 1.60 (95% CI 1.21-2.12) for negative experiences of support. Low positive experiences of social support further affected low fruit and vegetable intake. High negative experiences of social support

further affected smoking, high alcohol consumption, physical inactivity, overweight and poor self-perceived health.

Using the same social support measurement as in chapter 3, the effects of positive and negative experiences of social support on long-term mortality were investigated in chapter 4. Data were from 11,163 Dutch men and women aged 20-59 years who participated in the Doetinchem Cohort Study in 1987-1991. Social support was measured at baseline and after five years of follow-up. Mortality data were obtained from 1987 until 2008. Both low baseline levels and low repeated levels of positive experiences of support were predictive for increased mortality risk. The age and sex adjusted mortality risk was 1.57 (95% CI 1.03-2.39) in participants with repeated measurements of social support. Negative experiences of social support were not associated with mortality.

In chapter 5 we explored the associations between different dimensions of social support and loneliness to identify specific leads for health promotion activities. Data were from 2,405 non-institutionalised people aged 65 years and over. The constructs “everyday support”, “support in problem situations” and “esteem support” were assessed using the short version of the Social Support List-Interactions (SSL12-I). Social and emotional loneliness were assessed by 11 items of the De Jong-Gierveld loneliness scale. Using structural equation modelling, we found that everyday support captured the beneficial effects of the other social support constructs on social loneliness (standardised regression coefficient -0.75, 95% CI -0.84; -0.65) and emotional loneliness (standardised regression coefficient -0.71, 95% CI -0.80; -0.61).

To better target health promotion activities for healthy ageing, cluster analyses were performed in chapter 6 to group older people into subgroups with similar social engagement activity patterns. Cross-sectional data were used of 22,026 independently living elderly aged 65 or older, collected in 2005 by Dutch community health services. Five clusters were identified: 1) less socially engaged elderly; 2) less socially engaged caregivers; 3) socially engaged caregivers; 4) leisure-engaged elderly; and 5) productive-engaged elderly. Clusters 1 and 2, which included people who were not engaged in any social activity other than the care for a sick person, were identified as a possible target group. In this target group the prevalence of loneliness was 48%, compared to 30% in the socially engaged groups; poor self-perceived health: 41% compared to 14%; poor mental health: 25% compared to 9%; poor physical health: 27% compared to 2%.

Furthermore, to develop and implement programmes for complex public health problems tailored to the local setting, local authorities need support from practice and research. In Chapter 7, the results of chapters 2-4 and 6 are integrated and combined with additional qualitative research to demonstrate how these results jointly can contribute to the agenda setting and programme development of local policy making. We showed that local health surveys are a rich source of information and can be a powerful tool in public health practice. For a complete picture of the local health situation, a combination of quantitative health surveys and qualitative research is essential.

Finally, the main findings of this PhD research were summarised and methodological issues were

reflected in the general discussion (chapter 8). Also, implications for local public health practice and scientific research were considered. This thesis contributes to the growing evidence that well-functioning social relationships favourably influence health. We emphasise on that both the structural characteristics of social relationships and their functioning are important to health in older people. Future research on social relationships and healthy ageing should have a longitudinal design and should strive to repeatedly measure indicators of social relationships to increase their reliability. Special attention should be given to the role of neighbours, as they appeared to be a valuable community resource for older people's health. By integrating all our results, our local data have strengthened the scientific evidence-base for local policy making and have contributed to the development of an evidence-based community intervention programme supporting social participation among older people.

Summary  
in Dutch.

(Samenvatting)

Gezien het groeiende aantal ouderen in onze samenleving en de daaraan verbonden gevolgen voor gezondheid en het welzijn, is beleid ter ondersteuning van gezond ouder worden een centraal aandachtspunt op nationaal en Europees niveau. In Nederland is de bevordering van sociale steun en participatie van ouderen in de samenleving op lokaal niveau een van de prioriteiten. Echter, om gezondheidsbeleid voor ouderen te formuleren, is het belangrijk de associaties tussen sociale relaties en gezond ouder worden te begrijpen. Hoewel veel onderzoekers de samenhang tussen sociale relaties en gezond ouder al hebben onderzocht, is er nog geen overeenstemming over welke structurele en/of functionele aspecten van sociale relaties belangrijk zijn.

In dit proefschrift hebben we het verband tussen sociale relaties en gezondheid van ouderen onderzocht. Verschillende structurele en functionele kenmerken van sociale relaties zijn onderzocht om inzicht te krijgen in welke aspecten van sociale relaties belangrijk zijn met betrekking tot gezondheid. De resultaten van dit proefschrift hebben als wetenschappelijk bewijs gediend voor praktijkgericht onderzoek; door het ondersteunen van lokale beleidsvorming gericht op gezond ouder worden en door input te verstrekken voor de ontwikkeling van een lokaal complex interventie programma voor gezond ouder worden.

In de hoofdstukken 2, 3 en 4, hebben we de samenhang tussen sociale relaties en gezondheid bij ouderen onderzocht met behulp van cross-sectionele en longitudinale gegevens over de verschillende aspecten van sociale relaties en de verschillende gezondheidsuitkomsten. In de hoofdstukken 5 en 6 hebben we aanknopingspunten onderzocht voor gerichte interventies in de lokale context. In hoofdstuk 7 hebben we de resultaten van de hoofdstukken 2-4 en 6 geïntegreerd en gecombineerd met aanvullend kwalitatief onderzoek om aan te tonen hoe deze resultaten gezamenlijk kunnen bijdragen aan de agenda- en programma-ontwikkeling voor lokale beleidsvorming.

Als eerste hebben we cross-sectioneel onderzocht of structurele en functionele kenmerken van sociale relaties samenhangen met fysiek functioneren, mentale gezondheid en subjectief ervaren gezondheid (hoofdstuk 2). Gegevens van 22.149 zelfstandig-wonende ouderen van 65 jaar en ouder werden in 2005 via GGD'en verzameld. Frequentie van contact met familie, vrienden of buren, en tevredenheid met deze contacten werden gebruikt om het sociale netwerk te karakteriseren. Zowel de frequentie van de contacten en de tevredenheid met het contact hingen samen met de gezondheidstoestand. Buren bleken een belangrijke bron van het sociale netwerk van ouderen in relatie tot fysieke gezondheid (OR 1,87, 95% CI 1,68-2,07), mentale gezondheid (OR 1,53, 95% CI 1,39 tot 1,69) en subjectief ervaren gezondheid (OR 1,42, 95% CI 1,30-1,54).

In hoofdstuk 3 zijn cross-sectionele en prospectieve analyses uitgevoerd om de samenhang tussen sociale steun en een verscheidenheid van middellange en lange termijn gezondheidsgerelateerde uitkomsten te onderzoeken over een periode van 10 jaar. Er werden gegevens gebruikt van 4.724 Nederlandse mannen en vrouwen in de leeftijd 26-65 jaar die hebben deelgenomen aan de tweede (1993-1997), derde (1998-2002), en de vierde (2003-2007) studie ronde van de Doetinchem Cohort Studie. Positieve en negatieve ervaringen van sociale steun werden gemeten met behulp van de "Social Experiences Checklist" in de tweede studie ronde. Mentale gezondheid werd negatief beïnvloed door weinig positieve ervaringen en veel negatieve ervaringen van sociale steun. De prospectieve odds ratio was 1,86 (95% CI 1,39-2,49) voor positieve ervaringen en 1,60

(95% CI 1,21-2,12) voor negatieve ervaringen van sociale steun. Weinig positieve ervaringen van sociale steun hadden ook een nadelige invloed op consumptie van fruit en groente. Veel negatieve ervaringen van sociale steun hadden verder een nadelige invloed op roken, alcoholconsumptie, lichamelijke activiteit, overgewicht en zelf-ervaren gezondheid.

Met dezelfde sociale steun meting als in hoofdstuk 3, werden de effecten van positieve en negatieve ervaringen van sociale steun op sterfte op lange termijn onderzocht in hoofdstuk 4. Gegevens waren afkomstig van 11.163 Nederlandse mannen en vrouwen in de leeftijd van 20-59 jaar die hebben deelgenomen in de Doetinchem Cohort Studie in 1987-1991. Sociale steun werd gemeten op baseline en na vijf jaar follow-up. Sterfte gegevens werden verkregen van 1987 tot 2008. Zowel de lage baseline niveaus en lage niveaus van herhaalde positieve ervaringen van sociale steun waren voorspellend voor een toename in sterfte risico. Het leeftijd en geslacht gecorrigeerde sterfterisico was 1,57 (95% CI 1,03-2,39) in deelnemers met herhaalde metingen van sociale steun. Negatieve ervaringen van sociale ondersteuning waren niet gerelateerd aan sterfte.

In hoofdstuk 5 onderzochten we de samenhang tussen verschillende dimensies van sociale steun en eenzaamheid om specifieke aanknopingspunten te identificeren voor gezondheidsbevorderende activiteiten. Gegevens waren afkomstig van 2.405 zelfstandig wonende ouderen van 65 jaar en ouder. De constructen “alledaagse steun”, “steun in probleem situaties” en “steun voor vertrouwen” waren gemeten met behulp van de korte versie van de “Social Support List-Interaction” (SSL12-I). Sociale en emotionele eenzaamheid werden beoordeeld door 11 items van de De Jong-Gierveld eenzaamheidsschaal. Met behulp van de analysemethode “structural equation modelling”, vonden we dat de gunstige effecten van sociale steun vooral via “alledaagse steun” liepen (sociale eenzaamheid: gestandaardiseerde regressiecoëfficiënt -0,75, 95% CI -0,84; -0,65, en emotionele eenzaamheid: gestandaardiseerde regressiecoëfficiënt -0,71, 95% CI -0,80; -0,61).

Om gezondheidsbevorderende activiteiten voor ouderen beter aan te laten sluiten bij de doelgroep, zijn in hoofdstuk 6 cluster analyses uitgevoerd. Hiervoor werden ouderen met vergelijkbare activiteiten patronen ten aanzien van sociale participatie in subgroepen verdeeld. De gebruikte gegevens van 22.026 zelfstandig wonende ouderen van 65 jaar en ouder, waren in 2005 verzameld door GGD'en. Vijf clusters werden geïdentificeerd: 1) minder actieve ouderen, 2) minder actieve mantelzorgers; 3) actieve mantelzorgers, 4) vrijetijds-actieve ouderen; en 5) productief-actieve ouderen. Clusters 1 en 2, waarin ouderen zitten die niet sociaal participatief zijn behalve als mantelzorgers, werden geïdentificeerd als een mogelijke doelgroep. In deze doelgroep was de prevalentie van eenzaamheid 48%, tegenover 30% in de actieve groepen; slechte zelf-ervaren gezondheid: 41% tegenover 14%; slechte mentale gezondheid: 25% tegenover 9%; slechte lichamelijke gezondheid: 27% ten opzichte van 2%.

Voor het ontwikkelen en implementeren van lokale interventie programma's voor complexe problemen voor de volksgezondheid, hebben de lokale overheden steun nodig uit de praktijk en wetenschap. In hoofdstuk 7 zijn de resultaten van de hoofdstukken 2-4 en 6 geïntegreerd en gecombineerd met een aanvullend kwalitatief onderzoek om aan te tonen hoe deze resultaten gezamenlijk kunnen bijdragen aan de agendering en de ontwikkeling van de lokale beleidsvorming. We toonden aan dat lokale gezondheidmonitors een rijke bron van informatie zijn en een

krachtig instrument kunnen zijn in de volksgezondheidspraktijk. Echter, voor een compleet beeld van de lokale gezondheidssituatie is een combinatie van kwantitatieve gezondheidsmonitors en kwalitatief onderzoek van essentieel belang.

Ten slotte zijn de belangrijkste bevindingen van dit promotieonderzoek samengevat en de methodologische kwesties behandeld in de algemene discussie (hoofdstuk 8). Ook zijn de gevolgen voor de lokale volksgezondheidspraktijk en de wetenschap besproken. Dit proefschrift draagt bij aan het groeiende bewijs dat goed functionerende sociale relaties de gezondheid gunstig beïnvloeden. We benadrukken dat zowel de structurele kenmerken van sociale relaties en hun functie belangrijk zijn voor de gezondheid van ouderen. Speciale aandacht moet worden geschonken aan de rol van de burens, omdat zij een waardevolle bron bleken voor de gezondheid van oudere mensen. Door al onze resultaten te integreren, hebben onze lokale gegevens als wetenschappelijke basis gediend voor de lokale beleidsvorming en hebben ze bijgedragen aan de ontwikkeling van een lokaal interventie programma om maatschappelijke participatie van ouderen te bevorderen.





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Sim☺ne





*About Agora*

## **The Academic Collaborative Centre AGORA and the Healthy Ageing Programme**

This PhD project is part of the healthy ageing programme of the Academic Collaborative Centre AGORA. AGORA, which is Greek for marketplace, is a collaboration infrastructure that was set up in 2006 by Wageningen University and the community health service Gelre-IJssel. AGORA aims to contribute to the development of effective evidence-based problem-oriented interventions by synthesising knowledge and bridging the gaps between practice, science and policy.

A total of four strongly interrelated PhD projects constitute AGORA's healthy ageing programme. This PhD thesis covers the research of project 1. The initial objective of project 1 is to describe physical, mental and social health and its determinants in older people using existing epidemiological data. Knowledge gained in this way was used in the development of an intervention programme and in optimising a monitoring system for healthy ageing.

The objective of projects 2a and 2b is to develop, implement and evaluate an evidence-based intervention programme for healthy ageing. Following an inventory of ongoing and completed interventions in elderly people, the intervention programme will address the behavioural, social, contextual and organisational determinants and the health and well-being of the elderly. The intervention as such includes a baseline assessment, implementation of the intervention, an effect evaluation and process evaluation, all to be conducted at the community health service.

Project 3 focuses on the development of a knowledge management system meant to support and facilitate intersectoral collaboration for healthy ageing in the Gelre-IJssel region. Following an inventory of relevant organisations, stakeholders and public health policymakers, guidelines for effective intersectoral collaboration and community action for healthy ageing will be developed and evaluated. Results will also be applicable to health promotion in other areas.

Although formulated separately, the projects within the research programme of the Academic Collaborative Centre are closely intertwined. The information gained in the early stages of project 1 and 3 is used to set priorities and guide implementation in project 2. At the same time, practical experiences during baseline measurements and implementation of the interventions will be fed back to core-projects 1 and 3 in order to contribute to the optimisation of the monitoring system and the knowledge management system (figure 1). Furthermore, despite the epidemiological character of project 1 and the more policy-oriented character of project 3, both projects make extensive use of each others expertise, e.g. social determinants of health are included in project 1, and epidemiological data are used to discuss healthy ageing issues with potential stakeholders.

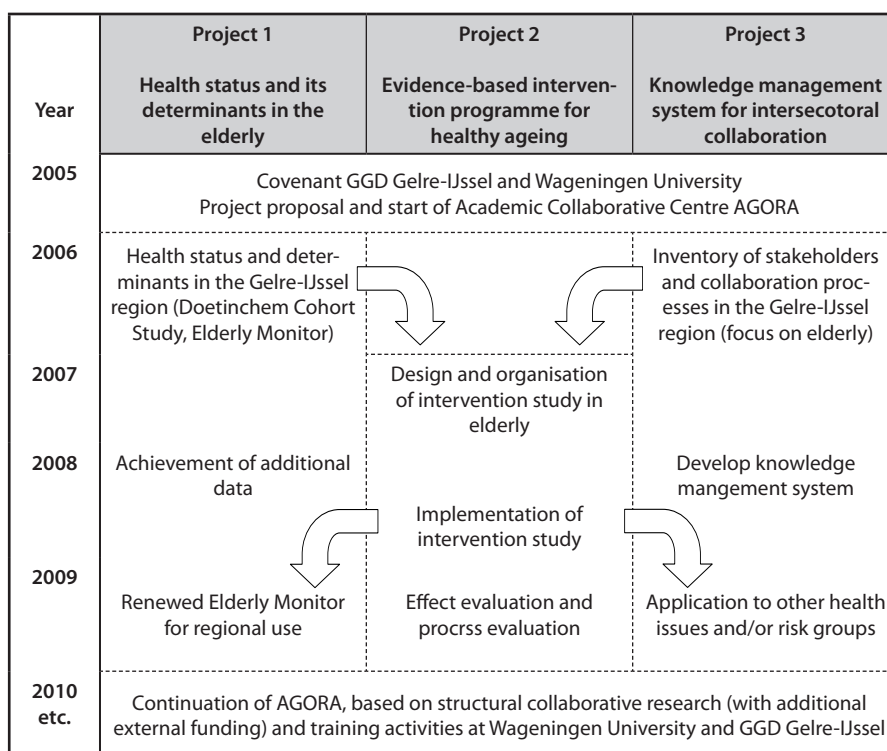


Figure 1. Schematic representation of the work programme of the Academic Collaborative Centre AGORA into three coherent core-projects.





*About the author.*



| About the author

## Curriculum vitae

Simone Croezen was born on March 22nd, 1980 in Hardenberg, the Netherlands. After completing secondary school at 'Vechtdal College' in Hardenberg, she started the Bachelor's programme in Biological and Medical Laboratory Research at 'Hogeschool Drenthe' in Emmen. As part of that study, she performed an internship on the anti-bacterial properties of plants for the use against diarrhoeal diseases at PE Technikon in Port-Elizabeth, South Africa and was involved in a research project on the use of antibodies for treatment of Anthrax infections at IQ Cooperation, Groningen. She obtained her Bachelor's degree in 2002 and enrolled in the Master programme Nutrition and Health at Wageningen University. She performed a Master's thesis entitled 'Skipping breakfast, alcohol consumption and physical inactivity as risk factors for overweight and obesity in adolescents: results of the E-MOVO project' and obtained her Master's degree with a major in Epidemiology and Public Health in September 2005. Her Master's thesis was nominated for the MSc thesis award by the Netherlands Epidemiology Society. Immediately after her graduation, she was appointed as a junior research scientist at the Division of Human Nutrition, Wageningen University where she contributed to the expert report: 'Food, Nutrition, Physical Activity and the Prevention of Cancer: a Global Perspective' of the World Cancer Research Fund. In May 2006, she was appointed as a PhD fellow at the Academic Collaborative Centre AGORA, a collaboration between the Wageningen University and the community health service (GGD) Gelre-IJssel. Her research focussed on social relationships and healthy ageing. During her PhD project, Simone joined the educational programme of the graduate school VLAG, she attended several (international) conferences and courses, and was involved in teaching at the BSc and MSc level. Additionally, she was a member of the organising committee of the PhD study tour to the United States in 2007. In 2009, she visited the Department of Epidemiology and Public Health, UCL, London, UK for 2 months. In 2010, she contributed to the book 'Epidemiology in Public Health Practice'. Currently, Simone is working as a research associate at the Department of Epidemiology and Public Health, UCL, London, UK.

## **Publications in peer-reviewed journals**

Croezen S, Haveman-Nies A, Picavet HSJ, Smid EA, de Groot CPGM, van 't Veer P, Verschuren WMM. Positive and negative experiences of social support and long-term mortality among middle-aged Dutch people. *Am J Epidemiol* (2010) 172(2): 173-79.

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### **Book contributions**

Croezen S, van 't Veer P, Dullemeijer C. Conduct a needs assessment. In: *Epidemiology in Public Health Practice*, Haveman-Nies A, Jansen SC, van Oers JAM, van 't Veer P (eds). (in press).

Contributor for the expert report 'Food, Nutrition, Physical Activity and the Prevention of Cancer: a Global Perspective' of the World Cancer Research Fund (2007).

## Overview of completed training activities

Description	Organiser & location	Year
<b>Discipline specific activities</b>		
<i>Courses</i>		
Analysis of Population health	NIHES, Rotterdam (NL)	2006
Analysis of Determinants	NIHES, Rotterdam (NL)	2006
Multilevel analysis	VUMC, Amsterdam (NL)	2007
Nutritional & Lifestyle Epidemiology	Graduate School VLAG, Wageningen (NL)	2007
Social Epidemiology	Escuela de Verano de Salud Pública, Menorca (Spain)	2008
<i>Conferences and meetings</i>		
Symposium Nutrition and Ageing	WUR, NZO, Wageningen (NL)	2006
Symposium Regionale VTV	Tranzo, Tilburg (NL)	2006
Nationaal Gerontologie Congres	Nederlandse Vereniging voor Gerontologie, Ede (NL)	2006, 2008
Nederlands congres Volksgezondheid	Rotterdam (NL)	2008, 2010
SSM/IEA conference	SSM/IEA, Cork (Ireland)	2007
AGORA symposium	AGORA, Zutphen (NL)	2006-2010
WEON	VvE, Maastricht, Amsterdam (NL)	2007, 2009
Wageningen Nutritional Sciences Forum	Division of Human Nutrition, WUR, Arnhem (NL)	2009
<b>General courses and workshops</b>		
PhD Competence Assessment	Wageningen Graduate Schools (WGS), Wageningen (NL)	2006
Talent day "Networking" and "Creative thinking"	NWO, Utrecht (NL)	2006
SAS opfriscursus	RIVM, Bilthoven (NL)	2006
PhD Introduction week	Graduate School VLAG, Ermelo (NL)	2006
Communication in Interdisciplinary Research	Wageningen Graduate Schools (WGS), Wageningen (NL)	2007
Effective behaviour in your professional surroundings	Wageningen Graduate Schools (WGS), Wageningen (NL)	2008
Personal Efficacy	Meijer & Meijaard, Wageningen (NL)	2008
Scientific Writing	Language Centre, WUR, Wageningen (NL)	2009
Master class "Starting with the client: New approaches to effective health promotion"	Graduate School VLAG, Wageningen (NL)	2009

Optional courses and activities		
Preparation research proposals	WUR, Wageningen (NL)	2006-2009
Organising and participating in PhD study tour USA	Division of Human Nutrition, WUR	2007
Participating in PhD study tour Nordic countries	Division of Human Nutrition, WUR	2009
Literature group "Oldsmobiles"	Division of Human Nutrition, WUR	2006-2010
Research, epidemiology and methodology meetings	Division of Human Nutrition, WUR	2006-2010
Research meetings AGORA	AGORA, Wageningen, Apeldoorn (NL)	2006-2009
2-month visit to Department of Epidemiology and Public Health, UCL, London (UK)		2009

## Colophon

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Picture taken by participant of thesis research: "Older people and their social network in pictures and words"

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