

# **Health-promoting intervention for community-dwelling older adults**

**Focusing on the concept of frailty and intervention outcome**

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Health-promoting intervention for community-dwelling older adults - Focusing on the concept of frailty and intervention outcome

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## ABSTRACT

**Aim:** The overall aim of this thesis was to increase our understanding of the concept of frailty in relation to older adults, and to review and evaluate outcomes in health-promoting interventions for community-dwelling older adults.

**Methods:** In study I, definitions of frailty applied in, the content and organisation in, and the effects of, health-promoting interventions for community-dwelling frail older persons were systematically reviewed using the International Classification of Functioning Disability and Health (ICF) as a structural framework. In study II, healthcare professionals' views of frailty in older persons were elucidated by means of focus group discussions. In studies III and IV, the outcome for frailty, self-rated health (SRH), independence and perceived security in activities of daily living (ADL) in the randomized controlled trial *Elderly Persons in the Risk Zone* was evaluated using quantitative analyses. The study addressed, and was tailored for, community-dwelling older adults (80+) at risk of becoming frail, and consisted of two interventions: a preventive home visit and four multiprofessional senior group meetings with one follow-up home visit, plus a control group.

**Results:** Diverse definitions of frailty were used in studies of health-promoting interventions for community-dwelling frail older persons; they contained a broad spectrum of interventions and were partially effective. Healthcare professionals viewed frailty in older persons as a complex concept founded on seven dimensions: "being bodily weak and ill", "being negatively influenced by personal qualities", "lacking balance in everyday activities", "being dependent in everyday life", "not being considered important", "being hindered by the physical milieu and defective community service", and "having an inadequate social network". Both interventions in *Elderly Persons in the Risk Zone* delayed deterioration of SRH in the short term and reduced the extent of dependence in ADL for a period of up to one year. The senior meetings were found to be the most beneficial intervention since they both postponed dependence in ADL during the period up to the one-year follow-up and reduced the extent of dependence in ADL for a period of up to two years. No effect on frailty or perceived security in ADL could be demonstrated.

**Conclusion:** The definition of frailty varies according to the different paradigms of the users. This underlines the importance of having clear definitions of frailty in all contexts, especially in research and in health promotion. Health-promoting interventions, made when older adults are at risk of becoming frail, can delay deterioration of SRH in the short term and dependence in ADL both in the short and the long term. Also, senior meetings seem to have a greater impact on delaying deterioration and reducing the extent of dependence in ADL than a single preventive home visit. This demonstrates the potential in *Elderly Persons in the Risk Zone* and the importance of further evaluation of outcome in, and development of, this promising health-promoting intervention.

**Keywords:** Aged 80 and over, frail elderly, health promotion, self-rated health, activities of daily living (ADL), review, International Classification of Functioning Disability and Health (ICF), focus groups, randomized controlled trial

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## LIST OF PAPERS

This thesis is based on the following papers, which will be referred to in the text by their Roman numerals:

I. Gustafsson S, Edberg A-K, Johansson B, Dahlin-Ivanoff S.

**Multi-component health promotion and disease prevention for community-dwelling frail elderly persons: a systematic review.**

Eur J Aging 2009; 6:315-29.

II. Gustafsson S, Edberg A-K, Dahlin-Ivanoff S.

**Swedish Health Care Professionals' View of Frailty in Older Persons.**

J Applied Gerontol 2011; Feb 7 [epub ahead print].

III. Gustafsson S, Wilhelmson K, Eklund K, Gosman-Hedström G, Zidén L, Häggblom Kronlöf G, Højgaard B, Slinde F, Rothenberg E, Landahl S, Dahlin-Ivanoff S.

**Health-Promoting Interventions for Persons Aged 80 Years and Older are Successful in the Short Term – Results from the Randomized and Three-Armed *Elderly Persons in the Risk Zone Study*.**

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IV. Gustafsson S, Eklund K, Wilhelmson K, Edberg A-K, Johansson B, Häggblom Kronlöf G, Gosman-Hedström G, Dahlin-Ivanoff S.

**Long Term Outcome for Independence and Perceived Security in ADL following Interventions in the Health-Promoting, Randomized, and Three-Armed Study *Elderly Persons in the Risk Zone*.**

Manuscript 2012.

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## ABBREVIATIONS

ADL	Activities of Daily Living
CI	Confidence Interval
HPP	Health Promotion Program
HPDP	Health-Promoting and Disease Preventive
IADL	Instrumental Activities of Daily Living
ICF	International Classification of Functioning, Disability and Health
MCD	Median Change of Deterioration
OR	Odds Ratio
OT	Occupational Therapist
PT	Physical Therapist
P	Physician
PADL	Personal Activities of Daily Living
RCT	Randomized Controlled Trial
RN	Registered Nurse
SRH	Self-Rated Health
SW	Social Worker
WHO	World Health Organization

## **INTRODUCTION**

This thesis consists of a review of selected literature (Study I), an article that elucidates a concept (Study II), and two articles originating in a health-promoting intervention study (Studies III and IV). All four papers may be viewed as small pieces contributing to a huge gerontology research jigsaw puzzle that, among other intentions, aims to identify effective health-promoting interventions for community-dwelling older adults. Before the papers are thoroughly presented and discussed, a short opening statement will be made, a brief overview of a selection of major fundamental ideas in this thesis will be given, and the underlying rationale will be described.

### **Opening statement**

The proportion of persons aged 80 years or older in the population in the Western world, including Sweden, is growing rapidly [1]. Many of these older adults are in good shape, are still living in the community, and lead active and satisfying lives. Nevertheless, older persons commonly experience downward changes such as decline in functioning and wellbeing [2-4]. A growing body of knowledge suggests that age-related decline can be delayed [5-7].

Interventions, with the means and capacity to effectively slow down the decline in health and wellbeing of older adults are vital both for the individual and society at large [8].

Consequently, there is a need to develop and evaluate such interventions, particularly with respect to frail older adults who are suffering from co-morbidity and are at risk of, or already, losing their ability to manage everyday activities [9-11]. This thesis therefore focuses on a central concept, the concept of frailty, and the outcome of health-promoting intervention for older adults. In order to facilitate an understanding of, and to explore, these phenomena, multiple perspectives, for instance, on aging, health, and occupation, as well as on health promotion, are required and will be applied and presented in the following sections.

### **Aging and its consequences**

#### ***Old age and longevity***

Aging is a natural part of life, but researchers debate at what point in time aging starts in the course of life and when a person should be considered “old”. A person 65-years or older is regularly referred to as an older adult due to the standard retirement age in many Western countries [12]. However, this thesis mainly concerns persons 80 years or older, an age group which is often classified as “the oldest old”. But, a classification according to a person’s

chronological age does not throw much light on aging, which is a dynamic, complex, and progressive process involving biological, psychological and social aspects [13]. Not only will it vary according to a person's individual context and culture, subjective experiences are of relevance to the perception of age [13-15]. Aging can also be explained by different life course levels, "ages". The third age is when a person retires from productive work, has no or little functional decline, and is able to choose what he/she wants to do [16]. The fourth age is characterized by the onset of decline in functioning and the occurrence of illness, which often result in dependence in everyday life and lowered quality of life. It is a period in life when an older person spends most of the time in his/her own home. The transition to, and the introduction of, the fourth age is the chief concern of this thesis.

The population of older people all over the world is growing rapidly and future projections predict a continuing extension in life expectancy [17]. In 2007, in Sweden, persons 80 years and older constituted 5% of the population, a proportion which is expected to increase to 8% by 2040 [1]. The aging of populations has generated theories concerning the consequences of increased longevity. One theory is that more years would be spent in poor health and with disabilities as people will live longer with chronic medical conditions and with an increasing burden of age-related diseases [18]. Another, more optimistic theory: "the compression of morbidity", predicts that increased longevity is linked to fewer medical conditions and less disability due to improvements in preventive approaches and interventions [19]. Finally, a third theory: "the dynamic equilibrium", relates increased longevity to a decreased prevalence of severe disabilities and medical conditions, yet an increase in minor disabilities and medical conditions [20]. In sum, aging is strongly associated with an increased risk of health problems and disability [2-4], indicating a need to identify signs of the aging process, which possibly constitute a downward trajectory from health to illness and disability in older people.

### ***The concept of frailty***

Amongst other suggestions, i.e. biomarkers [21] and fatigue [22], the concept of frailty has been proposed as a means of identifying signs of the aging process. The definition, delimitation, and identification of frailty in older individuals provide a tool for planning and implementing professional interventions with the goal to slow down adverse health effects of aging. Frailty becomes more prevalent with age and is associated with a higher risk of negative health outcomes, including falls, hospitalization, institutionalization, and mortality [23, 24]. Frailty has become an established concept in research in recent years [9, 23-25].



Nevertheless, there is no consensus definition, and the essence of the concept varies in the published literature [9, 23, 26].

A frequently used definition of frailty is: a state of decreased reserve resistance to stressors as a result of cumulative decline across multiple physiological systems, causing vulnerability to different outcomes [27]. This definition indicates that frailty is a complex geriatric syndrome with several interacting factors related to disability and co-morbidity, factors at times included in the concept itself [25, 28]. Also, frailty can be seen as a varying condition on a continuum from healthy through very frail [29, 30]. An American study [23] showed that 7% of the population 65 years and older could be defined as frail, while a Danish study [31] of 90 year-olds showed that 27% could be defined as very frail. A study published in 2008 [32] states that geriatric frailty is found in 20-30% of the population over 75 years. The prevalence figures vary in relation to increased age but might also differ in regard to the definition of key concepts.

### ***How to operationalize frailty***

One way to operationalize frailty is through a sum of a number of frailty criteria, an approach also used in the study *Elderly Persons in the Risk Zone*, the health-promoting intervention evaluated in studies III and IV. Fried and co-writers [23] recommend the presence of three or more of the following criteria: muscle weakness, poor endurance and energy, slow gait speed, unintentional weight loss, and low physical activity, in clinical practice to identify and measure frailty. This operational definition of frailty is unidimensional, included criteria are physical aspects of bodily functions, and in some of the reference literature it is denoted “physical frailty” [9, 23, 33]. Others incorporate factors from different areas into frailty, such as activity limitation [34], social relations, and environmental aspects [24, 30], implying that the concept is multidimensional.

Goebbens and co-writers [35] find that there are two possible ways of reasoning according to the definition of frailty. One way is to assume that the concept of frailty is an umbrella term containing different definitions. The other way is to strive for consensus and a mutual definition of frailty valid for all professionals and research orientations. Irrespective of different conceptual perceptions, researchers stress the need for further development of our understanding of frailty [24, 36], an appeal heeded in study II where one previously less explored aspect of frailty is highlighted - the views of healthcare professionals.

## **Relations between health, aging, and occupation**

### ***Health and aging***

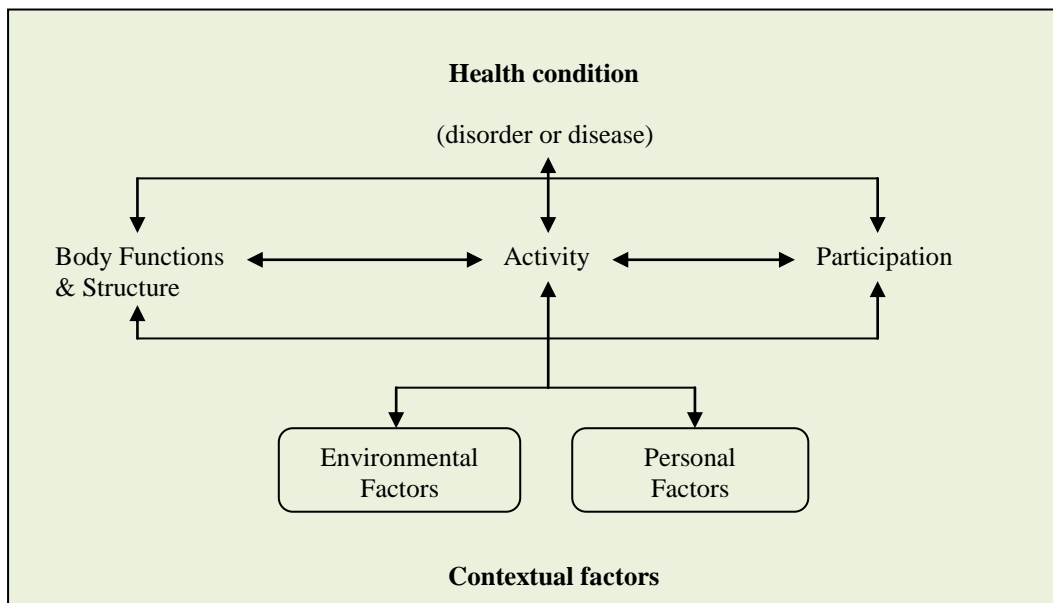
The World Health Organization (WHO) defines health as: A state of complete physical, social, and mental wellbeing, and not merely the absence of disease or infirmity [37]. Hence, definitions of health have developed since WHO's original statement in 1946 and are now increasingly directed towards the quality of life and an individual perspective on health. Within the context of health promotion, and in this thesis, health is considered less as an abstract state and more as a means to an end, which can be expressed in functional terms as a resource which permits people to lead an individually, socially and economically productive life [38]. Health is a positive concept emphasizing social and personal resources as well as physical capabilities. In regarding the concept of health as a fundamental human right, prerequisites for health include peace, adequate economic resources, food and shelter, and a stable eco-system and sustainable resource use. These fundamental human rights highlight the links between social and economic conditions, the physical environment, individual lifestyles and health, providing a holistic view of the concept of health. In addition, the spiritual dimension of health is increasingly recognized [39].

A healthy aging, focusing on positive aspects of aging, is an idea that has evolved in the last decades. One interpretation of the idea, "successful aging", is: "A state wherein an individual is able to invoke adaptive psychological and social mechanisms to compensate for physiological limitations to achieve a sense of wellbeing, high self-assessed quality of life, and a sense of personal fulfillment even in the context of illness and disability" [40] (page 88-89). This definition is in line with centenarian research showing that it is difficult, if not impossible, to achieve advanced age and remain free of co-morbidity and disability [41]. Moreover, older people consider themselves to have aged successfully despite chronic disease and/or disability [14, 42]. Summarized, this definition postulates that an individual with a chronic disease or functional limitations can age healthily through compensating for resources in other domains, a claim adding to the foundation of health promotion.

### ***Structure for describing health***

The International Classification of Functioning, Disability and Health (ICF) [43] is a biopsychosocial model and a classification system used as a structure and standardized language for describing health and health-related conditions (Figure 1). The domains in ICF describe different aspects of health and are classified into two parts, each with two components. The first part covers "functioning and disability", with the components "body

functions and structures” and “activities and participation”. Since an individual’s functioning and disability occur in a context, ICF also includes a second part, “contextual factors”, comprising the components “environmental factors” and “personal factors”. The overall aim of ICF is to provide a unified and standard language and framework for the description of health and health-related states in order to enhance communication between different users, such as healthcare workers, researchers, policy-makers and the public, including people with disabilities [43]. In this thesis, ICF is used as a general terminology and also as a framework for analysis (Study I).



**Figure 1.** Interaction between components of the International Classification of Functioning, Disability and Health (ICF). From the International Classification of Functioning, Disability and Health (p. 18), by the World Health Organization, 2001, Geneva, Switzerland.

### ***Self-rated health***

In study III, subjected or self-rated health (SRH) was used as an outcome. SRH is a significant factor in, and widely accepted as a reliable measurement of, the broader concept of general health [44]. SRH has been defined as evaluating the state of health in people, incorporating information on the biological, mental, functional, and spiritual dimensions of an individual’s health [45]. A self-rated judgment of one’s health, including satisfaction, reflects the operation of an individual’s different value and motivation systems [46]. In doing so, SRH captures multiple subjective aspects that are difficult to obtain via other objective methods of evaluating health [44]. Even so, subjective and objective measurements of health are naturally complementary, and both are necessary if an overall picture of an older adult’s state of health is to be obtained. SRH has proven to be a central outcome in prevention research, since it has

been shown to be an independent predictor of mortality and morbidity in an aging population [47, 48]. In addition, low SHR has also been found to be related to deteriorated physical functioning [4] and disability [49]. There are diverse methods and assessments for measuring SRH; one measure that is frequently used is the single question: “In general, would you say your health is: Excellent, very good, good, fair or poor” [44, 45, 50], a question also utilized in study III.

### ***Health and occupation***

The connection between health and occupation is highlighted in ICF by including activities (execution of a task or action by an individual) and participation (involvement in life situations) as aspects of health. In occupational therapy, engagement in occupation is found to contribute to people’s health [51] and participation in life [52]. Thus, occupational therapy strives to promote health and wellbeing through engagement in occupation [51-53].

Occupation is everything people do to occupy themselves, including looking after themselves (self-care), enjoying life (leisure), and contributing to the social and economic fabric of their communities (productivity) [51]. In addition, definitions of the concept of occupation frequently contain terms and underline the importance of goal-direction and individual meaning to the performance of activities and their relevance to a person’s desired life roles [54, 55].

Occupations are multidimensional and complex, involving both subjective (emotional and psychological) and objective (physically observable) aspects of performance [52]. Performance, the doing part of occupation, is a result of a dynamic intersection of the person, the context/environment and the person’s occupation [51]. Activities are the outcome of a set of tasks, consisting in turn of a series of actions [56]. Older adults who are more engaged in meaningful activities are healthier [57], and the level of occupational engagement is related to life satisfaction [58]. Therefore, the primary goal of occupational therapy is to enable people to participate successfully in the activities of everyday life [53]. With their focus on a person’s engagement in meaningful and goal-directed occupations in order to promote health and wellbeing, occupational therapists have an obvious role to play. They can contribute not only to the understanding of health in the older population but also to health-promoting interventions targeting this population in collaboration with other disciplines also providing preventive care [59].

The basic assumptions of occupational therapy are consistent with the concept of “active aging” [60], which is the process of optimizing opportunities for health, participation and

security in order to enhance quality of life as people age. “Active” refers to continuing participation in social, economic, cultural, spiritual, and community affairs, not just the ability to be physically active or to participate in the labour force. Older adults who have retired from work, are ill or have disabilities can remain active contributors to their families, peers, and communities. Hence, the relationship between health and occupation adds to the foundation of interventions targeting community-dwelling older adults and also needs to be further developed and evaluated in order to realize an active aging. This justifies the choice of ADL as a targeted outcome in this thesis (Studies III and IV).

## **Everyday life of older persons**

### ***Aging in place***

Studies have shown that virtually all older adults want to stay in their homes for as long as possible [61]. One’s home is a central and meaningful place to older adults, it is a place for activities, a place where everything happens on their own terms, and a place to feel secure [62]. Also, independence in daily activities is strongly linked to the home and independence is highly valued. When an older adult’s home is comfortable, familiar, and safe, it enables the person to rest and recover power and energy to move and to be active. Accordingly, “aging in place” - to be able to live in the home for as long as possible, is essential to life satisfaction for older adults [63]. In addition, society might benefit economically if older adults can remain living in their own home [64]. In Sweden, political strategies have been applied since the 1980s in order to enable older persons to age in their own homes [65]. The municipalities are responsible for providing necessary supportive services for older adults to uphold aging in place, e.g. home help services, security alarms, and meals on wheels [66]. In conclusion, this implies an increasing need for evaluation of factors that affect an older person’s possibility of aging in his/her own home. These factors include social capital, the home environment and the neighborhood environment [63] in addition to aspects of performing everyday activities. All of these should be considered in implementing and evaluating health-promoting intervention targeting community-dwelling older adults.

### ***Activities of daily living***

The overarching concept of occupation, presented earlier, can be sorted into areas of occupation: activities of daily living (ADL) which, in turn, consist of personal activities of daily living (PADL) and instrumental activities of daily living (IADL), rest and sleep, education, work, play, leisure and social participation [52]. PADL are oriented towards taking

care of one's own body, e.g. eating and showering, and are fundamental to living in a social world enabling basic survival and wellbeing for people [67]. IADL support daily life within the home and the community, exemplified by shopping and cleaning. In ICF, both PADL and IADL can be found as aspects of health in the component "activities and participation" [43].

### ***Independence in ADL***

As stated earlier, there are dissimilar aspects of occupational performance and one of them is independence. According to one definition, a person may be considered independent when he/she performs or directs the actions necessary to participate regardless of the amount or kind of assistance desired or required [52]. However, most outcome measures for ADL as well as the one used in this thesis, the ADL-staircase [68], use a narrower definition of independence. Independence in performing the ten activities listed in the ADL-staircase: cleaning, shopping, transportation, cooking, bathing, dressing, going to the toilet, transfer, continence, and feeding excludes assistance from other persons, which illustrates that independence can be interpreted in different ways. Also, independence may have different individual meanings for older adults and vary according to the social context [69]. In the former definition, independence is related to self-determination or autonomy, the clients being able to make choices and direct their care, while the latter, used in the ADL-staircase, is focused on physical self-reliance [70].

Many older persons become dependent in ADL, needing assistance to be able to carry out daily activities. One study [71], using a definition of independence based on physical self-reliance, reported that 13% of older adults (76 years) received assistance in PADL and 22% in IADL, the most common IADL being cleaning, cooking and shopping. In Sweden, approximately 9% of persons 65 years or older living in their ordinary housing in 2008, were reported to utilize the municipal home help service [66]. Being dependent on others and losing control of performance in ADL may be frustrating for this group since ADL are related to personal identity and feelings of independence in performing activities at any chosen time [67]. One study in Denmark [72] showed that very old persons (85+) found lack of everyday life satisfaction to be associated primarily with dependence on personal help and the use of home care services. Also, older adults' need of help in daily activities is strongly associated with mortality [73, 74].

### ***Perceived security in ADL***

Another aspect of occupational performance is perceived security in ADL. This feature came to light during the development of an occupational therapy program [75]. The older adults themselves experienced insecurity in ADL when they did not know if they were able to carry out an activity successfully from their point of view. The feeling of insecurity was found to be directly connected with the performance, the actual doing of the activity. Also, it was concluded that feelings of insecurity could exist despite absence of functional limitations and could affect a person's belief in managing ADL both in the present and the future. This feeling of doing activities successfully, perceived security in ADL, has similarities to the concept of self-efficacy: "belief in one's capabilities to organize and execute the course of action required to produce given attainments" [76]. They are both related to taking control of, and mastering, an activity, and they are both a perceived prediction of how a person will succeed in performing an activity. Feeling insecure in performing ADL also resembles anxiety, which has been found a significant risk factor for the progression of disability in older women [77]. In sum, perceived security in ADL is an important aspect of occupational performance, and in the aforementioned program as well as in this thesis it was operationalized by a scale linked to respective items in the ADL-staircase.

Finally, the ability to manage ADL characteristically deteriorates with age, and early signs, such as experienced difficulties, uncertainty and fatigue, are often followed by the need of assistance from someone else in order to manage ADL [78, 79]. Accordingly, this makes ADL an obvious target for health-promoting intervention in the older population, an assertion that corresponds to WHO's policy framework for active aging entailing the key goal of maintaining autonomy and independence for older people [60].

### **Health promotion for community-dwelling older adults**

#### ***Health promotion***

According to WHO, health promotion is the process of enabling people to increase control over, and to improve, their health, while disease prevention covers measures not only to prevent the occurrence of disease, such as risk factor reduction, but also to arrest its progress and reduce its consequences once established [37]. Disease prevention, as defined by WHO, partially overlaps the concept of health promotion for persons with chronic diseases, enhancing people's capacity to cope with chronic conditions [80]. Consequently, the definition of health promotion used in this thesis covers both health-promoting and disease preventive (HPDP) initiatives, which typically contain multi-component or complex

interventions (several interacting components) [81]. For the purpose of this thesis, a multi-component HPDP program is therefore defined as a program consisting of coordinated and multi-strategic initiatives targeting health promotion and disease prevention in all types of organizations providing outpatient healthcare. The term health promotion program (HPP) is used as an equivalent and interchangeable denomination.

The National Board of Health and Welfare in Sweden [82] emphasizes that healthcare should systematically integrate and target specific HPDP interventions on a daily basis in order to provide equal health for the whole Swedish population. Such interventions should be considered a natural part of the content in the entire care process. One specific group, individuals who are particularly vulnerable to disease and ill-health, has been pointed out as an important target for healthcare service in its role as public health promoter [83]. This government plan may serve as an example of the practical staging of WHO's global vision for health promotion proclaimed in the Ottawa Charter and the updated version in the Bangkok Charter [38].

### ***Theoretical foundations of health promotion***

Theoretical models used in planning and implementing health promotion can generally be categorized into three main groups: educational models, preventive models, and empowerment models [84]. To put it simply, educational models are traditionally based on giving "the right information" about health issues to people, and the preventive model strives to influence individuals to take responsibility for their own health [85]. The empowerment model is considered being the only model fulfilling the ideological requirements of health promotion according to Tones and Tylford [84]. The major criticism of the educational model is its failure to acknowledge the extent of freedom to choose, and the prevention model is considered to imply a risk of victim blaming the person, having too large an emphasis on the medical paradigm, and not sufficiently paying attention to social and environmental determinants of health. Hence, the goal of the empowerment model is to practice health education, but instead of persuading people to adopt health behaviors, it aims to empower by strengthening capabilities within the individual. Examples of such capabilities are life skills, capabilities that can enhance success in everyday living, and self-efficacy [84]. These capabilities, in turn, constitute one of the overarching goals of empowerment - gaining control over one's own life [86].



### ***Health promotion in practice***

In order to meet older adults' need of HPDP interventions comprising elements from various fields of knowledge (e.g. medicine, sociology, and occupational therapy), some programs have integrated efforts from several professions [87-89]. Cross-professional teamwork is often recommended in order to reduce costs and to make interventions effective [27], and is defined as collaboration between professionals from different disciplines working in a team towards a common goal [90]. A recently published review [91] found that the most frequently represented professions in cross-professional teams addressing older persons were in descending order: registered nurses (RN), occupational therapists (OT), physical therapists (PT), social workers (SW), and physicians (P). These findings agree with the conclusion reached by other researchers that cross-professional teams addressing frail older persons should include both nursing and rehabilitation staff [92]. They also agree with others' reflections on overall visions of aging, pointing out that it is necessary to exceed the boundaries of disciplines to further develop our knowledge [13].

Health promotion occurs at different levels, from standardized top-down national programs to unique grass-roots initiatives [93]. One model for implementing health promotion to community-dwelling older adults is an individual intervention in the form of one or more home visits. Preventive home visits have shown promising results if they are multi-component, include several follow-up visits, and address "younger elderly" whose health has not yet been markedly affected [94-96]. However, the repetition of home visits has lately been questioned [97]. A multiprofessional group intervention is another model, but this form has been less studied, and there is little evidence of its effectiveness so far. In sum, this underlines the necessity to further study outcomes in various models of health-promoting intervention for the target group described.

### **Rationale for this thesis**

This thesis is based on three premises associated with issues of health promotion in an aging population. Firstly, because research is constantly under development, there is a need to regularly update knowledge of the content, effects, and definitions of key concepts in RCTs evaluating HPPs for older persons. This is because RCTs are considered the gold standard for testing the efficacy of healthcare interventions, and extensive research indicates that they provide the best possible quantitative evidence of efficacy and effectiveness [98]. Secondly, although a number of studies [25, 28, 30] have explored the concept of frailty in older adults, few address how healthcare professionals working with the target group comprehend the

concept. This knowledge gap needs to be filled to increase our understanding of this fundamental concept, and hopefully lead to more appropriate responses to older persons and more effective health-promoting intervention procedures. Also, to identify relevant concepts, including the dimensions along which they may vary, based on engagement with theory, is a central issue in the ethics of health promotion [93].

Finally, researchers consider that health-promoting intervention for older persons is more effective when it is implemented in an early stage of frailty, before the older person becomes too frail [27, 99, 100]. Therefore, there is an urgent need to develop and evaluate health-promoting interventions tailored for older persons at risk of becoming frail in order to find effective intervention programs to strengthen older persons' health, prevent limitations in daily activities, and facilitate aging in place. *Elderly Persons in the Risk Zone* [101] was such a health-promoting program, which addressed community-dwelling older adults (80+) at risk of becoming frail. It was an RCT with two interventions, a preventive home visit and multi-professional senior group meetings with one follow-up home visit, plus a control group, with a follow-up to two years. With the goal of finding effective health-promoting intervention for older adults, outcomes of *Elderly Persons in the Risk Zone* need to be evaluated, both in the short and in the long term.

## **AIMS**

The overall aim of this thesis was to increase our understanding of the concept of frailty in relation to older adults, and to review and evaluate outcomes in health-promoting interventions for community-dwelling older adults.

Specific objectives for included studies;

- To investigate definitions of frailty used in studies of multi-component health-promoting and disease-preventive intervention programs for community-dwelling frail older persons and to review the content, organization, and effects of the interventions using ICF as a structural framework (Study I).
- To elucidate healthcare professionals' views of frailty in older persons (Study II).
- To evaluate *Elderly Persons in the Risk Zone* with regard to frailty, self-rated health, and ADL at the three-month follow-up (Study III).
- To evaluate *Elderly Persons in the Risk Zone* with regard to independence and perceived security in ADL at the one- and two-year follow-ups (Study IV).

## METHODS

In order to fulfil the overall aim and specific objectives of this thesis, a variety of methodological approaches was needed (Table I). The first study (Study I) was a systematic literature review, the second (Study II) was a qualitative focus group study, and the last two studies (Studies III and IV) were quantitative studies, evaluating outcomes from the RCT *Elderly Persons in the Risk Zone*.

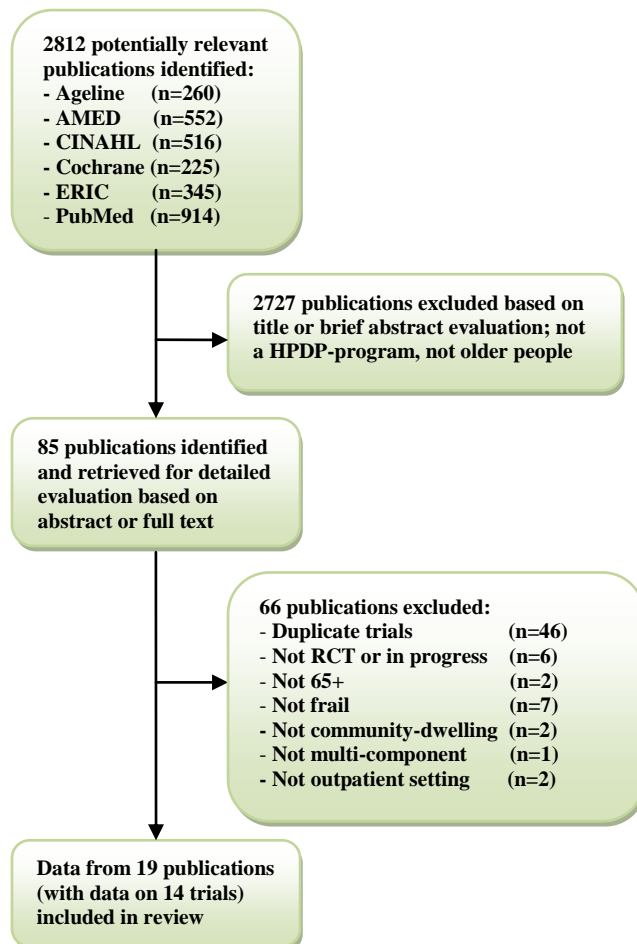
**Table I.** Overview of the studies in the thesis including the population or material, the design, and the data collection.

	Study population or material	Study design	Data collection
<b>Study I</b>	Original articles on RCTs concerning community-dwelling persons 65 years or older defined as frail, and with at least one intervention group of participants receiving HPDP interventions (n=19)	A systematic literature review	Database search in: Ageline, AMED, CINAHL, Cochrane Central Register of Controlled Trials, ERIC, and PubMed
<b>Study II</b>	Healthcare professionals: six OTs, six PTs, five RNs, and four SWs (n=21)	A qualitative study	Focus group discussions
<b>Study III</b>	Older adults (80+) at risk of becoming frail (n=459)	A RCT	Questionnaire on frailty indicators Question about SRH Questionnaire on ADL
<b>Study IV</b>	Older adults (80+) at risk of becoming frail (n=459)	A RCT	Questionnaire on ADL Questionnaire on perceived security in ADL

### Study I

The requirements of the first objective were met by using a systematic literature review. The intention was to identify original articles on RCTs concerning community-dwelling persons 65 years or older defined as frail, and with at least one intervention group of participants receiving multi-component HPDP interventions. The following electronic databases were searched: Ageline, AMED, CINAHL, Cochrane Central Register of Controlled Trials, ERIC, and PubMed. The database searches resulted in a total of 2812 findings (Figure 2). Eighty-five potentially relevant references were selected for detailed evaluation. Finally, a total of 19 articles were included for detailed review. Methodological quality was determined with the help of critical appraisal criteria in the Updated Method Guidelines for Systematic Reviews in the Cochrane Collaboration Back Review Group [102]. Since the 19 selected studies were not sufficiently similar to allow the pooling of data by statistical analyses, the review took a narrative form [103]. The range of available evidence was described and analyzed in order to

broaden the knowledge within the areas of the research questions investigated. Accordingly, data were extracted in order to synthesize the results. Data were analyzed using a deductive approach, and the ICF terminology [43] was used as a structural framework for the analysis. In addition, a form of vote-counting on the basis of *p*-values was used [104].



**Figure 2.** Identification of 19 eligible RCTs concerning multi-component HPDP interventions for community-dwelling frail elderly persons in study I.

## Study II

Since the second objective was to explore views and experiences a qualitative method, focus group discussions, was chosen. Focus groups highlight the participants' framework of understanding and provide insight into their articulation of knowledge [105-107].

A purposeful sampling procedure was used, and a variety in age and work experience was sought when selecting participants. The participants in the four focus groups comprised 21 healthcare professionals: six OTs, six PTs, five RNs, and four SWs (graduates of a school of social studies, home care supervisor or home aid assessor). They were employed either at the regional hospital, in primary or municipal care, worked in cross-professional teams, and were

involved in providing HPDP interventions for community-dwelling older persons. Table II provides a detailed overview of the participants in the study. Each of the four focus groups met once for not longer than one and a half hours. All focus group interviews had the same moderator, whose role was to facilitate interaction among participants by encouraging them to talk to each other. Focus group sessions were audio-taped, transcribed verbatim, and analyzed according to the method described by Kreuger [107].

**Table II.** A detailed overview of the participants in study II.

Participant (number)	Profession	Gender	Age (years)	Work organization	Graduation year	Total work experience (years)	Work experience with older persons (years)
1	OT	Female	27	Regional hospital	2004	2	2
2	OT	Female	51	Regional hospital	1994	12	12
3	OT	Female	46	Primary care	2005	2	2
4	OT	Female	52	Primary care	1978	28	28
5	OT	Female	37	Municipal care	2000	5	5
6	OT	Female	50	Municipal care	1979	17	15
7	PT	Female	42	Regional hospital	1988	15	15
8	PT	Female	31	Regional hospital	2000	7	7
9	PT	Male	32	Primary care	2002	5	5
10	PT	Female	42	Primary care	2004	3	3
11	PT	Female	60	Municipal care	1983	24	12
12	PT	Female	59	Municipal care	1978	28	20
13	RN	Female	30	Regional hospital	2004	3	3
14	RN	Female	30	Primary care	1999	8	8
15	RN	Female	26	Primary care	1971	36	36
16	RN	Female	58	Municipal care	1972	36	36
17	RN	Female	50	Municipal care	1982	25	14
18	SW	Female	49	Regional hospital	2003	4	4
19	SW	Female	27	Primary care	2004	3	3
20	SW	Female	55	Municipal care	1996	11	3
21	SW	Female	52	Municipal care	1999	8	8

### Studies III and IV

In order to meet the specific objectives of studies III and IV, to evaluate the effects of *Elderly Persons in the Risk Zone* [101] in regard to frailty, SRH, and independence and perceived security in ADL, a quantitative method was used.

#### *The health-promoting program*

*Elderly Persons in the Risk Zone* was a health-promoting intervention study performed in two urban districts in Gothenburg, Sweden, between November 2007 and May 2011. The study addressed, and was tailored for, community-dwelling older adults (80+) at risk of becoming frail. The main risk factor for frailty was age since frailty increases with age and all participants were at least 80 years of age. *Elderly Persons in the Risk Zone* had the

overarching aim to delay the progression of frailty in older adults, preserve their health, quality of life, and minimize their need of medical care. It was a randomized, single-blind, and three-study-arms trial with two intervention groups and one control group with a follow-up to two years. The overall hypothesis of the study was twofold: 1) it is possible to delay deterioration if an intervention is made when the older adults (80+) are at risk of becoming frail, and 2) a multiprofessional group intervention is more effective in delaying deterioration than a single preventive home visit.

The two interventions in *Elderly Persons in the Risk Zone* were developed and planned in co-operation with researchers, experts in the field, representatives from the urban districts, and local representatives of organizations for older adults. One of the two interventions consisted of a preventive home visit by a specially trained professional in the intervention team, an OT, a PT, a RN, or a SW. The intervention contained information about what respective urban districts could provide for older citizens, e.g. physical training groups, accessibility to assistive devices and housing modifications, and the identification of environmental fall risks in the home. The preventive home visit was guided by a protocol (Table III), although containing the opportunity for individual elaboration of elements, and lasted between one and a half to two hours.

**Table III.** The elements in the protocol used in the preventive home visit in the intervention study *Elderly Persons in the Risk Zone*.

Protocol elements
Information and advice about, and when appropriate instructions in, a basic home exercise program including balance exercises
Assessment of the fall prevention checklist, information and advice on how to prevent identified fall risks and continue be active, and in adequate cases a “safety walk” in the home
Information and advice about technical aids and housing modifications, and, if necessary, where and whom to turn to for purchase or application
Information and advice about smoking alarms, and, if necessary, an offer to check the smoking alarm
Information about the range of help and support available in Gothenburg and in the urban districts (volunteers, churches, mission fellow human, health centers etc.), and where to turn to for help with health problems and illness, opening hours, phone times, and phone numbers
Information on the possibility of an appointment with a pharmacist at the local pharmacy for review of and counselling on medicines
Information and advice about incontinence
Display and hand over a brochure with information on the Swedish legislation and possibilities for advise on and assessment of driving capacity by professionals
Information and advice about what the urban districts can provide in the form of local meeting places, activities run by local associations, physical training for seniors, walking groups for seniors, and possibility of receiving or providing volunteer interventions
Offer to register for “try-out” activities, a standalone group visit to local meeting places, a short introduction to computer sciences, petanque clubs for seniors, gyms for seniors, Nordic walking groups, and more
Information about public transportation, including busses adapted for older adults, and of mobility service for the disabled
Information on the Social Services Act, and on where and whom to contact in the urban district in order to apply for home care services

The second intervention comprised four weekly multiprofessional senior group meetings with one follow-up home visit. A collaborative multiprofessional intervention team: an OT, a RN, a PT, and a qualified SW, each responsible for one occasion, led the group meetings. This intervention provided an arena for the exchange of knowledge [108] with information and discussion about the aging process, the possible health consequences, and strategies for solving the various problems that may arise in the home environment. The older adults themselves were seen as experts, were encouraged to make autonomous decisions and, as far as possible, control their own lives [86]. Predetermined themes (Table IV), outlined in a booklet written in a popular style by researchers in the field and especially designed for the intervention, formed a basis for the meetings [109]. The content of the discussions varied according to the participants’ individual experiences and needs. A follow-up home visit took



place two to three weeks after the meetings. Participants in the control group had, on their own initiative, access to the ordinary range of community services offered by the municipal care for older persons. Both interventions were largely implemented according to plan. All participants, 100%, assigned to a preventive home visit received the intervention. Ninety-seven percent of the participants in the senior meetings (n=165) attended all four meetings, while 2% (n=4) attended three meetings and 1% (n=2) attended two meetings.

**Table IV.** The themes from the booklet used in the senior meetings in the intervention study *Elderly Persons in the Risk Zone*

Themes from the booklet	Principal professional*
Aging	PT
Physical activity helps keep you physically fit	PT
Food is a prerequisite for health	PT
You can take care of problems with your health	RN
How to use medicines	RN
To cope with everyday life	OT
You do not need to feel insecure	OT
Technology in everyday life	OT
Will I lose my memory?	OT
Life events and quality of life during aging	SW
Anyone who needs help can get help	SW

\* Physical therapist (PT), registered nurse (RN), occupational therapist (OT), and social worker (SW).

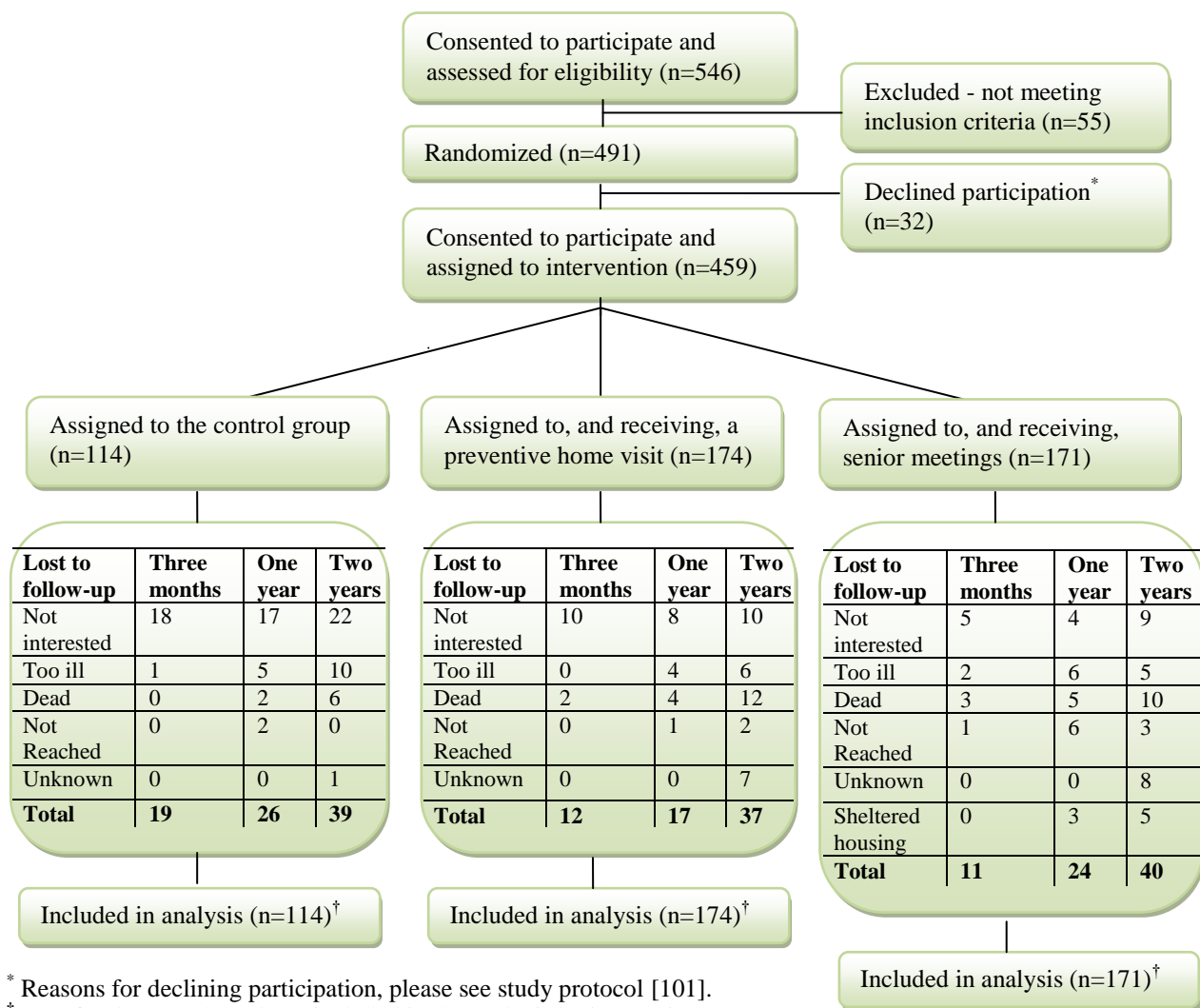
### ***Participants***

The eligible study population consisted of adults 80 years or older, living in two of the 21 urban districts in Gothenburg (n=3906). Equal numbers from official registers in the two urban districts were listed in random order and the persons were included until the intended sample size was reached. Invitation letters were sent to all persons in the sample not registered to receive municipal home help service and residing at sheltered living or institutions (n=2031). A follow-up telephone call was made about 1-2 weeks later where 365 persons were non-eligible (n=147) or not traceable (n=218). Of the remaining persons (n=1666), 1120 were unable or unwilling to participate (no interest n=936, lack of time n=116, not having the strength n=68) resulting in 546 persons who consented to participate. The participants should, in order to be included, fulfil the following criteria: 1) live in their ordinary housing, 2) not be dependent on the municipal home help service or care, 3) be independent of help from another person in ADL, and 4) be cognitively intact (defined as

having a score of 25 or higher assessed with the Mini Mental State Examination [110]). Based on the power calculation, and after written informed consent had been obtained, a total of 459 older adults were randomly assigned by the use of opaque sealed envelopes to one of the three study-arms by a research assistant (Figure 3). The baseline characteristics of participants are presented in table V. There were no statistically significant differences between the intervention groups and the control group in terms of demographic data, SRH, or frailty.

### ***Power calculation***

A power calculation was done before the start of the study. The outcome measures had not been tested for their ability to detect change over time according to the target group, adults 80 years and older. Therefore, a general model was used to determine the power and sample size [111]. The power calculation was based on the expected relative change over time in functional abilities between the study-arms, a significance level of  $\alpha = 0.05$ , and a power of 80% in a two-sided test. Thus, at least 112 persons were required in each intervention group to be able to detect a difference of at least 15% between the groups. A comparison between the control group and the intervention groups would require 72 persons in the control group, assuming a difference of at least 20%. Accordingly, it was found that at least 300 persons were needed; a total of 459 persons were therefore included to allow for dropouts.



**Figure 3.** The flow of participants through the study *Elderly Persons in the Risk Zone* and the reasons for declining participation at three-month, one-year, and two-year follow-ups.

**Table V.** Baseline characteristics and *p*-values for differences between study-arms in the study *Elderly Persons in the Risk Zone*.

Characteristics	Control group n=114	Preventive home visit n=174	Senior meetings n=171	<i>p</i> -value
Median age (range)	86 (80-97)	86 (80-94)	85 (80-94)	0.24
Female, n (%)	70 (61)	111 (64)	113 (66)	0.63
Living alone, n (%)	55 (48)	99 (57)	103 (60)	0.10
Academic education*, n (%)	25 (22)	40 (23)	32 (19)	0.69
Self-rated health <sup>†</sup> , n (%)	90 (79)	139 (80)	142 (83)	0.63
Median sum of frailty indicators, (range)	1 (0-5)	1 (0-5)	1 (0-5)	0.89

\* Tertiary education (university or college).

<sup>†</sup> Excellent/very good/good.

### ***Data collection***

Data collection was performed in the participant's home by research assistants (OT, PT, or RN). They were trained in how to administer the assessments and inter-rater reliability was tested. To ensure as much standardization of the assessments as possible, study protocol meetings were held regularly throughout the study. In addition, data on the municipal home help service and mortality were collected from municipal records. Those assessing the outcomes were blind to group assignment.

### ***The setting***

The two urban districts in Gothenburg where the study *Elderly Persons in the Risk Zone* took place, Örgryte and Härlanda, were situated outside the city centre, but within the city limits, with a mix of self-owned houses and apartment blocks. The general educational level and income level of residents were slightly better, and the sickness rate somewhat lower, than in the population of the city of Gothenburg as a whole (Table VI).

**Table VI.** Detailed overview of the demographics in the two urban districts in studies III and IV.

<b>Demographics in 2009</b>	<b>Örgryte and Härlanda</b>	<b>Gothenburg</b>
<b>Population</b> (% of population in Gbg)	55 822 (11)	507 330
<b>Persons 65+</b> (% of population)	8 309 (14.9)	74 680 (14.7)
<b>Persons 80+</b> (% of population)	3579 (6.4)	23 967 (4.7)
<b>General education level, % tertiary education*</b>	56	46
<b>General income level, Skr</b>	250 000	231 700
<b>Sickness rate<sup>†</sup></b>	25	31
<b>Municipal home help service, number of cases</b> (% of cases in Gbg)	1150 (13.6)	8431

\* Tertiary education (university or college).

<sup>†</sup> Sickness rate (ohälsotal) is a calculated value obtained by dividing the sum of the number of days with sickness, disability pension, rehabilitation, and sickness compensation/pay by the number of inhabitants aged 25-64 years.

### ***Outcome measures***

Several primary and secondary outcome measures in *Elderly Persons in the Risk Zone* are to be reported in various papers, or are papers in progress. In this thesis, the change between baseline and the follow-up in question of the following outcomes are evaluated and presented: frailty, SHR, and ADL at the three-month follow-up (Study III), and, independence and perceived security in ADL at the one- and two-year follow-ups (Study IV).

*Frailty* was measured by the sum of core frailty indicators as stated in the study protocol [101]. Originally, the study protocol enumerated eight frailty indicators, but two of them were not included in the three-month follow-up assessment: impaired cognition and visual impairment. Accordingly, six core frailty indicators were included in the sum of frailty indicators used in study III: weakness, fatigue, weight loss, low physical activity, poor balance, and gait speed. The sum of frailty indicators, with scores from 0 to 6, comprised the number of indicators exceeding the cut-off for frailty for each indicator: weakness, a grip strength below 13 kg for women and 21 kg for males for the dominant hand, and below 10 kg for women and 18 kg for males for the non-dominant hand, measured with a hand dynamometer [112]. Fatigue was measured by answering yes to the question: “Have you suffered any general fatigue/tiredness over the last three months?” [113] and weight loss by the question: “Have you suffered from any weight loss over the last three months?” [113]. Low physical activity was defined as one to two walks per week or less. Low balance was a value of 47 or lower on Berg’s balance scale [114]. Low gait speed was walking four meters at a speed of 6.7 seconds or slower [115].

*Self-rated health* (SRH) was measured by the single question: “In general, would you say your health is: excellent, very good, good, fair or poor?” This question is identical to the initial question in the well-known Short-Form Health Survey (SF-36) [50] and is utilized as a measure of an individual’s global health status. Validity of SRH has been proven for many cultures and language regions [116]. In the analysis, the response alternatives were dichotomized into “good” (excellent, very good, and good) and “bad” (fair and poor).

*Activities of daily living* (ADL) were measured with the help of the ADL-staircase [68], which contains six PADL and four IADL. This instrument is recommended for use with older persons and has been found to have good reliability and validity in this connection [117]. When managed independently, nine out of the ten original activities were summarized into a score between 0-9: cleaning, shopping, transportation, cooking, bathing, dressing, going to the toilet, transfer, and feeding. The tenth item, continence, was left out because of its questionable status as an activity. Dependence was defined as another person being involved

in the activity by giving personal or directive assistance. People living together were assessed as independent if they performed the activity when alone.

*Perceived security in ADL* was measured with the help of a four-pointed scale linked to respective items in the ADL-staircase [75]. The security scale ranks were: 1 = secure, 2 = fairly secure, 3 = insecure and 4 = very insecure. In the analysis, the ranks were dichotomized into “secure” and “insecure” (fairly secure, insecure, and very insecure).

### ***Statistical analysis***

The analyses in studies III and IV were made on the basis of the intention-to-treat principle (ITT), which means that every participant who consented to participate and for whom baseline data existed, was analyzed in the original group to which he/she was randomized [111]. Special attention was paid to managing missing data. The basic assumption for imputing data was that older adults (80+) are expected to deteriorate over time in the natural course of the aging process. Therefore, if a measure was missing at the three-month follow-up, the imputation method chosen was to replace the missing value with a value based on the median change of deterioration (MCD) between baseline and the three-month follow-up of all who participated at the follow-up. The MCD is a conservative form of the worst change of deterioration, which, in turn, is related to the single imputation method of the worst case [118]. In practice, the MCD for an outcome measure was added to/subtracted from (depending on the outcome measure) the individual value registered at baseline, and imputed, substituting missing data at the three-month follow-up. The equivalent principle, but forward step-wise, was used for the imputation of missing data at the one- and two-year follow-ups. Consequently, the MCD between two measuring points was added to/subtracted from the last genuine individual value registered, and imputed, substituting missing data at the follow-up in question. Sensitivity analyses were performed, but are not presented in the original papers. To rationalize the choice of the imputation method, the results of the MCD analyses were compared to complete cases analyses [119], which showed aligned trends. Our stated basic assumption guided the final preference for the method used in the analyses presented.

Baseline and dropout characteristics among the three groups were compared using  $\chi^2$  or Fishers exact tests for dichotomous variables,  $t$ -tests for continuous variables, and Mann-Whitney  $U$ -tests for ordinal data. In the final analyses, the outcome measures were analyzed using overall  $\chi^2$  tests, and thereafter compared group-wise by calculating the Odds Ratio (OR). Two-sided significance tests were used throughout. A  $p$ -value of 0.05 or less was considered significant and a 95% Confidence Interval (CI) is provided, using normal

approximation of the log-odds ratio, for each analysis presented in a table. Statistical analyses were performed using SPSS (PASW Statistics, 18.0, 2009, IBM SPSS Inc, Chicago, IL).

## **ETHICAL CONSIDERATIONS**

In study I, included and reviewed articles would meet basic ethical standards for approval in respective countries ethical instance and legislations, which they did. In study II, information about the study to the head manager of each health organization and participants was carefully prepared and implemented. The information to the participants, the healthcare professionals, was given both in person and in written letters where it was clearly stated that participation was entirely voluntary.

Studies III and IV were approved by the Regional Ethical Review Board in Gothenburg, ref.nr: 650-07, and written informed consent was obtained from the participants. In order to enable a long term evaluation of *Elderly Persons in the Risk Zone*, a three-armed study design with two intervention groups and a control group was implemented. After the end of the study, the participants in the control group were asked if they wished to take part in either of the two interventions, which, at that time, had been implemented in the common routines of the urban districts.

## **RESULTS**

The results are described in detail in the separate papers (Studies I to IV). This section comprises a summary of the specific findings in respective study.

### **Study I**

The reviewed studies provided evidence for consensus by including various aspects of impairments in body functions and structures as an integral part of frailty with the exception for one subgroup: mental/cognitive functions. In contrast, opinions differed quite consistently regarding the inclusion of aspects of activity limitations and participation restrictions, environmental, and personal factors in the definition of frailty.

The multi-component HPDP programs reviewed contained a broad spectrum of interventions covering body functions and structures, activity and participation, environmental, and personal factors. Ten of the 14 HPDP programs covered various intervention elements that referred to all four ICF components. Eleven programs involved registered personnel only, while a more divergent pattern was seen in the remaining organizational aspects of the interventions; length, location, age segments, participatory approach, and contextual information as well as in theoretical foundation of the interventions. The review suggested that HPDP programs are partially effective. Measures of body functions and structures were significantly improved in a total of 5 out of 17 targeted aspects (29%). For activity and participation, 12 out of 32 (38%) of targeted aspects were positively changed. The score for environmental factors was 7 out of 22 (32%), and for personal factors the results were 8 out of 22 (36%) objectives for change (Table VII).



**Table VII.** The effects of the 14 HPDP programs reviewed, presented as a form of vote-counting based on *p*-values. A significant difference ( $p<0.05$ ) between the intervention and the control group is marked by a “+”, a non-significant result by a “0”.

<b>First author and publication year*</b>	<b>Body functions and structures</b> (4 subgroups, n=17) <sup>†</sup>	<b>Activity and participation</b> (5 subgroups, n=32) <sup>†</sup>	<b>Environmental factors</b> (5 subgroups, n=22) <sup>†</sup>	<b>Personal factors</b> (4 subgroups, n=22) <sup>†</sup>
Bouman A, 2008+2008	0 0	0 0	0 0	0 0
Chin A Paw, 2001+2002	+	+ 0		0
Dalby, 2000			+ 0 0	0
Gill, 2002+2004		+++	0	
Gitlin, 2006+2006		++ 0	+	+++
Hall, 1992	0		+ 0	+ 0
Hebert, 2001	0	0 0 0 0	0 0 0	0 0
Holland, 2005	+ 0 0	+ 0 0	0 0	0
Leveille, 1998 and Phelan, 2004	0	++ 0	+ + 0	+ 0
Mann, 1999	+ 0	+ 0 0 0		
Markle-Reid, 2006	+		+	+ 0
Rockwood, 2000	0	0 0 0	0	+ 0 0
Stuck, 2000	+ 0 0	+ 0	+ 0 0	0
van Haastregt, 2000	0	+ 0 0		+ 0
<b>Total +/0</b>	<b>5/12</b>	<b>12/20</b>	<b>7/15</b>	<b>8/14</b>

\* For complete information on references, see study I.

† For complete information on subgroups, see study I.

## Study II

The result showed that healthcare professionals’ viewed frailty in older persons as a complex concept founded on seven dimensions: “being bodily weak and ill”, “being negatively influenced by personal qualities”, “lacking balance in everyday activities”, “being dependent in everyday life”, “not being considered important”, “being hindered by the physical milieu and defective community service”, and “having an inadequate social network” (Figure 4).

Being bodily weak and ill meant that frailty had its origin within the body and its functions. In addition, diseases such as stroke and dementia were found to commonly occur amongst frail older persons. Being negatively influenced by personal qualities implied that certain personal qualities, attributes of the person, could have a negative impact and result in frailty. Examples given were overwhelming feelings of loneliness and an older person’s inability to handle crises in life. Lacking balance in everyday activities meant that frailty could be the result of either inactivity or an overload of activities in daily life. Additionally, being dependent in everyday life, needing help from someone in order to perform daily activities was also believed to indicate frailty in an older person. Phenomena such as not being considered important by others and being excluded from involvement in everyday life also characterized frailty in older adults. This meant that older persons were neither heard, nor asked for, and that others made decisions regarding them. Also, being hindered by the physical milieu and

defective community service implied frailty. This could connote risks in the home environment, inaccurate medication, low income, or difficulty dealing with everyday technology. Finally, having an inadequate social network with few or no relatives and friends were considered to be a sign of frailty in older persons.

In the discussions, the concept of frailty was occasionally explained by aspects in one dimension but more frequently by concurrent aspects in two or more dimensions. Additional complexity was depicted in the idea of aspects interacting, both within and between dimensions, and that the number of aspects involved influenced the extent of frailty. Furthermore, it was found that the age of a person did not explain or predict frailty even though a connection between age and frailty was considered. The dimensions were also found to form a time course. Frailty was comprehended as a changeable condition in relation to the different aspects involved, time of occurrence and interrelations. A development was depicted in which older persons were described as “early frail” or “mildly frail,” with few involved aspects, and “advanced frail,” where most aspects of all dimensions were present. Finally, while focus group participants considered that the development of frailty could be stopped or slowed down temporarily, it inevitably led to the older person’s death.



**Figure 4.** The seven dimensions in the concept of frailty found in study II.

### **Studies III and IV**

The dropout rates in the intervention study *Elderly Persons in the Risk Zone* at the three-month, one-year, and two-year follow-ups were; 9%, 15%, respective 25% (n=42/67/116). At all follow-ups, there was a significantly larger proportion of dropouts in the control group than in the two intervention groups ( $p=0.006/0.008/0.036$ ). “Not interested” was the main reason for declining participation at all follow-ups in the preventive home visit and the control groups, while the main reasons for declining participation in the senior meetings were more varied (Figure 3). No significant differences were found between participants and dropouts concerning gender, marital status, education, or living conditions. However the dropouts at three-months had significantly lower self-rated health ( $p=0.04$ ) at baseline, and, more often reported weight loss ( $p=0.004$ ), and had a higher consumption of municipal home help service at three months ( $p=0.001$ ) compared to the intervention participants. In addition, the dropouts at one-year had significantly worse self-rated health (fair or poor) ( $p= 0.03$ ) compared to the participants, and a higher proportion of municipal home help service ( $p=0.002$ ). At the two-year follow-up, dropouts were significantly older ( $p=0.001$ ), had lower balance scores ( $p=0.03$ ), and were less physically active ( $p<0.001$ ). Finally, a total of five persons (1%) had died by the time of the three-month follow-up, eleven (2%) by the one-year and 28 (6%) by the two-year follow-up.

Seventy-one percent of the participants in the control group had no progression of frailty from baseline to three-month follow-up compared to 70% in the preventive home visit group and 64% in the senior meetings (Table VIII). There was no significant difference in frailty between any of the groups (Table IX).

**Table VIII.** No deterioration of frailty, self-rated health (SRH) and activities of daily living (ADL) between baseline and three-month follow-up of participants in the study *Elderly Persons in the Risk Zone*.

<b>Outcome measure</b>	<b>Control group</b>	<b>Preventive home visit</b>	<b>Senior meetings</b>	<b>All participants</b>
	n=114	n=174	n=171	n=459
<b>Frailty<sup>*</sup>, n (%)</b>	81 (71)	121 (70)	110 (64)	312 (68)
<b>SRH<sup>†</sup>, n (%)</b>	92 (81)	157 (90)	151 (88)	400 (87)
<b>ADL<sup>‡</sup>, n (%)</b>	75 (66)	115 (66)	135 (79)	325 (71)

\* The sum of six core frailty indicators: weakness, fatigue, weight loss, low physical activity, poor balance, and gait speed.

† The question: “In general would you say your health is: excellent, very good, good, fair or poor?”

‡ The sum of nine activities in the ADL-staircase: cleaning, shopping, transportation, cooking, bathing, dressing, going to the toilet, transfer, and feeding.

Eighty-one percent of the participants in the control group had not deteriorated in SRH at three-month follow-up compared to 90% in the preventive home visit and 88% in the senior meetings groups (Table VIII). There was a significant difference between both interventions and the control group, the Odds Ratio (OR) for no deterioration in SRH in the intervention groups being double that of the control group, 1.99 (95% CI=1.12 to 3.54). The preventive home visit group had an OR of 2.21 (95% CI=1.12 to 4.37) and the senior meetings an OR of 1.81 (95% CI=0.93 to 3.49). There was no significant difference in SRH between the two interventions (Table IX).

**Table IX.** Odds Ratio (OR), Confidence Interval (CI), and *p*-value (*p*) for no deterioration of outcome measures between baseline and three months of participants in the study *Elderly Persons in the Risk Zone*.

Reference group*	Frailty <sup>†</sup>			SRH <sup>‡</sup>			ADL <sup>§</sup>		
	OR	(CI)	( <i>p</i> )	OR	(CI)	( <i>p</i> )	OR	(CI)	( <i>p</i> )
Interventions vs. <b>control</b>	0.83	(0.52 to 1.31)	0.42	1.99	(1.12 to 3.54)	0.02	1.37	(0.87 to 2.15)	0.18
Preventive home visit vs. <b>control</b>	0.93	(0.55 to 1.56)	0.78	2.21	(1.12 to 4.37)	0.02	1.01	(0.62 to 1.67)	0.96
Senior meetings vs. <b>control</b>	0.73	(0.44 to 1.23)	0.24	1.81	(0.93 to 3.49)	0.08	1.95	(1.14 to 3.33)	0.01
Senior meetings vs. <b>preventive home visit</b>	0.79	(0.50 to 1.24)	0.30	0.82	(0.41 to 1.62)	0.56	1.92	(1.19 to 3.12)	0.01

\* In bold.

<sup>†</sup> A sum of six core frailty indicators: weakness, fatigue, weight loss, low physical activity, poor balance, and gait speed.

<sup>‡</sup> The question: “In general would you say your health is: excellent, very good, good, fair or poor?”

<sup>§</sup> The sum of nine activities in the ADL-staircase; cleaning, shopping, transportation, cooking, bathing, dressing, going to the toilet, transfer, and feeding.

All participants were independent in ADL at the baseline of the study. Sixty-six percent of the participants in the control group had no deterioration in ADL and were still independent at the three-month follow-up compared to 66% in the preventive home visit and 79% in the senior meetings groups (Table VIII). At the one- and two-year follow-ups, 44% and 35%, respectively, of the participants in the control group remained independent compared to 55% and 39%, respectively, in the preventive home visit, and 60% and 36%, respectively, in the senior meetings groups (Table X). All three groups followed the same general pattern of dependence in ADL at all follow-ups, the largest degree of dependence being found in cleaning, followed by shopping, cooking, and transportation. Partaking in senior meetings resulted in an almost doubled OR, 1.95 (95% CI=1.14 to 3.33), for postponing dependence in

ADL at three-months in comparison with the control group (Table IX). The significant difference in favor of the senior meetings remained at one-year with an OR of 1.94 (95% CI=1.20 to 3.13) (Table X). Also, both interventions reduced dependence in two and three or more ADL at one year compared to the control group with ORs of 0.22 to 0.38. At the two-year follow-up, the analysis showed a significant difference in favor of the senior meetings in reduced dependence in three or more ADL (OR 0.56, 95% CI=0.33 to 0.95) and in four or more ADL (OR 0.40, 95% CI=0.21 to 0.77).

**Table X.** Proportion (%), Odds Ratio (OR), 95% Confidence Interval (CI), and *p*-value (*p*) for independence in ADL and dependence in two to four or more ADL between study-arms in *Elderly Persons in the Risk Zone*.

OUTCOME MEASURE		CONTROL GROUP* %	A PREVENTIVE HOME VISIT			SENIOR MEETINGS				
			%	OR	(CI)	<i>p</i>	%	OR	(CI)	<i>p</i>
Independence in ADL	(1-year)	44	55	1.54	(0.96 to 2.48)	n.s	60	1.94	(1.20 to 3.13)	<0.01
	(2-year)	35	39	1.19	(0.73 to 1.94)	n.s	36	1.03	(0.62 to 1.68)	n.s
Dependence in two or more ADL	(1-year)	42	21	0.37	(0.22 to 0.62)	<0.01	22	0.38	(0.23 to 0.64)	<0.01
	(2-year)	52	43	0.71	(0.44 to 1.13)	n.s	44	0.73	(0.45 to 1.17)	n.s
Dependence in three or more ADL	(1-year)	14	4	0.26	(0.10 to 0.65)	<0.01	4	0.22	(0.08 to 0.59)	<0.01
	(2-year)	35	25	0.63	(0.37 to 1.05)	n.s	23	0.56	(0.33 to 0.95)	0.03
Dependence in four or more ADL	(1-year)	5	2	0.42	(0.12 to 1.54)	n.s	2	0.32	(0.08 to 1.32)	n.s
	(2-year)	24	16	0.62	(0.34 to 1.12)	n.s	11	0.40	(0.21 to 0.77)	0.01

\* Reference group (1.00).

Concerning perceived security in ADL at the one- and two-year follow-ups, the most frequently rated insecure IADL in all groups was cleaning, and for PADL, bathing. The analyses showed that there was no significant difference between any of the groups in postponing perceived insecurity in ADL at the one-year follow-up (Table XI). There was, however, a significant difference between the study arms in the deterioration of perceived security in two and three or more activities at the two-year follow-up where participants in a preventive home visit had deteriorated more than those in the control group with an OR of 2.33 (95% CI=1.01 to 5.34) and 4.90 (95% CI=1.99 to 21.99), respectively.

**Table XI** Proportion (%), Odds Ratio (OR), 95% Confidence Interval (CI), and *p*-value (*p*) for non-deteriorated perceived security in ADL and deteriorated perceived security in two and three or more ADL between study-arms in *Elderly Persons in the Risk Zone*.

OUTCOME MEASURE		CONTROL GROUP* %	A PREVENTIVE HOME VISIT			SENIOR MEETINGS				
			%	OR	(CI)	<i>p</i>	%	OR	(CI)	<i>p</i>
Non-deteriorated perceived security in ADL	(1-year)	76	76	1.01	(0.58 to 1.26)	n.s	80	1.21	(0.68 to 2.13)	n.s
	(2-year)	67	68	1.08	(0.65 to 1.79)	n.s	65	0.93	(0.56 to 1.53)	n.s
Deteriorated perceived security in two or more ADL	(1-year)	17	9	0.51	(0.25 to 1.03)	n.s	12	0.66	(0.31 to 1.31)	n.s
	(2-year)	7	15	2.33	(1.01 to 5.34)	0.05	13	1.96	(0.84 to 4.56)	n.s
Deteriorated perceived security in three or more ADL	(1-year)	6	2	0.36	(0.10 to 1.26)	n.s	4	0.56	(0.18 to 1.70)	n.s
	(2-year)	2	8	4.90	(1.99 to 21.99)	0.04	6	3.85	(0.84 to 17.71)	n.s

\* Reference group (1.00).

## **DISCUSSION**

### **Discussion of the findings**

The findings of this thesis fall into two main categories: definitions of the concept of frailty and the outcome of health-promoting intervention for community-dwelling older adults. Firstly, diverse definitions of frailty were used in RCTs of health-promoting intervention for community-dwelling frail older persons; they contained a broad spectrum of interventions, and were partially effective. Secondly, healthcare professionals' viewed frailty in older persons as a complex concept founded on seven dimensions. Thirdly, both interventions in *Elderly Persons in the Risk Zone* delayed deterioration of SRH in the short term and reduced the extent of dependence in ADL for a period up to one year. The senior meetings were found to be the most beneficial intervention since they both postponed dependence in ADL in the period up to the one-year follow-up and reduced the extent of dependence in ADL for a period up to two years. Finally, no effect on frailty or perceived security in ADL could be demonstrated. In the following sections, a selection of the findings is discussed.

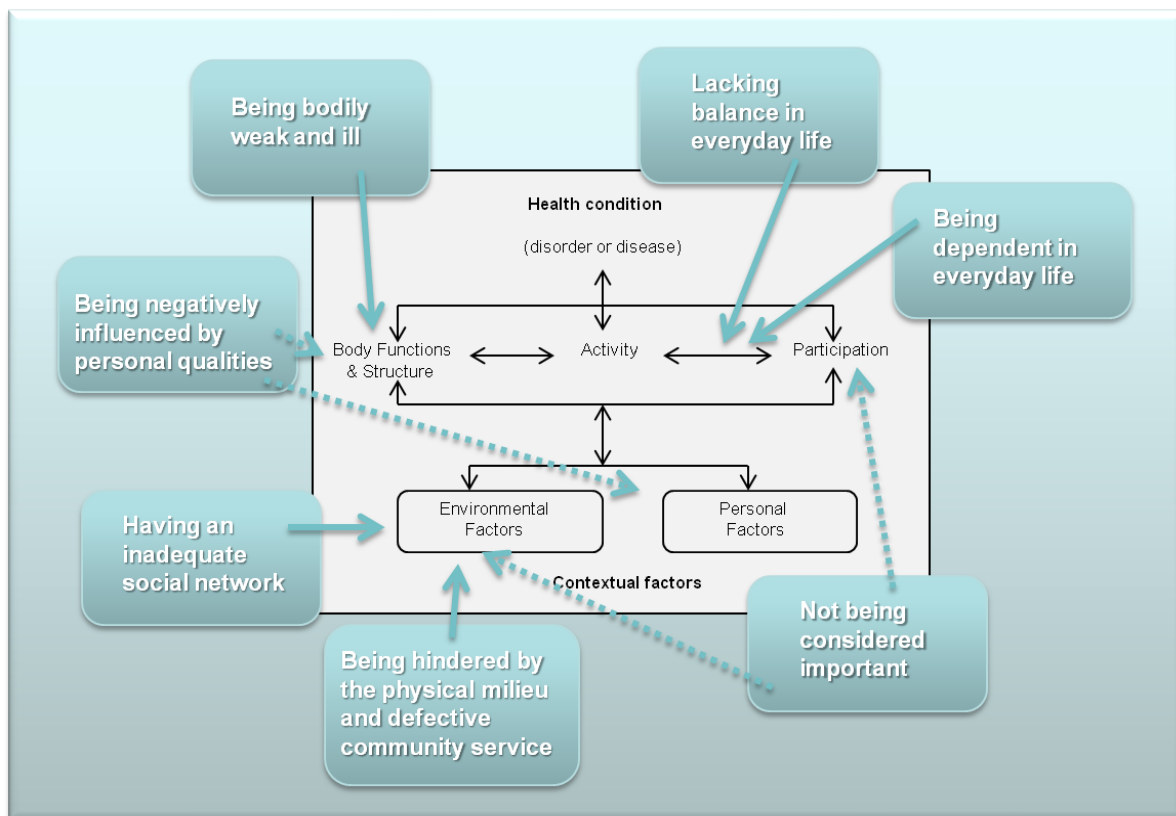
### ***The concept of frailty***

The result of study I showed that the definition of frailty, in a selection of the research literature, was ambiguous. Also, study II revealed that healthcare professional's views of frailty in older persons did not coincide with the frequently utilized unidimensional definitions of frailty. The merged results are in line with recent research on frailty, in which the absence of a uniform definition of frailty was seen to persist even after more than 30 years of studies on the topic [120]. In agreement with the findings of this thesis, it seems evident that two clusters of definitions co-exists: the unidimensional definitions, explaining frailty in aspects of bodily functions, and the multidimensional, including one or more additional components of functioning and contextual factors in the definition. An interesting view on this issue is that there exists a cultural difference between the definitions of frailty in the disciplines involved [35]. It appears that unidimensional definitions are more common in the discipline of geriatric medicine, and that holistic, multidimensional, definitions are more frequent in the contexts of other disciplines. This opinion is consistent with the result in study II since the healthcare professionals, viewing frailty in accordance with a multidimensional definition, represent a variety of disciplines outside the field of geriatric medicine.

In study II, the view of frailty was founded on seven dimensions. These included "being dependent in everyday life", which was perceived as an integral part of the concept of frailty.

Dependence in daily life is a consequence of activity limitation, difficulties an individual may have executing activities, a negative aspect of the ICF component “activities and participation” [43]. The inclusion of dependence in everyday life as a part of frailty is supported by the older adults themselves [121, 122], but others find that this dimension is a consequence of frailty and therefore, logically, not a part of the concept [8, 23, 33]. This ambiguity is also evident in this thesis since the study *Elderly Persons in the Risk Zone* adopts the latter view by operationalizing frailty as a number of core indicators attributable to the ICF component of “body functions and structures”, while healthcare professionals, implementing health-promoting intervention to older adults, view frailty as a multidimensional concept, one whose dimensions can be linked to several components in ICF and, in a far-reaching implication, can be apprehended as the opposite of health in older persons (Figure 5. Note that the figure should only be viewed as a preliminary draft that requires a more thorough linking analysis). However, there may be a non-negligible advantage in separating aspects of frailty attributable to the ICF component “body functions and structures” from aspects of additional frailty dimensions that could be linked to other ICF components since it enables the identification of an “at risk group”, or “pre-frail” older persons, suitable for tailored primary health prevention. But, such an approach might also be questioned if it implies a unidirectional causality between aspects of frailty attributable to body functions and structures and other dimensions of frailty. An alternative method to identify an “at risk group” could be through a compilation of a larger number of aspects of frailty from multiple dimensions with clear limits for non-frailty, pre-frailty, and frailty, in line with the Frailty Index developed by Mitinski et al [123]. Consequently, the continuing debate on the components of frailty points to the present necessity to accept frailty as an umbrella term containing different definitions depending on from which paradigm (a set of assumptions and fundamental questions within a specified context) the concept is viewed. The definition of frailty varies according to whether it is perceived by a specific healthcare profession or a whole cross-professional team, within a research paradigm or in clinical practice, from an “inside perspective” apprehended by older adults themselves or an outside societal perspective. All in all, this underlines the importance of stating clear definitions of the varying concept of frailty in all contexts where it is utilized, especially in research and in health-promotion where the studied population or targeted group needs to be definite and the results measured.





**Figure 5.** The seven dimensions in the concept of frailty found in study II, preliminary linked to ICF.

***The dimension “not being considered important”***

One dimension found to be included in frailty by the healthcare professionals was “not being considered important”. This dimension has previously not been retrieved in any literature on frailty and was discussed in the original article (Study II), a discussion which needs to be elaborated. There is some speculation that this dimension is in fact a general phenomenon of old age, not only a dimension of the concept of frailty. The summarized content: exclusion from involvement in everyday life, that older persons are neither heard, nor asked for, and that others make decisions regarding them could be interpreted as “ageism” - the systematic stereotyping of, and discrimination against people, simply because of their age [124]. Ageism is a social construct that is internalized in the attitudes, beliefs, and behaviors of individuals [125]. Old age is stigmatized with attributes such as physical and mental decline, social withdrawal, and increasing self-preoccupation, which, in turn, legitimize marginalization and the discrimination of older persons. Since older adults who are more engaged in meaningful activities are healthier [57], and the level of occupational engagement is related to life satisfaction [58], excluding older persons from occupations they need and want to do can be interpreted as a form of occupational injustice [51]. Therefore, it is vital to counteract ageism by taking steps to increase older adults’ engagement in occupations and participation in

society. An “active aging” approach [60], to optimize opportunities for older persons to continue to participate in everyday life, to be active contributors to their families, peers, and communities, can counteract ageism. The goals of *Elderly Persons in the Risk Zone* and the contents of the interventions (Tables III and IV) seem to coincide with principles of active aging and may indirectly counteract ageism by encouraging and supporting older persons to remain active and participate in society. This is an extensive assumption, which obviously needs to be examined along with outcomes measuring the participants’ perceived level of participation.

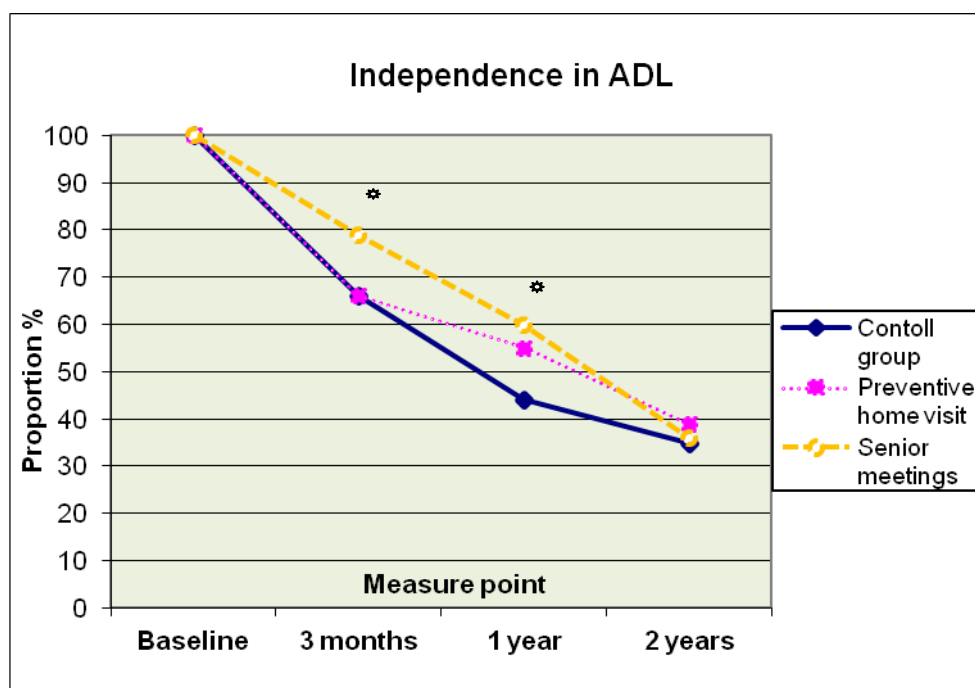
### ***Outcome of health-promoting intervention***

The initial review (Study I) showed that HPDP interventions for frail older adults were only partially effective. Noteworthy was that 13 out of 14 reviewed HPPs failed to achieve a positive result for general wellbeing (including SRH). Also, only half of the HPPs targeting ADL led to significant effects. Closer examination showed that these results had no relation to study quality since studies of both high and low quality demonstrated significant effects and vice versa. One conclusion in study I, supported by other studies [11, 97, 126, 127], was that HPDP programs should target older persons with moderate frailty instead of those with severe frailty, and that HPDP interventions are likely to be more successful if they target older persons at an early stage of frailty. Others takes this issue further and state that primary prevention for older adults should target at risk, pre-frail, individuals rather than non-frail or frail persons [128]. These assertions, in addition to the beneficial results obtained in studies III and IV, imply that the interventions in *Elderly Persons in the Risk Zone* were correctly timed by addressing independently community-dwelling persons 80 years and older as the “at risk” population.

### ***Outcome for ADL***

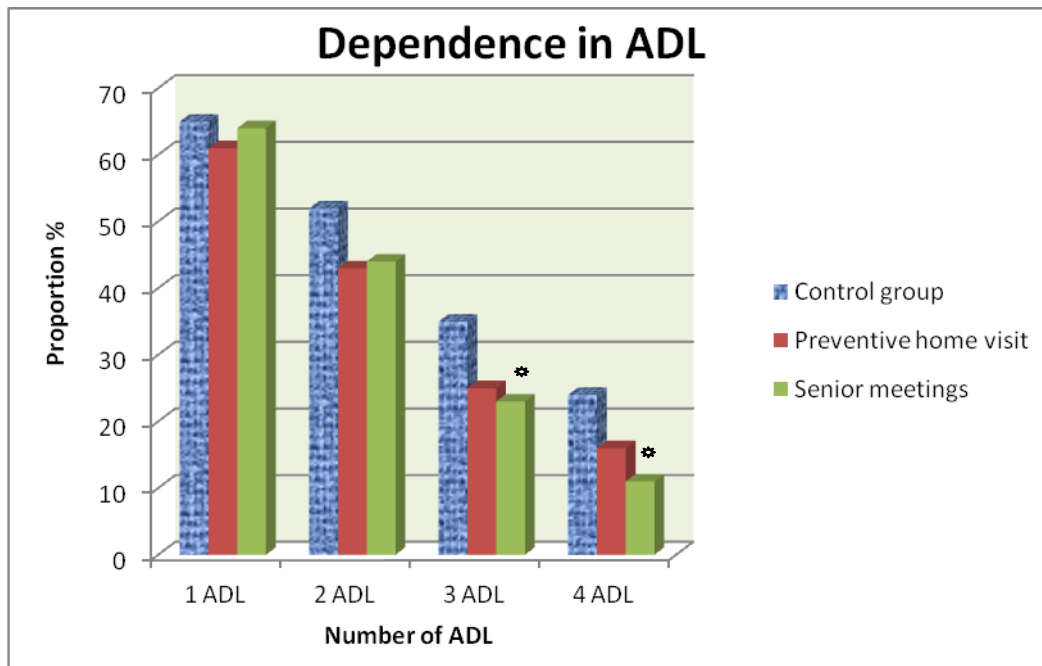
The results concerning ADL in studies III and IV show a clear pattern (Figure 6). The three-month and one-year follow-ups revealed a general downward trend in independence in ADL for all study participants but a significantly higher proportion of independent participants in the senior meetings group. By the time of the two-year follow-up, the differences between the groups regarding the proportions of persons independent in ADL had evened out, but there was a significant difference in favor of the senior meetings as regards the extent of dependence in ADL, which was reduced (fewer areas/items of ADL) (Figure 7). It is noteworthy that a reduction in the extent of dependence in ADL was demonstrated after one

year for participants in a preventive home visit but not after two years. These results add to the growing body of knowledge suggesting that age-related decline can be delayed [5-7], and, consequently, they support the more optimistic theories of longevity [19, 20]. Moreover, the results imply that both interventions support aging in place, and that intervention participants, particularly persons in the advantageous senior meetings, may have experienced a higher quality of life due to the reduced extent of dependence in ADL, a known association [129, 130]. Finally, the reduced extent of dependence in ADL for up to two years suggests that the urban districts might have benefited financially if the intervention participants, above all those in the senior meetings, made less demands on the municipal home care service. Beneficial health-economic effects for preventive home visits to older persons (75+) have been demonstrated earlier [131], but evidence of such effects is so far lacking for multiprofessional senior group meetings and remains to be proven.



\* A significant difference.

**Figure 6.** Proportion of independence in activities of daily living (ADL) between baseline and the two-year follow-up in the study *Elderly Persons in the Risk Zone*.



\* A significant difference.

**Figure 7.** Proportion of dependence in one to four or more activities of daily living (ADL) at the two-year follow-up in the study *Elderly Persons in the Risk Zone*.

### ***Outcome of self-rated health***

Since ADL contribute to health through the component “activities and participation” [43], they interact with SRH. A self-rated judgment of one’s health captures multiple subjective aspects and satisfaction, which also involves aspects of, and satisfaction with, ADL. In doing so, the result for SRH in *Elderly Persons in the Risk Zone* is associated with the result for ADL. Both a preventive home visit and senior meetings delayed deterioration in SRH in the short term, but the senior meetings group did not attain a statistically significant difference on its own compared to the control group. The above reasoning implies that the delay of dependence in ADL at three months may have influenced the delay of deterioration in SRH in the short term for participants in the senior meetings. Hence, it also indicates that other subjective aspects besides ADL were at play since deterioration in SRH was also delayed among the participants in a preventive home visit although their dependence in ADL was not. Nevertheless, the outcome of SRH is vital since SRH has been described as one of the most important client-oriented health outcomes available [132]. The delay of deterioration in SRH might have benefited the participants in the intervention groups in several other ways. For instance, previous research has shown that SRH is an independent predictor of mortality in an aging population [47, 48], an association which implies that participants in both interventions may have had lower mortality rates than the control group. In a recent Swedish study [133],

preventive home visits to older persons (75+) were found to postpone mortality during the time of the intervention, but no such result has been demonstrated so far for multiprofessional senior group meetings. Also, SRH has been demonstrated to be a strong contributor to older persons' reasons for living [134], and better SRH reduces the likelihood of depression symptoms [135]. Thus, delayed deterioration of SRH in the intervention groups may indicate lower rates of mortality and depression and enhanced quality of life scores in the short term, assumptions that need to be further investigated and evaluated in the long term.

### ***Possible success factor in both interventions***

One possible success factor in both interventions is their multi-component contents, which covered a broad spectrum of elements in health for older adults (Tables III and IV). The positive influence of multidimensionality has been supported by others, finding the sum of the parts in an intervention program greater than the value of each separate part [136]. The multidimensionality also reflects a holistic view of health [38], an apparent theoretical basis in both interventions. A holistic view of health in the interventions is also apparent through the different knowledge fields represented by the multiprofessional personnel, particularly in the senior meetings. Also, in considering the overarching aim of *Elderly Persons in the Risk Zone*; to delay the progression of frailty in older adults, preserve their health and quality of life, and minimize their need of medical care [101], various types of knowledge are essential to cover, and grasp, the broad range of aspects that comprise health and frailty in an older population. Consequently, health and frailty in an older population are multiprofessional concerns due to the complexity of both concepts, supporting the need of a cross-professional team in implementing health promotion.

### ***Differences between the interventions***

One difference, possibly explaining their advantage over a preventive home visit, was that the senior meetings were group-based and offered a forum for the exchange of knowledge rather than knowledge transfer [108]. The group setting provided an opportunity for learning from each other and a forum for meeting people in similar situations, experienced as essential content in group intervention for older adults (66-85 years) [137]. That a group setting seems to be a favorable pedagogical form for older persons and has a positive effect on ADL dependence has also been proven by others [138]. The approach of the senior meetings in this study was to encourage people to decide for themselves and, as far as possible, take and maintain control over their own lives. People were informed about how to adapt their

behavior and belief in their competency to perform effective preventive tasks. This approach is consistent with the theories of empowerment [84, 139] and the fact that older adults tend to have a strong inner force for maintaining health in order to age in place and strive to maintain independence and control over their daily lives [62, 140]. This force might have been enhanced by the senior meetings, providing another explanation for the increased and temporally prolonged effects on ADL. In addition, even though the discussions in the senior meetings were guided by predetermined themes (Table IV), they varied according to the participants' individual needs and experiences. This allowed participants to discuss individually meaningful activities of relevance to desired life roles, enabling engagement in occupation, which is important to people's health and participation in life [51-55]. The structure of the discussions also manifested a person-centered perspective, a presumption in an empowering approach, clearly present not only in the senior meetings but also in a preventive home visit. In sum, there are several possible explanations why the senior meetings proved more advantageous than a preventive home visit. Nonetheless, other outcomes in *Elderly Persons in the Risk Zone* remain to be evaluated, and the aggregated results need to be analyzed before the superiority of either intervention can be established.

Finally, the effects of complex interventions for older adults (mean age 65+) have recently been reviewed and the findings imply that earlier studies were more effective than later studies, reflecting improved geriatric care [141]. Hence, the results of this thesis, showing that older adults still have unmet needs, partially refute these findings. This underlines the potential in, and importance of further development of, promising health-promoting interventions. Furthermore, the same study [141] concluded that evidence for the success of complex interventions addressing older people is obvious, and that all older people should be offered preventive intervention. The results demonstrated in this thesis clearly corroborate this claim. Accordingly, healthcare policy specialists and governmental agencies should continue to recognize that health-promoting intervention for older adults must be a key element in healthcare provision.

## **Methodological considerations**

### ***General methodological discussion***

The overall aim of this thesis was complex and dynamic, and the four specific objectives required a variety of methods that reflect a broad scientific approach. In using both qualitative and quantitative methods, an empirical continuum from classical medical research

(positivism) to human sciences (holism) is represented. In addition, the selected methods meet the requirements of reaching from width to depth, from grasping an overview of a research area by a literature review (Study I), to investigating the impact of a specified intervention on a specific aspect of health for a clearly identified group of people (Study IV). Being convinced that both qualitative and quantitative methods are useful in approaching one's research questions is what distinguishes a researcher based in a mixed methods paradigm [142], one that is formed through combining methods from two historically separate paradigms, positivism and holism, and finding them compatible [143]. This paradigm is sometimes enumerated "the third research paradigm", and its goal is to draw from the strengths and minimize the weaknesses of both positions in a single research study and across studies. The mixed methods approach can also be described as pragmatic, a workable solution, and the researcher applying it as "a pragmatic researcher" [144]. In this thesis, mixed methods were used both within the same study, through the transformation of qualitative data into quantitative measures (conversion), as well as between studies, in using both qualitative and quantitative methods in the thesis as a whole (paradigmatic mixing) [145].

The role of the researcher varies widely according to the different methodological approaches adopted. In qualitative methods, as the one used in study II, the researcher is involved and subjective, generalizing reality in the light of time and context. In quantitative methods, as applied in studies III and IV, the researcher is objective, eliminating bias, remaining emotionally detached, and uninvolved with the objects of the study [143]. Consequently, a high degree of consciousness is demanded of the researcher throughout the entire research process. In using mixed methods in this thesis, I gained knowledge of different approaches in science and their dissimilar opportunities and constraints. A limitation, however, was that it was not possible to achieve extended or in-depth knowledge with all methods used but only more superficial knowledge with each method. One can conclude that the use of three different methods in this thesis posed a challenge, but was, at the same time, a strength in that it allowed the mixing and matching of design components that offered the best opportunities for answering the specific research questions. Finally, in using mixed methods, the researcher gains an understanding of multiple methods that, in turn, can facilitate communication and collaboration with other researchers in a wide(r) field of research.

### *Specific methodological issues*

In addition to a general methodological discussion, addressed in the previous section, several specific methodological issues in each study need to be discussed. There are a number of

interesting aspects to discuss in relation to the diversity of methods used in this thesis and the following sections are a selection of them.

### *Use of ICF as a structural framework*

In study I, ICF [43] was used as a structural heuristic framework for the analysis, which resulted in challenges and difficulties described in the original article. The main challenge was found to be the interpretation of the substance in included articles, most of which were probably not written with ICF in mind or with ICF terminology, and to classify it into ICF components. This raises the question of ICF's presence and accessibility in research today. How widely used is ICF, especially in gerontology research, and how is it used? Another linked problem in study I was related to the various ways that one could interpret concepts and categories within the framework itself. Thus, an additional question about the accessibility of ICF, its ease of use, needs to be posed. In a literature review from 2011 [146], investigating the reported use of ICF since its release in 2001 until 2009, the majority of included publications were conceptual papers or papers reporting clinical and rehabilitation studies, and one-third of the them were published in 2008 and 2009. The authors draw the conclusion that ICF has contributed to the development of research on functioning and disability in several contexts and found that its use in a great variety of fields to be proof that a cultural change and a new conceptualization of functioning and disability are taking place.

Even so, there seems to be some doubt about the applicability of ICF in gerontology research after all. A simple compilation of papers included in the aforementioned review, solely based on the titles, shows that out of a total of 670 studies, 25 (4%) had exclusively older adults as an apparent primary focus. The validity of this result is obviously limited, but this surely calls for increased use of ICF in gerontology studies. Concerns have been raised implying possible explanations for the limited use of ICF in gerontology studies so far [147]. One is the lack of precision between the ICF language and existing measures of late-life functioning. In particular, problems in the fit between established ADL measures and performance-based measures of functioning, with the domains of activity and participation, are outlined. This may, in turn, be a consequence of a lack of theoretical differentiation in ICF between the concepts "activity" and "participation", handing over the operationalization of the definitions to the user. Also, the domain for personal factors has not yet been developed, leading to uncertainty in the interpretation of its conceptual meaning. These ambiguities were also experienced in the realization of study I, even though the linking of outcome measures was made on an overall level, not on a detailed level. The latter can be seen as a shortcoming



since use of existing ICF linking rules would have enhanced the quality of the linking process. Consequently, there is a need to further clarify particular domains in ICF and for researchers to obtain, immerse themselves in, and further develop existing linking tools [148, 149].

To sum up, ICF needs to be refined for optimized clarity in some respects, which would enable a full utilization of ICF's potential as a common language for communication of research. In addition, gerontology researchers must not hesitate to apply ICF as a conceptual tool in various areas of research, and, as has been pointed out, jointly develop this language with the ultimate goal of a common language for healthcare research worldwide [150].

### ***Selection of participants for the focus groups***

Focus group discussions were used in study II. This is a widely utilized qualitative method in healthcare research, considered both accepted and established as an academic research tool [105, 151]. Even so, alternative methods might have been equally appropriate in addressing the aim of study II, e.g. individual interviews. The following methodological question concerning study II has already received attention in the original paper but needs further elaboration: the selection of participants. For instance, why were no physicians or dieticians invited to participate in the focus group discussions? The answer is that two main rationales guided the selection of participants. One was a recent review [91], which showed that the four professions chosen (RN, OT, PT, and SW) are the most common ones to be found in cross-professional teams for older persons. The other was the fact that the intervention staff in *Elderly Persons in the Risk Zone* belonged to the healthcare professions selected, making a reasonable connection between study II and the trial evaluated in studies III and IV. Logically, the result of study II may have been different if representatives of other or additional healthcare professions had been included, a postulation that needs to be considered in the understanding of the result.

### ***Linguistic challenge in discussing frailty***

The last methodological issue concerning study II, not previously highlighted, is the translation of the investigated English key concept “frailty” into Swedish. In Swedish today, there is no existing precise linguistic translation of the term. Two denominations are commonly and interchangeably used in the Swedish healthcare discourse; “skörhet” and “sårbarhet”. The complications in qualitatively studying frailty when lacking a precise translation of the concept in the mother tongue has also been recognized by others [122]. Similar to these researchers, precautions were taken in order to reduce any possible confusion

of the translated concept in study II. This included written information on the concept in the invitation letter, personal verbal information to participants, and a short discussion clarifying the meaning of the term in the initial phase of each of the four focus group sessions. An alternative solution would have been to modify the focus group methodology itself, as suggested in a study investigating another elusive concept namely “aging identity” [152]. There, multiple sessions with one and the same focus group were used in order to let the participants reflect between the sessions and in doing so enhance their communication of tacit knowledge, maximally deepen the discussions, and achieve data saturation within the same group. Hence, it can be concluded, that the presence of the linguistic imprecision in the context of study II might have affected the result, implying that this phenomenon should be taken into account in considering the result.

### ***Choice of imputation method***

In the original papers (Studies III and IV), one of the issues discussed was the imputation method, and this will be further elaborated here. The choice of the imputation method was firstly guided by our assumption that persons 80 years and older are expected to deteriorate over time in the natural course of the aging process. Secondly, we had to classify missing data as data missing not at random [153] after analysis of the dropouts showed that they had significantly worse baseline measures than participants at each follow-up. Our study *Elderly Persons in the Risk Zone* verified the selection effect of dropouts that others have already drawn attention to: that dropouts are more likely to show worse outcomes than participants in intervention studies aimed at older adults [154]. Therefore, we applied the median change of deterioration (MCD) as an imputation method. A conservative form of the worst change of deterioration, in turn, related to the single imputation method of the worst case [118]. However, other methods might also have been appropriate, for example, a different pre-specified imputation technique for each different reason for withdrawal. A realization of this alternative could have been to replace missing data due to death with the worst rank [155] in addition to missing data for other reasons being imputed with the MCD. Even so, this optional method would probably not have led to a different final result in studies III and IV since the low mortality rates for dropouts were evenly distributed between the study arms (at two-year follow-up: control group 5%, preventive home visit 7%, and senior meetings 6%).

Finally, in considering the results of studies III and IV, it is important to be aware that there is no universally applicable method of handling missing values, and that different approaches may lead to different results. But, the conservative choice of the imputation

method used in studies III and IV rather underestimates than overestimates the intervention effects, implying that the effects might have been more pronounced than those demonstrated.

### ***Potential influence of self-reported outcomes***

Another methodological aspect of studies III and IV is the influence that the structured interviews used for data collection might have had on the results. The interviews mainly contained self-reported outcomes and, amongst them, measures of frailty, SRH, and ADL. This raises the question of advantages and disadvantages of using self-reported outcomes in gerontology studies, and their possible impact. One study [156] reported that older adults (60-84 years) who scored high on neuroticism were more likely to report disability, suggesting that neuroticism may play an important role in subjective perception and should be considered when interpreting data based on self-reports. Others have found that cognitive impairments amongst older persons (77+) seemed to increase the risk of discrepancies between self-assessment and performance-based measures [157], and that self-reported ADL by the oldest old (80+) not only reflect objective measures of functioning but probably also subjective components [158]. In contrast, a review of 17 studies examining correlations between assessments of function obtained using self-report and those obtained using performance-based measures for community-dwelling older adults (55+) found that both approaches probably reflected a similar assessment of function [159]. Also, an important factor to take into account regarding this issue, in accordance with a practical perspective on research, is that self-reported assessments require less time and expense than performance-based assessments. It is probable that more than one measure and approach in evaluating functional ability in older adults is needed, a requirement partly implemented in *Elderly Persons in the Risk Zone* in which some outcomes had multiple measures and some were measured both by a self-report and a performance test. However, only one method was applied for measuring independence in ADL, suggesting that factors discussed above might have affected the result. Finally, the structured interviews took place in the homes of participants, which was obviously an advantage, as the research assistants were able to clarify any questions arising, resulting in a more precise response from the participants. This practice most likely enhanced the validity in the interviews.

### ***Possible bias due to the Hawthorne and the Placebo effects***

A final subject to discuss is a possible bias of the results in studies III and IV due to the Hawthorne and the Placebo effects. The Hawthorne effect is a form of reactivity whereby

subjects improve or modify an aspect of their behavior being measured experimentally simply in response to the fact that they are being studied [160], not in response to any intervention. Consequently, results of clinical trials can be upwardly biased by the attention given to the participants. This phenomenon was investigated in a recent intervention study [161], where half of the improvement in the primary outcomes was found to be attributed to the Hawthorne effect. Translated into the context of *Elderly Persons in the Risk Zone*, in its most negative staging, this could signify that the positive results gained actually were much smaller and that no benefits would be attained when implementing the interventions in the common routine of community practice. However, an incidence of a Hawthorne effect of the described magnitude would cause the results of many clinical trials to be seriously questioned, and consequently, the concept has been challenged. Others, aiming at examining the concept and its use in research, found that it had multiple, contradictory, and imprecise meanings [162]. They concluded that the concept has no useful role in the discussion of research findings.

Another phenomenon often referred to in methodology discussions, similar to the Hawthorne effect, is the Placebo effect - a beneficial effect in a patient following a particular treatment that arises from the patient's expectations concerning the treatment rather than from the treatment itself [163], also a possible bias in *Elderly Persons in the Risk Zone*. Participants in the two interventions might have had high expectations of the intervention effect and thereby scored higher on the outcomes than their actual status in comparison with the participants in the control group. This expectation of beneficial effects might also explain why the number of dropouts in the control group was significantly higher than in the intervention groups. This explanation is regarded as less likely, and the result has been interpreted instead to mean, in addition to dropouts having worse outcomes, that the participants were motivated to stay in the intervention groups by real beneficial effects. This interpretation is in line with others [164], who state that the Placebo effect is not a single, and certainly not a primary, explanation of bias in reported improvement of outcomes. Instead, there is a multiplicity of factors to be considered, e.g. fluctuation of symptoms, answers of politeness, and additional treatment. In sum, even if the Hawthorne and the Placebo effects might be less useful concepts in discussing intervention trial methodology, it is important to consider possible uncontrolled-for events and their influence. Possible bias of results in an intervention trial, such as *Elderly Persons in the Risk Zone*, is as confirmed above, an extensive and complex subject, which demands deeper reflection on the part of the researcher in interpreting data and drawing conclusions.

## CONCLUSIONS

In conclusion, this thesis has revealed that the definition of frailty in a selection of the research literature was ambiguous and that healthcare professionals view frailty in older adults as a complex and multidimensional concept which does not coincide with the frequently utilized unidimensional definitions. Consequently, the definition of frailty varies according to the different paradigms of the users. This conclusion underlines the importance of stating clear definitions of the varying concept of frailty in all contexts, especially in research and in implementing health-promoting intervention for older adults where the studied population or targeted group needs to be definite and the results measured.

In addition, it can be concluded that health-promoting interventions, made when older adults are at risk of becoming frail, can delay deterioration in self-rated health in the short term and dependence in ADL both in the short and in the long term. Also, a multiprofessional group intervention such as the senior meetings described seems to have a greater impact on delaying deterioration and reducing the extent of dependence in ADL than a single preventive home visit. This demonstrates the potential in *Elderly Persons in the Risk Zone* and the importance of further evaluation of outcome in, and the development of, this promising health-promoting intervention. Accordingly, healthcare policy specialists and governmental agencies should continue to recognize that health-promoting intervention for older adults must be a key element in healthcare provision.

## **FUTURE RESEARCH**

This thesis has proven that a selection of outcome measures in the RCT *Elderly Persons in the Risk Zone* has beneficial effects both in the short and in the long term. However, other outcomes of interest remain to be studied, separately as well as in correlation with each other, in the short and in the long term. Consequently, several such studies are under way. More specific ideas for future research are to apply a gender perspective to the outcome and also to analyze if type of housing, education, living alone or cohabitating affect the results. Such analysis could provide an indication of which intervention is more appropriate for each subgroup of older adults and whether the intervention content could be further tailored to specific requirements. In addition, the beneficial result of the senior meetings, the reduced extent of dependence in ADL for a period of up to two years, had led the researcher to reflect whether the effects of this intervention could be further augmented to also include postponed deterioration of dependence and perceived insecurity in ADL at two years. In response to this idea, a suggestion to include booster sessions in the implementation of the senior meetings was discussed in study IV. It would be highly interesting to add one or two booster sessions to the present four senior meetings and the one follow-up, and to evaluate this proposed novel approach.

Qualitative studies of older adults' experience of participating in the two interventions in *Elderly Persons in the Risk Zone* are essential in order to deepen the understanding of the content in "the black boxes" of the interventions. Such studies are, at the time of writing, in progress and will certainly add valuable knowledge. In addition, it is of interest to study the health economic effects of the interventions described in this thesis, as well as other outcomes, and again some research is already being undertaken in this area. A complete aggregate picture of all the different aspects of the two interventions in *Elderly Persons in the Risk Zone* will enable a judgement of their overall benefits, future usefulness, and utility.

Finally, additional studies of the concept of frailty are needed in order to unravel ambiguities and to increase the knowledge of this complex idea. In particular, further attention should be paid to the perspectives of other healthcare professionals than those represented in study II, of professionals in different contexts, and of the older adults themselves.

## SWEDISH SUMMARY

**Huvudsyftet** med avhandlingen var att öka förståelsen för begreppet skörhet (frailty) i relation till äldre personer samt att granska och utvärdera resultaten av hälsofrämjande intervention för hemmaboende äldre personer.

**Metoder:** I studie I granskades definitioner av skörhet som användes i hälsofrämjande intervention för sköra äldre personer samt innehållet i, organisationen och effekterna av interventionen genom att använda Klassifikation av funktionstillstånd, funktionshinder och hälsa (ICF) som strukturell ram. I studie II belystes hälso- och sjukvårdspersonalens syn på skörhet hos äldre personer med hjälp av kvalitativa fokusgruppdiskussioner. I studierna III och IV utvärderades resultatet av skörhet, självskattad hälsa samt oberoende och upplevd säkerhet i aktiviteter i dagligt liv (ADL) i den randomiserade och kontrollerade studien *Äldre Personer i Riskzon* genom kvantitativa analyser. Studien riktade sig till och var anpassad för hemmaboende äldre personer (80+) som löper risk att bli sköra och den bestod av två interventioner: ett förebyggande hembesök och fyra multiprofessionella senior gruppträffar med ett uppföljande hembesök jämfört med en kontrollgrupp.

**Resultat:** Ett flertal olika definitioner av begreppet skörhet användes i studier av hälsofrämjande intervention för hemmaboende sköra äldre personer. Studierna innehöll ett brett spektrum av interventioner som i vissa delar var effektiva. Hälso- och sjukvårdspersonal uppfattade skörhet hos äldre människor som ett komplext begrepp bestående av sju dimensioner: ”att vara kroppsligt svag och sjuk”, ”att vara negativt påverkad av personliga egenskaper”, ”att sakna balans i vardagliga aktiviteter”, ”att vara beroende i det dagliga livet”, ”att inte anses viktig”, ”att hindras av fysisk miljö och bristfällig samhällsservice” och ”att ha ett otillräckligt socialt nätverk”. Båda interventionerna i *Äldre Personer i Riskzon* fördröjde försämring av självskattad hälsa på kort sikt samt minskade omfattningen av beroende i ADL under en period upp till ett år. Seniorträffarna befanns vara den mest fördelaktiga interventionen eftersom de fördröjde beroende i ADL fram till ettårsuppföljningen och minskade omfattningen av beroende i ADL under en period upp till två år. Ingen effekt på skörhet eller upplevd säkerhet i ADL kunde påvisas.

**Slutsats:** Definitionen av begreppet skörhet varierar beroende på användares olika paradigmer. Detta understryker vikten av att ange en tydlig definition av begreppet skörhet i alla sammanhang, särskilt inom forskning och hälsopromotion. Hälsofrämjande interventioner som görs när äldre personer löper risk att bli sköra kan fördröja försämring av självskattad hälsa på kort sikt och beroende i ADL på både kort och lång sikt. Seniorträffar verkar ha en större inverkan på att fördröja försämring och minska omfattningen av beroende i ADL än ett förebyggande hembesök. Detta visar på potentialen i *Äldre Personer i Riskzon* och vikten av att vidare utvärdera resultaten och utveckla denna lovande hälsofrämjande intervention.

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