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Everyday life and home modification for older adults

- Impacts, concepts and instrument development

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ABSTRACT

The general aim of this thesis was to increase knowledge about the impact of home modifications (HMs) on aspects of everyday life tasks among older adults living with disability. The thesis also aimed to further develop an instrument assessing ability to perform everyday life tasks and to explore and describe experiences of safety and security in everyday life after home modifications.

This thesis included four studies. In **Study I** the psychometric properties of the Client-Clinician Assessment Protocol (C-CAP) Part I used on older adults in need of HM were investigated using Rasch rating scale model. The C-CAP Part I collects data on self-rated independence, difficulty and safety in everyday life tasks. In **Studies II and III** the C-CAP Part I was used to investigate perceived ability to perform everyday life tasks after HM, using a pre-post test design with an intervention and a comparison group. In **Study II** changes in everyday life tasks after HM were investigated using data from baseline and a two-month follow-up. Then in **Study III** a mixed methods analysis was applied, investigating perceived difficulty in everyday life tasks and confounding factors influencing perceived difficulty up to six months after HM. In **Study IV** qualitative interviews were conducted with eight older adults, based on a grounded theory approach focusing on safety and security in everyday life tasks after HM. The interviews were analyzed using a comparative method in combination with a hermeneutic interpretation.

The findings in **Study I** showed that the three scales in C-CAP Part I had both strengths and limitations when used on older adults in need of HM. The difficulty scale showed acceptable internal scale validity, person response validity, and person separation reliability, whereas the independence scale did not show internal scale validity and the safety scale showed a low person separation reliability. In **Studies II and III** the results showed that persons receiving HM perceived their ability to perform everyday life tasks to be less difficult and safer up to six months after the HM installation. The largest changes in everyday life could be seen in tasks related to the received HM, such as showering, getting into and out of the home, and transferring on stairs. Furthermore, the time people had to wait for their HM to be installed was found to have a negative impact on the person's ability to perform everyday life tasks. In **Study IV** the findings revealed that to feel safe and secure in everyday life was based on three prerequisites: feeling healthy, having someone to rely on and feeling at home. The fulfillment of these prerequisites also impacted on the participants' strategies for handling problems in everyday life tasks, as well as on the ability to use and benefit from technology such as HM.

In conclusion, the studies included in this thesis have contributed new knowledge related to older adults and aspects of perceived ability to perform everyday life tasks, impacts of HM, and the development of central concepts and an instrument. The findings show that HM has a positive impact on perceived ability to perform everyday life tasks for older adults. Older adults receiving HM report decreased difficulty and increased safety in the performance of everyday life tasks. Impacts of HM also found to be related to personal aspects were the ability to feel safe and secure, and also the possibility to benefit from HM was based on the degree of fulfilled prerequisites. Furthermore, the C-CAP Part I is considered to be a beneficial instrument to apply when investigating impacts of HM, although it needs to be revised. In the process of evaluating and developing instruments it became apparent that the need of a theoretical understanding and definition of central concepts is of vital importance. The findings provide a useful contribution to clinical practice not only for occupational therapists, but also for other professionals who meet older adults with disabilities who are aging in place.

Key words: community living, environmental interventions, occupational therapy, ADL, self-report, elderly, intervention study, autonomy.

LIST OF PUBLICATIONS

This thesis is based on the following publications, referred to in the text by their roman numerals:

- I. **Petersson, I.**, Fisher, A.G., Hemmingsson, H., & Lilja, M. (2007). The Client-Clinician Assessment Protocol (C-CAP) Part I: Evaluation of its psychometric properties for use with people aging with disabilities in need of home modifications. *OTJR: Occupation, Participation and Health*, 27 (4), 140-148.
- II. **Petersson, I.**, Lilja, M., Hammel, J., & Kottorp, A. (2008). The impact of home modification services on ability in everyday life for people ageing with disabilities. *Journal of Rehabilitation Medicine*, 40, 253-260.
- III. **Petersson, I.**, Kottorp, A., Bergström, J., & Lilja, M. (in press). Longitudinal changes in everyday life after home modifications for people aging with disabilities. *Scandinavian Journal of Occupational Therapy*.
- IV. **Petersson, I.**, Lilja, M., & Borell, L. Concepts related to being safe and secure in everyday life- – A study of older adults' experiences after home modification (*in manus*).

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LIST OF ABBREVIATIONS

AERA	American Educational Research Association
AHM	Agency of Home Modification
APA	American Psychological Association
CAOT	Canadian Association of Occupational Therapist
C-CAP	Client-Clinician Assessment Protocol
FIM	Functional Independence Measure
FSA	Förbundet Sveriges Arbetsterapeuter
HM	Home modification
HMP	Home modification project
I-ADL	Instrumental activities of daily living
ICF	International Classification of Functioning, Disability and Health
<i>MnSq</i>	Mean Square
MOHO	Model of human occupation
NCME	National Council on Measurement in Education
OARS	Older American Resources and Services
P-ADL	Personal activities of daily living
RCT	Randomized controlled trail
SE	Standard error
SFS	Svensk Författningssamling

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INTRODUCTION

My interest in older adults' and their ability to perform everyday life tasks after home modification (HM) started during my clinical practice as an occupational therapist working in community-based rehabilitation. As an occupational therapist in this area of practice, one of the most important services is to enable people to live in their homes and to perform everyday life tasks. In my clinical practice I saw that for community-living older adults with reduced abilities, the home could be associated with physical environmental problems. For instance, stairs constitute a barrier in their everyday lives such as doing the grocery shopping or just picking up the mail. Working as an occupational therapist in the community I used HM as an intervention for reducing environmental barriers. At the same time I often asked myself – What impact does HM have on older adults' everyday life tasks? HMs are defined as individually tailored architectural and structural interventions to the home or immediate outdoor environment, such as ramps, stair lifts, widened doorways and automatic door openers (Boverket, 2000). HM is a commonly used intervention within occupational therapy (Fänge & Iwarsson, 2007; Gitlin, 1998; Stark, 2003), and especially for older adults who are facing problems with the performance of everyday life tasks due to barriers in the home environment (Johansson, 2008; Gitlin, Mann, Tomit & Marcus, 2001a; Socialstyrelsen, 2008). HM interventions are often used to reduce these barriers and improve the person's ability to perform everyday life tasks. However, knowledge about everyday life after HM for older adults is lacking and has not been given much attention in research. Despite the common use of HM we do not know if these interventions impact on the older adults' everyday lives. In addition to the lack of knowledge, there is also a lack of suitable instruments to apply within occupational therapy in order to investigate changes in everyday life tasks after HM. Therefore, this thesis will focus on instrument development, central concepts, and on investigation impacts of HM on perceived ability to perform everyday life tasks after HM for older adults. The thesis applies a user's perspective, i.e. the perceptions of the older adults, and has an occupational perspective, focusing on the perceived ability to perform a task.

BACKGROUND

In order to facilitate an understanding of the focus of, and the rationale behind this thesis, a theoretical background is provided in the following chapter. The background aims at providing an overview of: older adults aging with disabilities and their everyday lives, HM

interventions and impacts, theoretical reasoning, and methodological challenges in assessing aspects of everyday life tasks after HM.

Older adults with disability in Sweden

The concept of disability

In this thesis the population in focus was older adults with disability. The perspective on and the concept of disability has been widely discussed within healthcare (Hammel, Charlton, Jones, Kramer & Wilson, 2008; Putnam, 2002; Stark, 2001). For long the medical model has been the most commonly used in order to explain disability. According to this model a disability is based on a person's functional limitations and the impact from the environment is not considered. However, the disability rights movement views disability differently and emphasizes the impact of the environment for the creation of disability. The disability rights movement's definition is based on the social model of disability that stresses how societal barriers in the environment such as political and structural systems are the reasons for disability, and emphasizes the right for persons with disabilities to participate in society (Hammel et al., 2008; Shakespeare, 2006). In occupational therapy a person's ability as well as disability is regarded as resulting from a combination of both personal and environmental factors (Kielhofner, 2008). A similar line of reasoning can also be found in the International Classification of Functioning, Disability and Health (ICF) (WHO, 2001). The ICF is a biopsychosocial model and classification system that provides a framework describing health, human functioning, and disability. The ICF integrated the views from both the medical model and the social model and hence take both personal and environmental approaches towards explaining functioning and disability. According to ICF the concept of disability is an umbrella term that describes health problems in relation to impairments in body functions and structures, activity limitation, and participation restriction. The contextual factors, including environmental and personal factors, impacts both positively and negatively on the person's disability or functioning (WHO, 2001). Older adults in need of HM may experience disability on all three levels. As an example, older adults may have reduced muscle power in the legs (impairment in body functions and structures). This problem may lead to activity limitations such as problems with climbing stairs, but also to participation restriction in leisure or social activities. Contextual factors such as a lack of elevator may impact on these problems. HM can be regarded as an intervention to reduce activity limitation and participation restriction. In

conclusion ICF (2001) views disability (expressed as impairments, activity limitations, and participation restrictions) as the result of a dynamic interaction between the health condition and contextual factors (WHO, 2001). In this thesis disability is viewed in relation to the theoretical framework (Kielhofner, 2008; Lawton & Nahemov, 1973, Lawton, 1989), which has a similar perspective of disability to that of ICF (2001) as being created through an interaction between components related to the person and the environment. However the theoretical framework also regards tasks such as climbing stairs as being a component that impacts on the ability or disability to perform a task. In this thesis disability is therefore understood in an occupational context and indicates a reduced ability to perform an everyday life task at home and in the community, related both to personal factors but also to the environment, or both (Kielhofner, 2008; Lawton & Nahemov, 1973, Lawton, 1989).

Aging in Sweden

Sweden has one of the oldest populations in the world (Larsson, 2006). In 2005, 17% of the population consisted of persons over the age of 65; the number of older persons will increase in the future and be close to 23% of the population in 2030 (Socialstyrelsen, 2008). A majority of the older adults live in ordinary housing (94%) and most are women (Larsson, 2006). In Sweden political strategies have been targeted since the 1980s towards enabling older adults to age in their own homes, i.e. to age in place (Larsson, 2006; Socialstyrelsen 2000). To age in place means to be able to live in the home for as long as possible (Socialstyrelsen, 2000; 2008). The local authorities are responsible for ensuring that the older adults are able to age in place and to provide necessary services (Socialstyrelsen 2008). The supportive services include home help services, day care, security alarms, night patrols, meals on wheels, assistive devices, and transport services. HM is also an example of a service provided by the local authorities in order to enable aging in place, by remodeling the home and immediate outdoor environment to improve accessibility (Larsson, 2006; Socialstyrelsen, 2007).

Aging has been found to be strongly associated with an increased risk of health problems and disability (Femia, Zarit & Johansson, 2001; Iwarsson, 2005; Kemp & Mosqueda, 1997; Socialstyrelsen, 2008; Thompson, 2004). In general, older adults are defined as persons over the age of 65 (Socialstyrelsen, 2008; Thompson, 2004). However, aging is a dynamic process not always related to the chronological age (Krause & Adkins, 2004). Research has found that people who live with impairments in body functions and experience an early onset of chronic conditions experience age-related disability earlier than

people who experience the process of normal health decline associated with aging (Campbell, Sheets & Strong, 1999; Kemp & Mosqueda, 1997; Krause & Adkins, 2004; Putnam, 2002). This accelerated aging indicates that a person with chronic conditions such as polio or rheumatoid arthritis can experience symptoms of early aging such as osteoarthritis, respiratory disease, and circulatory disorders in adult life, 20 to 25 years earlier than people who experience a later onset of chronic health conditions (Campbell et al., 1999; Kemp & Mosqueda, 1997).

In conclusion, the older population is increasing. In Sweden, older people are supposed to age in place. However, as people age the risk of disability increases due to a combination of aspects related to the person, the health condition, and to environmental factors. Aging can therefore be associated with problems performing everyday life tasks in the home and in the community.

The impact of aging on everyday life tasks

As previously described, as people age and experience health problems the ability to perform everyday life tasks often decreases (Femia, Zarit & Johansson, 2001; Iwarsson, 2005; Kemp & Mosqueda, 1997; Socialstyrelsen, 2008; Thompson, 2004). In this thesis, ability to perform everyday life tasks has been in focus. Everyday life tasks are defined here as self care, transfers, home maintenance, and leisure. These tasks are also sometimes referred to as personal activities of daily living (P-ADL) and instrumental activities of daily living (I-ADL). Tasks include for example to dress oneself, to take a bath, to take a walk, to clean the house or to shop for groceries.

Empirical studies investigating aging and everyday life for older adults have found that problems in everyday life tasks increase gradually as a consequence of aging, including reduced performance capacity through decreased health (Ahacic, Kåreholt, Thorslund & Parker, 2007; Ernsth Bravell, Berg & Malmberg, 2008; Jagger, Arthur, Spiers, Clarke, 2001; Iwarsson, 2005). Problems in everyday life often begin with tasks related to home-maintenance tasks such as grocery shopping and cleaning, and are later followed by problems with transfers and self-care tasks such as dressing and personal hygiene (Agahi et al., 2008; Femia, Zarit, & Johansson, 2001; Lawton & Brody, 1969). There can be several explanations for the decrease in ability, related both to personal and environmental factors (Kielhofner, 2008; Lawton & Nahemov, 1973, Lawton, 1989).

In a systematic literature review by Stuck and colleagues (1999), risk factors for reduced ability to perform everyday life tasks for community-living older adults were investigated. They identified that cognitive impairment, depression, isolation, poor self-rated health, and low level of physical activity impacted on the older adults' ability to perform everyday life tasks. Furthermore, studies conducted in both Sweden and Denmark have found that a reduced physical performance capacity such as pain and fatigue are common for older adults and have large impacts on their ability to perform everyday life tasks (Ahacic et al., 2007; Avlund, Vass & Hendriksen, 2003).

However, as previously described, problems in everyday life tasks may not only be a consequence of the person's reduced performance capacities; they may also be related to barriers and inaccessible environments (Kielhofner, 2008; Lawton & Simon, 1968; Lawton & Nahemov, 1973, Lawton, 1989). Empirical research has also found that the home environment has a vital role for older adults' abilities to perform everyday life tasks (Iwarsson, 2005; Gitlin, 2003; Oswald et al., 2007). The ENABLE-AGE Project (Oswald et al., 2007) is a large cross-national, interdisciplinary European project including five countries. It aims at increasing understanding of the relationship between housing, health, and everyday life in the aging process. Findings from this project showed that both objective and self-reported housing satisfaction were related to both well-being and ability to perform everyday life tasks for older people in all five countries. Older adults who perceived their housing as useful had greater well-being and were more independent in their everyday life tasks (Oswald et al., 2007). Furthermore, researchers have found that many older adults with disability have barriers in their home environments that hinder their abilities to perform their everyday life tasks. The barriers are often physical and are mostly found in stairways and bathrooms (Gitlin et al., 2001a; Iwarsson & Isaksson, 1996; Mann, Hurren, Tomita, Bengali & Steinfeld, 1994; Stark, 2001).

Problems with performing everyday life tasks are experienced differently by older adults. The problems may be shown as increased dependency, greater difficulty, lack of safety, or as a reduced efficacy in performing a task (Birge James, 2008; Fisher, 2005; Thompson, 2004) such as getting into and out of the bathtub. Researchers have identified that experiencing difficulty in the performance of a task impacts on the older adult's everyday life. In a series of studies it has been found that people experiencing difficulties in everyday life tasks have an increased risk of developing disability, dependency, and greater healthcare needs as well as a higher risk for future dependency and disability (Fried, Young, Rubin, & Bandeen-Roche, 2001; Gill, Allore & Guo, 2003; Gill, Robison, & Tinetti, 1998; Jagger et al.,

2001). Furthermore, experiencing difficulty in the performance of everyday life tasks can also lead to a lower level of self-rated health, as well as a higher degree of depression and social isolation (Femia et al., 2001). Martin and colleagues (2005) also found that difficulty in the performance of everyday life tasks increased people's fear of falling (Martin, Hart, Spector, Doyle & Harari, 2005). Similarly, experiencing unsafety has been shown to decrease involvement in the performance of everyday life tasks for older adults (Mann et al., 1994; Zimmer & Chappell, 1999), and to advance disability (Brenes et al., 2005). It is also one of the most common reasons for dependency and placement in nursing homes (Cheek, Ballantyne & Roder-Allen 2005; Fonad, Robin Wahlin, Heikkilää & Emami, 2006; Socialdepartementet 2008).

In conclusion, older adults often face a reduced ability to perform everyday life tasks due to a combination of reduced performance capacity and barriers in the environment. Experiencing problems such as difficulty and unsafety has been shown to decrease older adults' involvement in everyday life tasks and to reduce the ability to age in place. From this conclusion one could say that there are two ways to support older adults' everyday lives and aging in place – to increase their performance capacity and/or decrease barriers in the environment.

Home modification intervention and impacts on everyday life tasks

Home modification intervention in Sweden

In general, in Sweden HM is an intervention used to remove barriers in the environment in order to enable a person's performance of everyday life tasks. HMs are defined as individually tailored interventions including architectural and structural modifications to the home or immediate outdoor environment. Examples of HMs are ramps, stair lifts, widened doorways, and automatic door openers (Boverket, 2000). The definition of and regulation of HM differs between countries. In Sweden HM services are regulated by law (Svensk Författningssamling (SFS) 1992:1574). In the law it is stated that persons with functional limitations who experience problems in everyday life have the right to receive HM grants in order to modify the home and make it possible to live an independent life (SFS 1992:1574). The local authorities are responsible for administering the HM grant. The grant consists of a financial contribution that should cover reasonable costs related to a specific HM. Funding is provided irrespective of the financial situation of the applicant and is not dependent on a

person's housing situation – whether they are living in a rented or owner-occupied apartment or house. In order to receive HM a person has to apply for the grant from the local authorities. In addition, a professional such as an occupational therapist or physician needs to certify that the person concerned has a genuine need for a modification to address the problems he or she encounters in everyday life due to a permanent functional limitation. The final decisions concerning the approval or refusal of an application are made by the local authorities in conjunction with the applicant, and when the applicant does not own the dwelling, also with the applicant's landlord. The HM is later installed by professionals, i.e. contracted carpenters with specific competence in HM. The HM process is described in more detail elsewhere (Boverket, 2000).

The number of applications for HM and the cost of HMs in Sweden are increasing annually. In 2006 about 60 thousand HM grants were approved at a total cost of 897 million Swedish crowns. In relation to the Swedish population, Boverket has calculated that 0.7% of the overall population in Sweden applies for an HM annually (Boverket, 2007). However, there is a general lack of statistics describing the persons in need of HM, i.e. those who constitute this 0.7% of the population. Previous research studying persons in need of HM in different parts of Sweden has indicated that the majority of persons applying for HMs are older adults (over the age of 65 years) (Arman & Lindahl, 2005) with a mean age of around 75 years (Fänge & Iwarsson, 2005; Johansson, Lilja, Petersson & Borell, 2007). From the official statistics in 2006 it can be seen that most HM grants are generally small, covering modifications under 5000 Swedish crowns. Furthermore, the HMs most applied in newer buildings were removal of thresholds, hand rails and modifications to bathrooms. The degree of refusal of HM grants was 3% in 2006, indicating that most persons who apply also receive their HMs (Boverket, 2007).

Impacts of home modifications on everyday life tasks

In spite of the wide use of HM the extent of research and knowledge of HM impacts on performance of everyday life tasks is still limited. Most of the research within this field is concentrated to Sweden and to the United States (Fänge & Iwarsson, 2005; Gitlin, Winter, Dennis, Corcoran, Schinfeld & Hauck, 2006a; Johansson, 2008; Mann, Ottenbacher, Fraas, Tomita & Granger, 1999; Stark, 2004). As previously stated, HM is defined differently from country to country, making comparisons of research findings problematic. In the United States, HM intervention is often included as a part of broader sector labeled environmental interventions. These environmental interventions can include HM, assistive devices, and oral

instructions by an occupational therapist. The diversity of the intervention definitions is problematic and should be taken into consideration when making comparisons of research findings.

In a randomized trial by Mann and colleagues (1999), the impacts of an assistive technology and environmental intervention program for frail older adults were evaluated. The findings indicated that participants who had received environmental interventions showed less decline in functional dependence than those in the comparison group. This study also shows that the provision of environmental interventions has economic benefits, as it reduces the need for institutional and in-home personnel. Furthermore, in a series of studies Gitlin and colleagues (Gitlin, Corcoran, Winter, Boyce & Hauck, 2001b; Gitlin, Hauck, Winter, Dennis & Schulz, 2006b; Gitlin, Winter, Corcoran, Dennis, Schinfeld, Hauck, 2003; Gitlin et al., 2006a) have investigated environmental interventions for persons with Alzheimer's disease and their caregivers and also for frail older adults. In a trial from 2001, Gitlin and colleagues investigated impacts of an environmental intervention program for older adults with Alzheimer's disease and their caregivers. The findings suggested that environmental interventions have positive, but not statistically significant impact on everyday life tasks by reducing the decline in I-ADL dependency, as well as on enhancing caregiver self-efficacy (Gitlin et al., 2001). These results were further confirmed in a later study, where a reduced burden was identified for caregivers of persons with Alzheimer's disease who had received environmental interventions. This study did not, however, find that the persons with Alzheimer's disease had any beneficial impacts on their ability to perform everyday life tasks after the intervention (Gitlin et al., 2003). In more recent studies by Gitlin and colleagues, a multicomponent intervention program for vulnerable older adults was investigated. The first study identified a statistically significant reduction in level of difficulty in both P-ADL and I-ADL, as well as in fear of falling for persons receiving the intervention. The effect was also found to be sustained at the 12-month follow-up, indicating a longitudinal impact of the intervention (Gitlin et al., 2006a). In a subsequent study the intervention was also shown to have a positive impact on survival (Gitlin et al., 2006b). In a longitudinal study conducted in Sweden, Fänge & Iwarsson (2005) investigated functional dependency in everyday life tasks for a general sample of persons receiving HMs. The study did not identify any overall changes in functional dependency over time; however a significant decrease was noticed in dependency for the bathing item.

Aside from these longitudinal or randomized trials, some smaller investigations considering environmental interventions have also been conducted. In a study by Stark (2004)

impacts of an occupational therapy intervention for 16 older persons, including HMs, were investigated. The results indicated that the older adults perceived themselves as more satisfied with their performance of everyday life tasks after the intervention. In a study conducted in the United Kingdom, Heywood (2005) interviewed a mixed group of people receiving HM about its effectiveness. Heywood found that HMs can be effective if they are based on the person's needs. Interventions that, on the other hand, failed to incorporate and respect the person's privacy, sense of control, or connection to the home could be harmful for the client. Similar results were also found in a study by Johansson (2008) and Tanner, Tilse & de Jonge (2008), where qualitative studies were conducted with older adults who had received HM. The findings indicated that impacts of HM are influenced by the meaning of the home and the service delivery process. Interventions that are based on the older adults' perceived needs have a positive impact and can reinforce the home as a place of meaning and safety for the older adult.

The studies presented above summarize the research within the impact areas of HM for older adults. The limited research on impacts of HM indicates a positive impact on performance of everyday life tasks. Older adults report greater satisfaction, reduced difficulty and fear of falling, as well as a small and not significant trend of reduced functional dependence after receiving the intervention. Further the studies showed that the intervention could impact on survival and moreover provide economic benefits. However, viewing these studies altogether some common methodological issues can be detected, which should be taken into consideration.

First, the majority of the research presented has been conducted in the United States and has investigated impacts of environmental interventions. These interventions include not only HMs but also assistive technology, home renovations, and behavioral interventions which should be considered when making comparisons of research findings across countries. The findings therefore indicate that changes in the home environment may have beneficial impacts on performance of everyday life tasks (Gitlin et al., 2001b; 2006a; Mann et al., 1999), however the specific impact of HM defined as architectural and structural modifications to the home environment still remains largely undocumented.

Second, functional independence has been used to a large extent as an outcome measure in the studies of HM without finding any larger impacts. This indicates a need for using new methods and outcome measures in order to provide more insight into impacts of HM in the performance of everyday life tasks.

Third, the findings provided by Heywood (2005), Johansson (2008) and Tanner et al. (2008) are important and highlight the complexity of providing interventions in the home environment. These studies also provide insights on the individuality of HM impacts as being related to personal aspects such as perceived problems and needs and attachment to the home. Within occupational therapy a focus on the persons and their values and needs, i.e. client-centered practice, is regarded as fundamental in order to understand impacts of intervention and changes in the performance of everyday life tasks (Kielhofner, 2008; Law, 1998). Furthermore, the home environment cannot be considered a neutral place but rather a place of great individual value, meaning, and identity for its inhabitants (Rowles, 2000; Rubenstein, 1989) and a place where older adults can feel safe and in control (Dahlin-Ivanhof, Haak, Fänge & Iwarsson, 2007; Tamm, 1999). Making a change in the home environment, such as with a HM, could therefore affect the meaning of the home and the sense of control and safety. This makes the investigation of changes after HM even more problematic, as the impact could be related to many different aspects.

Summing up, HMs are interventions used to a large extent to decrease environmental barriers and increase the ability to perform everyday life tasks. Despite the common use the impacts of HM are sparsely investigated. The existing studies, with their methodological approaches, have not been able to identify any larger impacts of HM on ability to perform everyday life tasks for older adults. In order for future research to be able to contribute support of the HM impacts, new methodological approaches that can capture dynamic interaction between the HM, the home environment, and the person's perceptions are needed.

Assessing aspects of everyday life tasks after home modification

In order to receive information of a person's ability to perform everyday life tasks, different approaches could be used. One approach is to perform an assessment using standardized instruments. To assess refers here to the process of evaluating a phenomenon, including a measurement of the phenomenon's extent using an appropriate instrument (American Educational Research Association (AERA), American Psychological Association (APA) & National Council on Measurement in Education (NCME), 1999; Wade, 1992). To select an instrument that can be applied both in clinical practice and when conducting research on the perceived ability to perform everyday life tasks after HM, some important issues need to be addressed. These issues are related to the construct investigated, the items included in the instrument, and the method used for data collection.

First, as previously described, existing research on HM has to a large extent used instruments investigating the construct of functional independence, such as the Functional Independence Measure (FIM) (Gitlin et al., 2001b; Mann et al., 1999) and the ADL Staircase (Fänge & Iwarsson, 2005). However, these instruments did not identify any larger changes in the performance of everyday life tasks after HM (Fänge & Iwarsson, 2005; Gitlin et al., 2001b; Mann et al., 1999). This could indicate that: a) HM does not have any impact on level of independence or b) independence is not a sensitive construct to apply in order to detect changes after HM.

Level of independence, defined as the extent of support used to perform a task, is one of the most commonly used outcome measures in rehabilitation and occupational therapy. Assessing levels of independence for older adults aging at home is suggested to be of importance in order to plan and implement relevant support services (Birge James, 2008; Letts & Bosch, 2005; Wade, 1992). However, as previous research could only identify minimal impacts using independence as an outcome measure, there is a need to apply instruments using other constructs related to the ability to perform everyday life tasks when conducting research on older adults and HM (Fänge & Iwarsson, 2005; Gitlin, 2003; Golland, 2003). For instance, the concept of difficulty in performing everyday life tasks has been found to generate another type of information on a person's ability to perform a task, compared to the concept of independence (Gill et al., 1998; Grimby, Andréén, Darving & Wright, 1998; Jette, 1994; Johansson, 2008), where older adults can report on experiencing difficulty in the performance of everyday life tasks but and still be independent (Gill et al., 1998; Jette, 1994; Johansson, 2008). Difficulty in performing everyday life tasks has also been found to be a sensitive outcome measure to use when investigating impacts of health care interventions (Jette, 1994) and HM for older adults (Gitlin et al., 2006a). Furthermore, feeling safe is considered an important aspect for enabling performance of everyday life tasks and aging in place (Fonad et al., 2006; Mann et al., 1994; Zimmer & Chappell, 1999). HMs are often provided for people feeling unsafe, and are assumed to increase safety (Arman & Lindal, 2005; Gitlin, 1998; Stark, 2003). This impact has, however, not been investigated to any great extent in research. Hence, the constructs of difficulty and safety in everyday life are assumed in this thesis to provide complementary information to independence in relation to identifying changes in aspects of performance of everyday life tasks after HM.

Secondly, the instrument needs a focus on the home environment and needs also to include relevant tasks that are to be performed in the home context. Many instruments of everyday life include only self-care tasks. These include The Katz Index (Katz, Ford,

Moskowitz, Jackson, & Jaffe, 1963), The Functional Independence Measure (FIM) (Keith, Granger, Hamilton, & Sherwin, 1987) and The Barthel Index (Mahoney & Barthel, 1965). However when assessing persons in the private home environment, such as persons in need of HMs, it is important to acknowledge other tasks like grocery shopping, meal preparation, and cleaning as these are tasks that are central to being able to live and function in the home (Fisher, 1993; Gitlin, 2005; Lawton & Brody, 1969).

Third, in collecting data with an instrument, there is a need to apply a method of data collection that is based on the person's own perceptions. Instruments focusing on performance of everyday life tasks apply different data collection methods, mostly professional observations or self-reports (Fisher, 2005; Gitlin, 2005; Kielhofner, 2008). Observations and self-reports have been found to generate different findings related to ability to perform everyday day life tasks (Reuben et al., 2004). Observations are in general regarded as generating more accurate estimations of a person's ability to perform everyday life tasks and to be more sensitive to change (Guralnik, Branch, Cummings, & Curb, 1989; Sherman & Reuben, 1998), whereas self-reports tend to suffer from ceiling effects impacting on sensitivity (Doble & Fisher, 1998; Guralnik et al., 1989; Sherman & Reuben, 1998) and to be influenced by the respondents' cognitive and mental health (Guralnik et al., 1989; Kempen, Steverink, Ormel & Deeg, 1996). However, when conducting research that aims at understanding the persons' perceptions of their ability to perform everyday life tasks, self-report is considered to be the only preferable method to use, despite known limitations.

Rationales for instrument development

When selecting an appropriate instrument, both in clinical work and in research, to use for assessing ability to perform everyday life tasks, it is important to consider the instrument's psychometric properties in relation to the population in focus (Kazdin, 2003; AERA, APA & NCME, 1999; Spector, 1992). Evidence of an instrument's psychometric properties (i.e. aspects of validity and reliability) for the sample investigated is crucial in order to make accurate interpretations of the findings (AERA, APA & NCME, 1999; Kazdin, 2003; Spector, 1992). The validity indicates the degree of which evidence and theory supports the interpretations of the scores from an instrument. Reliability, however, refers to the instrument's consistency when testing procedures are repeated on a population in focus (AERA, APA & NCME, 1999). For instruments under development, knowledge of their psychometric properties are fundamental in order to guide further development and provide directions for their applications. There are different methods to apply when investigating

psychometric properties of an instrument. These methods are in general originated from classic and modern test theory (Bond & Fox, 2001). Classic test theory assumes that there exists a linear relation between the construct investigated, such as difficulty in the performance of everyday life tasks and the items in the instrument. In classic test theory the inter-correlations of the items are explored and the items on a scale are seen as repeated questions of the same construct. It is assumed that data is normally distributed and based on an interval scale (Bond & Fox, 2001; Spector, 1992). Instruments focusing on everyday life are often based on ordinal scales and are hence not directly applicable to classic test theory methods. The Rasch model is a mathematical model based on modern test statistics that could be applied when developing instruments and for evaluating psychometric properties of instruments. The Rasch models originates from modern test theory and do not assume a normal distribution of data and can be applied to ordinal data. The analysis is based on responses to single items and not to the total score as used in classic test theory. It provides the researcher with rich information of the psychometric properties of persons, items and the scale, and in addition it provides a method to transform ordinal data to interval measures (Bond & Fox, 2001). Data on an interval level is often required when conducting mathematical and statistical analyses such as counting mean values (Bond & Fox, 2001; Fisher, 1993; Merbitz, Morris & Grip, 1989). However, investigation of instruments and their development is not only conducted in studies aiming to investigate aspects of validity and reliability. Any clinical study using the specific instrument as a measure also provides additional information to the validity, refinement, and further development of the instrument. When using an instrument that is under continuous development as an outcome measure in intervention studies, such data also provide additional information to the development process of the instrument, such as the instrument's sensitivity to detect change, and precision of estimations (AERA, APA & NCME, 1999).

In conclusion, previously conducted studies of HM impact on the performance of everyday life tasks have some methodological limitations that must be recognized and considered. This indicates a need for new methodological approaches in order to increase the knowledge of HM impacts on older adults' ability to perform everyday life tasks. In the process of selecting a suitable instrument to apply when investigating impacts of HM it is important to consider the method of data collection, the included items, and the construct used. Furthermore, knowledge and evidence of the instrument's psychometric properties is crucial in order to make accurate interpretations of the findings. However, in order to understand how ability to perform everyday life tasks can be viewed and also investigated, a

theoretical framework that could provide knowledge and guidelines in the research process is needed.

Ability to perform everyday life tasks – theoretical framework

This thesis has a focus on the ability to perform everyday life tasks after HM, and specifically on the person's own perceived ability. A person's ability to perform a task could be defined and understood in various ways. For this reason it is important to clarify the theoretical framework applied when defining and using the concept of ability. In this thesis the theoretical framework consisted of models related both to occupational therapy using the Model of Human Occupation (Kielhofner, 2008), and to environmental gerontology by the competence-environmental press framework (Lawton & Nahemov, 1973, Lawton, 1989).

The competence-environmental press framework (Lawton & Nahemov, 1973; Lawton, 1989) from Lawton's ecological model of aging is one of the most applied theoretical frameworks on studies on older adults and environments across disciplines (Gitlin, 2003; Iwarsson, 2005; Wahl & Weisman, 2003). The model explores how behavior, in this thesis labeled as performance of a task, is created through an interaction between the person and the environment. The person component consists of a set of competences within the person such as cognitive functions, physical health, and psychosocial adjustments. The environmental component is regarded as consisting of demands. The interaction between the two components, i.e. personal competence and environmental demands, generates an outcome labeled as behavior (Lawton & Nahemov, 1973). The degree of success of this behavior is related to the fit between the personal and environmental components (Lawton & Nahemov, 1973; Lawton, 1989). According to the docility hypothesis (Lawton & Simon, 1968) which was stated alongside the development of the framework, persons with low competence are more vulnerable to environmental demands than those with high competence. This reasoning indicates that persons with reduced competence (such as reduced muscle strength in legs) experience problems in creating an adaptive behavior (such as to walk) due to a high environmental press (such as high thresholds). A successful behavior can be created by either reducing environmental demand (removing the threshold) or increasing personal competence (improving muscle strength in the legs) or both.

The Model of Human Occupation (MOHO) (Kielhofner, 2008) is an occupational therapy conceptual practice model. In contrast to the competence-environmental press framework (Lawton & Nahemov, 1973; Lawton, 1989) MOHO has an explicit focus on the

performance of a task such as the everyday life tasks and how the performance is created and perceived by the person. Although MOHO differs from the competence-environmental press framework in relation to its emphasis on actual doing of a task, it also divides the perspective on the interaction between the person and the environment. According to MOHO the person's ability to perform a task is created by three interrelated parts; volition, habituation, and performance capacity, which influence the ability to perform a task. A person's volition is considered to impact on how we view the world and what the person chooses to perform; it represents the person's interests, values, and motivations. Volition also includes personal causation which represents the view of one's capability of doing and the effect of one's actions. Personal causation impacts on what everyday life tasks the person chooses to perform and how the performance is perceived by the person. Habituation represents how the person organizes everyday life tasks through habits, roles, and routines. Habituation is viewed as important components in a person's everyday life that provide a sense of structure, familiarity, and meaning to one's life. Habituation is strongly linked to familiarity, both in environments and in relation to temporal patterns such as habits during ordinary weeks and weekends. A disruption in habituation such as a person not being able to perform an everyday life task according to his or her routine has a large impact on a person's well-being and possibility to be active. The performance capacity contains the physical and mental capacities, both objective components and subjective experiences that influence the ability to perform an everyday life task. In addition, it is not only the person that enables the performance of an everyday life task, but also the environment in which the task takes place. The environment is defined as consisting of physical, social, cultural, economic, and political aspects. The environment is viewed as constantly interacting and impacting on a person's motivation, organization and capacity to perform an everyday life task by either supporting or demanding (Kielhofner, 2008).

Furthermore, the perceived ability to perform a task is a dynamic state. The perceived ability is changing according to the task that should be performed, to the current state of the person, and to the environment in which it takes place and is hence affected by temporal aspects. A person's perceived ability to perform a task is thereby influenced by time, indicating that the perception may change at different time points due to the influence of the actual time, but also in relation to the specific task and to environmental and personal components (Kielhofner, 2008; Lawton & Nahemov, 1973; Lawton, 1989).

According to Kielhofner (2008), people have a perception of their ability to perform a task based on their own values and needs and on the norms in the environment. The construct

of ability in this thesis is built on this view. This means that a decrease in the ability to perform a task is noticed and acknowledged by the person as he or she experiences problems in the performance. The completion of a task does not fulfill the person's needs and expectations. The reduced ability can be indicated by increased difficulty, unsafety, a need of support, or the fact that the task is more time- and energy-consuming to perform (Fisher, 2005; Gitlin & Corcoran, 2000).

To summarize, the theoretical reasoning presented has served as a framework in order to identify and understand aspects influencing the ability to perform everyday life tasks. In this thesis the ability to perform a task is viewed as created through an interaction between the person, the environment, and the task over time. The framework stresses the importance of the person's motivation, values, and perceptions behind the perceived ability to perform an everyday life task, indicating that a subjective approach towards understanding ability is of importance. The framework regards the environment as having a vital role for a person's perceived ability to perform an everyday life task, and emphasizes that the environment can either enable or hinder performance. People who are aging are regarded as having a reduced capacity to perform everyday life tasks, and are more vulnerable to and often facing environmental hinders. For these people, though, a reduction in environmental hinders, such as through HM, is considered to improve the ability to perform everyday life tasks.

The background given for this thesis shows that the population of older adults is increasing in Sweden and that older people are supposed to age in their homes. However, as people age the ability to perform everyday life tasks decreases, often due to a combination of a person's reduced capacity and environmental hinders in the home. HM is an intervention used by the society to reduce physical environmental barriers and improve persons ability to perform everyday life tasks. In spite of the extensive use of HM, its impact on everyday life tasks is sparsely investigated. The existing studies, with their methodological approaches, have not been able to identify any larger impacts of HM on ability to perform everyday life tasks for older adults. In order for future research to be able to contribute support of the HM impacts, new methodological approaches are needed that can capture dynamic interaction between the HM, the home environment, and the person's perceptions. One challenge is to select a suitable instrument to apply when investigating impacts of HM. In this selection process it is important to consider the method of data collection, the included items, and the construct used. Furthermore, knowledge and evidence of the instrument's psychometric properties is crucial in order to make accurate interpretations of the findings.

AIM OF THE THESIS

The general aim of this thesis was to increase knowledge about the impact of home modifications on aspects of everyday life tasks among older adults living with disability. The thesis also aimed to further develop an instrument assessing ability to perform everyday life tasks, and to explore and describe experiences of safety and security in everyday life after home modifications.

The specific aims of the four studies included in this thesis were:

- Study I. To evaluate aspects of validity and reliability (i.e., internal scale validity, person response validity and person separation) of the Client-Clinician Assessment Protocol (C-CAP) Part I with a sample of people aging with disabilities in need of home modifications services.

- Study II. To examine the impact of home modifications on self-rated ability in daily life for people aging with disability.

- Study III. To investigate longitudinal impacts of home modifications on difficulty in everyday life for people aging with disabilities, and further to investigate if other factors had any additional impact on difficulty in everyday life for people receiving home modifications.

- Study IV. To explore aspects contributing to experiences of safety and security in everyday life among a sample of older adults receiving home modification services.

METHODS

Research context for the thesis

The studies included in this thesis are part of a larger research project, the Home Modification Project (HMP). This research project was conducted in a collaboration between researchers at Karolinska Institutet, Stockholm, Sweden and University of Illinois, Chicago, Illinois, USA. In this thesis only the data from the Swedish sample have been used and therefore only the Swedish procedure will be presented. The overall aim of the HMP was to increase the understanding of HM for older adults with disabilities. This was studied using a broad set of methods including both quantitative and qualitative designs. Included in this project was a longitudinal intervention study using a pretest-posttest design (Kazdin, 2003) and included an intervention group and a comparison group. Data were collected on three occasions pre- and post-HM, using a package of different instruments. The HMP in Sweden was conducted in collaboration with an Agency of Home Modification (AHM), for sample recruitment. This AHM was the responsible authority that handled all applications for HM in a municipality in a larger city in Sweden. The four studies in this thesis are based upon this particular longitudinal intervention study. An overview of the four studies can be found in Table I.

Table I: *Overview of the four studies included in this thesis.*

Characteristics of the studies	Study I	Study II	Study III	Study IV
Focus	Investigate psychometric properties of C-CAP Part I.	Investigate impacts of HM on ability in everyday life tasks.	Investigate longitudinal changes in everyday life tasks after HM.	Explore and describe aspects influencing safety and security in everyday life.
Design	Cross-sectional, instrument evaluation	Intervention study Pretest-posttest design	Intervention study Pretest-posttest design	Qualitative, using a grounded theory approach
Sample	<i>n</i> = 103	<i>n</i> = 114	<i>n</i> = 103	<i>n</i> = 8
Data collection	Self-reported ability in everyday life using C-CAP Part I	Self-reported ability in everyday life using C-CAP Part I from baseline and Follow-up 1	Self-reported ability in everyday life using C-CAP Part I from baseline, Follow-up 1 and Follow-up 2	Open-ended interviews
Data analysis	Rasch rating scale model	Rasch rating scale model, t-tests, effect size, differential item function (DIF)	Rasch rating scale model, random coefficient model	Comparative method and hermeneutic interpretation

Participants

The Home Modification Project (HMP)

Participants for the HMP were recruited from the AHM during 2002-2004. The participants included in the HMP served as a base for inclusion in the four specific studies in this thesis. Therefore the recruitment process for the HMP will be presented first, and be followed later by the specific participant recruitment for the four studies.

Recruitment was conducted through collaboration between the researchers and the professionals (i.e. occupational therapists and physiotherapists) working at the AHM. The professionals were trained to screen potential participants who had applied for HM grants, using the inclusion criteria for the research project.

The inclusion criteria for participation in the study were that the participants were (a) 40 years old or older, (b) living in a community-based dwelling, (c) able to communicate in Swedish and actively participate in the study, and (d) having problems in everyday life and requesting HM related to at least one of following three areas. The areas included (1) getting in and out of the home, for example opening the house door or climbing stairs, (2) mobility indoors, e.g. moving between rooms and using stairs indoors, or (3) self care in the bathroom, e.g. showering, using toilet, or washing hands and face at sink. The inclusion criterion was based on the area where a problem was identified and not on a specific HM, as an HM such as a handrail may be used in all three areas.

Criteria for exclusion were persons with (a) reduced cognitive status, based on a Mini Mental State Examination score below 19 (Folstein, Folstein & McHuge, 1975); or (b) depression, based on scores of 24 or above assessed using the CES-D Depression Scale (Radloff, 1977). The exclusion criteria were chosen in order to exclude potential participants who would not be able to understand, concentrate on, and answer the questions in a valid and reliable manner in the data collection process.

The professionals at the AHM identified potential participants from two different sources: (1) the list of persons whose application for HM grants had been approved, and who were scheduled to receive their HMs within four weeks (refers to the intervention group in the studies), (2) the list of persons who had applied for HM grants within the past month. These persons were waiting for their applications to be administered and assessed by the AHM (refers to the comparison group in the studies). These participants therefore came from the AHM's natural waiting list group. During the participant recruitment period (2002-2004) the average waiting time for an HM

application to be administered at AHM was about six months (range 1-22 months). The wide range of months waiting for the HM was due to varying administration routines at AHM. If a participant in the comparison group received an HM before the data collection process had ended they were (a) transferred to the intervention group if possible, or (b) excluded from the study.

The professionals at AHM made initial contact, informed the potential participants about the project, and asked for their consent to be contacted by the researchers. Written information about the research study was mailed to those who agreed to be contacted, followed up by telephone contact in order to request informed consent. A maximum of ten participants were consecutively included each month, as this was the maximal number the research team could collect data on, with respect to time resources. In total the professionals at AHM identified 244 persons who were considered potential participants, and they were provided with more information about the research project. Out of the 244 persons, 107 were excluded due to criteria. Reasons for exclusion were: could not take part in research due to subjective health problems ($n=37$), HM already installed ($n=37$), could not be reached ($n=6$), moved or withdrew application for HM ($n=3$), Mini Mental State Examination ($n=12$), CES-D Depression scale ($n=6$), or other reasons ($n=6$). Of the 137 eligible persons that met the inclusion criteria 23 persons declined participation. Therefore the total sample in the HMP consisted of 114 participants.

There were no significant differences in gender, age, or requested HM between those who agreed to participate ($n=114$) and those who declined ($n=23$). The particular AHM used for participant recruitment in this research project receives about 6000 applications for HM annually. Of those, 3800 applications were from persons over the age of 40 and concerned modifications related to the areas in focus for this study (Bostadsanpassningsavdelningen, 2004). A comparison between the 114 participants included in this study and the persons who submitted the 3800 applications showed no significant difference in relation to age, gender, and applied number of HMs.

Participants in this thesis

The specific sample selection for the four studies will be presented below. The 114 participants included in the HMP served as a base for inclusion in the four specific studies included in this thesis. The demographic characteristics of the sample, divided into the four studies, are presented in Table II. In the sample the majority of the participants were women who lived alone in apartments. The mean age was 75 years.

The most requested HMs were replacement of bathtub and automatic door openers (see Table II for more information).

Table II: *Characteristics of the participants.*

	Study I <i>n</i> =103	Study II <i>n</i> =114		Study III <i>n</i> =103		Study IV <i>n</i> =8
		Intervention <i>n</i> =73	Comparison <i>n</i> = 41	Intervention <i>n</i> =74	Comparison <i>n</i> =29	
Age , mean (SD)	74 (11)	75 (12)	75 (10)	75 (12)	75 (12)	75 (6)
Gender , <i>n</i>						
Female	70	50	28	51	19	4
Male	33	23	13	23	10	4
Social situation , <i>n</i>						
Alone	64	43	28	44	19	4
Someone	39	30	13	30	10	4
Dwelling , <i>n</i>						
Apartment	91	66	33	67	21	8
One-family house	12	7	8	7	8	0
Requested HM , <i>n</i>						
Shower	50	31	20	31	11	2
Toilet	8	4	4	4	2	0
Stair lift	13	11	7	11	6	4
Ramp	8	6	3	6	3	2
Handrail	7	6	2	6	2	0
Automatic door-opener	39	35	9	36	6	3
Other	7	4	4	4	4	0

The participants reported on a variety and combination of health problems. A large number of participants reported on problems related to the cardiovascular and respiratory systems such as heart problems (*n*=57), and respiratory problems (*n*=36). Other problems commonly reported by the participants were related to neuromusculoskeletal and movement-related functions such as joint mobility as a consequence of rheumatism or osteoarthritis (*n*=49). Sensory functions such as seeing (*n*=37) and hearing (*n*=40) were also reported as problems for the participants. The participants reported their overall health as relatively low (16 % as bad, 54 % as fairly, 20 % as good, 3 % as very good and 7 % as excellent). Further, at baseline the sample (*n*=114) reported a high level of independence where technical devices were used in many of the everyday life tasks that included transfers, such as getting into and out of house. Although the sample reported a high level of independence they also perceived

their performance of everyday life tasks as difficult. This was more apparent in tasks related to the specific HM areas such as managing stairs and bathing/showering. The sample did not report on any larger safety problems although a range in the ratings could be noted on almost every everyday life task. More information on the samples' ability to perform everyday life tasks can be found in Table III.

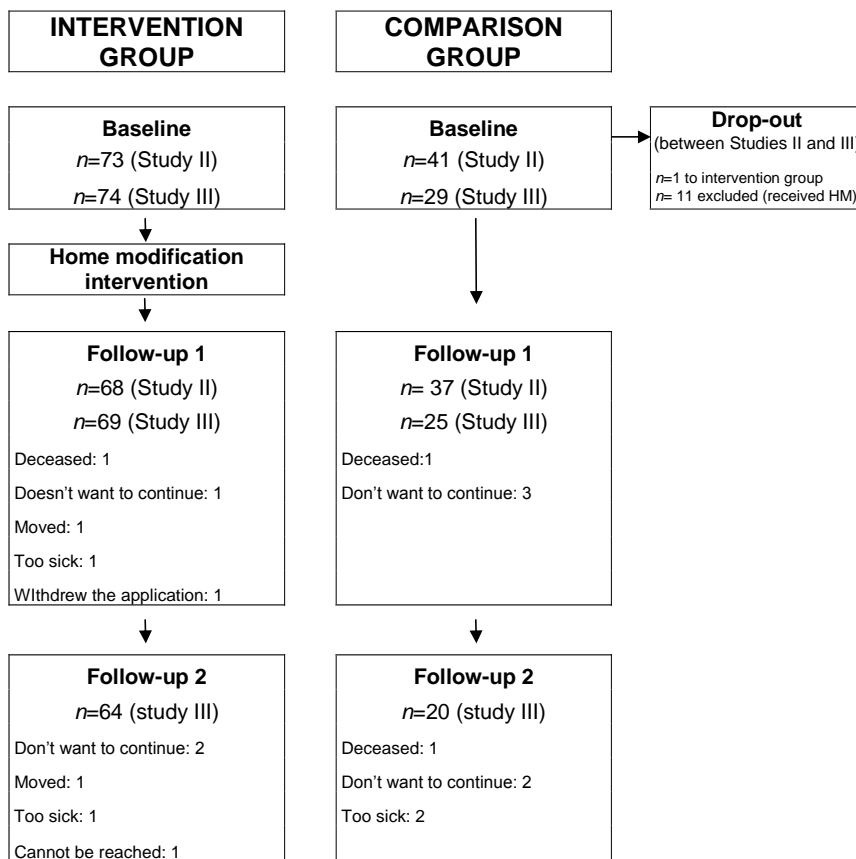
Tabell III: *Self perceived ability to perform everyday life tasks at baseline, expressed in median values and ranges.*

Item	Independence scale		Difficulty scale		Safety scale	
	Intervention (n=73)	Comparison (n=41)	Intervention (n=73)	Comparison (n=41)	Intervention (n=73)	Comparison (n=41)
1. Feed Self	4 (4-1)	4 (4-2)	5 (5-3)	5 (5-2)	3 (3-2)	3 (3-1)
2. Dress upper body	4 (4-1)	4 (4-2)	5 (5-2)	5 (5-3)	3 (3-2)	3 (3-2)
3. Dress lower body	4 (4-1)	4 (4-2)	4 (5-2)	4 (5-2)	3 (3-1)	3 (3-2)
4. Grooming	4 (4-1)	4 (4-2)	5 (5-2)	5 (5-4)	3 (3-2)	3 (3)
5. Bath/shower	3 (4-1)	3 (4-1)	4 (5-1)	3 (5-1)	3 (3-1)	3 (3-1)
6. Transfer to toilet	3 (4-1)	4 (4-2)	5 (5-2)	5 (5-2)	3 (3-2)	3 (3-2)
7. Get in and out of house	3 (4-1)	3 (4-1)	3 (5-1)	3 (5-1)	3 (3-1)	3 (3-1)
8. Walk indoors	3 (4-1)	4 (4-1)	5 (5-1)	5 (5-3)	3 (3-1)	3 (3-1)
9. Walk a block	3 (4-1)	3 (4-1)	4 (5-1)	4 (5-1)	3 (3-1)	3 (3-1)
10. Managing stairs	3 (4-1)	4 (4-1)	2 (5-1)	3 (5-1)	3 (3-1)	2 (3-1)
11. Move in/out of bed	4 (4-1)	4 (4-1)	4 (5-2)	4 (5-2)	3 (3-2)	3 (3-2)
12. Get on/off of chair	4 (4-2)	4 (4-2)	5 (5-2)	5 (5-2)	3 (3-1)	3 (3-1)
13. Get in/out of car	4 (4-1)	4 (4-1)	4 (5-1)	4 (5-1)	3 (3-1)	3 (3-1)
14. Prepare meals	4 (4-1)	4 (4-2)	5 (5-1)	5 (5-1)	3 (3-1)	3 (3-2)
15. Do grocery shopping	3 (4-1)	3 (4-1)	4 (5-1)	4 (5-1)	3 (3-1)	3 (3-1)
16. Do light housework	4 (4-1)	4 (4-1)	4 (5-1)	4 (5-1)	3 (3-2)	3 (3-2)
17. Take medication	4 (4-1)	4 (4-1)	5 (5-3)	5 (5-4)	3 (3)	3 (3-2)
18. Leisure/ social activities	4 (4-1)	4 (4-1)	5 (5-1)	5 (5-1)	3 (3-1)	3 (3)

Studies I-III

Study I was based on the 103 participants included at the time of the analysis (August 2004). In Study II the total sample in the HMP was used, i.e. 114 participants, divided into the intervention group with 73 participants and the comparison group with 41 participants. In Study III the sample included 103 participants, with 74 participants in the intervention group and 29 in the comparison group. For more information see Figure 1.

Figure 1: Data collection process in study II and III



Study IV

In Study IV the participants were recruited from the 114 participants in the HMP. For inclusion in this qualitative study the participants had to: a) have ended their participation in the HMP, b) received their applied HM, c) be over the age of 65, and d) report unsafety in any of the 18 tasks in the C-CAP Part I (Lilja 2002), in the HMP data collection. The inclusion criteria were chosen as this study aimed at describing experiences of living with HM, and not during the HM installation process. Additional participants under the age of 65 were excluded from this study as issues and

experiences related to safety and security in everyday life tends to increase with aging (Fonad et al., 2006; Mann et al., 1994). In order to provide richness in the data, variations were sought in age, gender, housing, and social situation, in residence in urban and rural areas, as well as in received HMs. The potential participants were selected from the HMP on the basis of the inclusion criteria and the demographic characteristics requested for this qualitative study. The first author contacted the potential participant with an information letter. The letter was followed by a telephone contact obtaining verbal consent for participation and booking the interview. The participants were included one at a time in order to enrich and fill gaps in the data and emerging categories. The final sample consisted of eight community-living older persons. The participant characteristics are presented in Table II.

Data collection and procedure

Studies I-III procedures

The data included in Studies I-III are based on the longitudinal study included in the HMP using a quasi-experimental pretest-posttest design (Kazdin, 2003). The data were collected in three sessions, i.e. baseline, Follow-up 1 and Follow-up 2 for both intervention group and comparison group. The studies included in this thesis are based on data collected at the three different time points. In Study I the baseline data were used regardless of group belonging. In Studies II and III comparisons between intervention and comparison groups were made based on data from baseline and Follow-up 1 (Study II) and data from all three data collection sessions (Study III). For the intervention group the baseline data collection was conducted about two months prior to the installation of HM. These participants had, on average, been on the AHM's waiting list for HM inquiry for five months. The first follow-up was conducted about two months after HM installation and the last follow-up about six months after the installation of the HM. For the comparison group the baseline was conducted about two months after they had applied for HM. The first follow-up was conducted two months after the baseline and the last follow-up was conducted six months after baseline. None of the participants in the comparison group received any HMs during the period of data collection. See Table IV for more information.

Table IV: *Time (expressed in mean months and SD) from date where application for HM was received at AHM to the data collection sessions and delivery of HM intervention*

	Baseline	Intervention	Follow-up 1	Follow-up 2
Intervention group	4.8 (4.2)	6.3 (3.1)	8.9 (2.0)	13.5 (1.0)
Comparison group	1.8 (1.1)		4.2 (0.4)	8.4 (0.8)

Of the 114 participants included at baseline in Study II, 105 participated in the follow-up interview. The attrition rate was 8%. A comparison between the remaining 105 participants and the nine drop-outs did not reveal any differences in terms of demographics or applied HMs.

Study III included data from baseline and Follow-up 1 as well as from Follow-up 2. Out of the 103 participants included at baseline, 94 participated in the first follow-up and 84 participated in the second follow-up, leaving an attrition rate at the second follow-up of 18% for both groups (31% for the comparison group and 13% for the intervention group). A comparison between the remaining participants and the drop-outs did not reveal any differences in terms of the demographics or applied HMs. Reasons for drop-outs in Studies II and III are presented in Figure 1. The differences in the numbers of participants in the intervention and comparison groups, as well as in the number of participants included in Studies II and III, was due to changes in administrative routines at the AHM. Shortening of waiting times for the HM application to be administered was one example of such a change. For these studies this resulted in the fact that some of the participants in the comparison group received their HMs before the data collection process had ended. These participants could therefore not be used as comparisons. As it would have been unethical to deny these participants the HM interventions, they were (a) transferred to the intervention group (n=1) if possible, or (b) excluded from the study (n=11) (see Figure 1 for more information).

Data were collected in the participants' homes according to a standardized procedure. Data on demographic characteristics and self-rated health were collected using The Older American Recourses and Service (OARS) instrument (Fillenbaum, 1988) and Short Form-36 (Sullivan, Karlsson & Ware, 1994) whereas data on perceived ability to perform everyday life tasks were collected using the C-CAP Part I instrument (Lilja, 2002). One research assistant and three PhD students collected all data. The quality of the data collection was monitored and

reviewed closely by: a) providing training sessions, b) having written standardized rules for completion of the interviews, c) continuous supervising of interviewers, and d) having monthly coordination meetings.

Data collection instruments

ShortForm-36 (SF-36)

The Swedish version of the SF-36 was used to collect data on the older adults' perceived health (Sullivan et al., 1994). In this thesis data from the first question in SF-36 "*Overall, would you rate your health as*" has been applied in order to describe characteristics of the sample.

Older American Recourses and Services (OARS)

The OARS (Fillenbaum, 1988) was used in the studies to collect demographic data on the sample. The OARS includes questions related to age, gender, and dwelling and also on the person's perceived social and economical recourses and health status. The instrument was modified by the research group in order to be applied in a Swedish context.

Client-Clinician Assessment Protocol (C-CAP)

The Client-Clinician Assessment Protocol (C-CAP) (Gitlin & Corcoran, 2000) investigates older adults' abilities to perform everyday life tasks. In relation to the ICF (WHO, 2001), C-CAP Part I has a focus on disability or functioning related to activity and participation. The C-CAP was developed in the United States, through collaboration between researchers and occupational therapists working in geriatric settings, in response to the need for an instrument that includes a focus on clients' self-rated abilities to perform everyday life tasks in their home environments and communities (Gitlin & Corcoran, 2000). The theoretical framework of C-CAP is built on models and theories related to occupational therapy, psychology, and environmental gerontology. It consists of the Model of Human Occupation (Kielhofner, 1995), Competence-Environmental Press framework (Lawton & Nahemov, 1973) and the Person-Control framework (Schultz & Heckhausen, 1999). The theoretical framework provides an understanding and explanation of ability to perform everyday life tasks for older adults who are being operationalized in the instrument. According to the theoretical framework a person's ability to perform everyday life tasks is viewed as a result of the

interaction between the person, the environment, and the task. The C-CAP consists of four parts. Part I is a client self-rating of ability to perform everyday life tasks assessed in relation to independence, difficulty, and safety. Parts II-IV consist of performance-based assessments of the client's ability to perform everyday life tasks and the impact of the home environment on the performance. However, as the C-CAP is a newly developed instrument no psychometric evaluation has been conducted yet on the original American version of the instrument (Gitlin & Corcoran, 2000).

The C-CAP Part I was applied in this thesis (Studies I-III) to assess the older adult's ability to perform everyday life tasks. The C-CAP Part I was chosen as it departs from the persons' perceptions of their ability to perform, include a broad set of everyday tasks including self care, transfers, home maintenance, and leisure. It measures perceived ability using the three scales of independence, difficulty, and safety. The C-CAP Part I was therefore considered to be a potential instrument for investigating additional impacts of HM. In order to apply C-CAP in a Swedish context, the instrument was translated into Swedish and later back-translated to English (Beaton, Bombardier, Guillemin, & Bosi Ferraz, 2000). In this thesis the Swedish version of C-CAP Part I (Lilja, 2002) was applied.

The C-CAP Part I consists of three scales that collect data on self-rated independence, difficulty, and safety in 18 everyday life tasks. The 18 tasks are related to self care, transfers, home maintenance and leisure (feed self, dress upper body, dress lower body, grooming, bath/shower, transfer to toilet, get in/out of the house, walk indoors, walk a block, managing stairs, move in/out of bed, get on/off chair, get in/out of car, prepare meals, do grocery shopping, do light housework, take medication, leisure and social activities). The C-CAP Part I also includes a fourth scale that can be considered more of a checklist of client motivation in everyday life. As this scale is considered to be a checklist it has not been included in any of the studies.

The C-CAP Part I is conducted as a structured interview with the occupational therapist working in collaboration with the client. The occupational therapists ask the clients about their self-rated abilities to perform the 18 tasks. For each of the 18 tasks the clients are asked three questions concerning how they perceive their independence, difficulty, and safety. The clients rate their abilities on three separate rating scales, with the level of independence being rated on a four-point scale (4=independent, 3=uses technical device or HM, 2=uses only help from a person, 1= uses both help from a person and technical device and/or HM). The level of difficulty is measured on a five-point scale (5=no difficulty, 4= a little difficulty, 3=difficult,

2=a lot of difficulty, 1=unable to do at all), and the level of safety on a three-point scale (3=feel safe, 2=feel a little unsafe, 1=feel very unsafe). The scales are presented to the client in both oral and written form by the occupational therapist to enable the clients to identify which category represents their ability. The chosen score is then documented by the occupational therapist on the C-CAP instrument paper chart. The three scales are scored separately and the scores on the items are not added together (Lilja, 2002).

Procedure study Study IV

In Study IV data were collected through qualitative interviews at two sessions in the participants' homes. The interviews were conducted using an interview guide with open-ended questions related to experiences of safety and security in everyday life (Kvale, 1996). In this study security was added as a concept. To feel safe and secure are related to each other and as no clear differentiation could be found in research these two concepts were used together throughout the data collection. The guide included open-ended questions related to everyday life such as, "*Can you tell me about an event or task where you felt safe and secure?*". Probe questions were used in combination with the open-ended questions in order to get the participant to describe the tasks or situations more in depth, for example, "*Can you tell me more?*" (Kvale, 1996). After the first interview the data were read and discussed by the authors. This discussion indicated further directions by: a) providing a foundation for the follow-up interview and b) guiding the inclusion of additional participants in order to enrich the data. Here the guiding principal was to search for as many differences in characteristics as possible. At the second interview an individual interview guide based on the first data collection was applied. In this interview the researcher invited the participant to further develop and describe aspects that emerged from the first data collection or to reflect on new aspects related to safety/security. The interviews lasted between 25 and 65 minutes. The 16 interviews were tape-recorded and transcribed verbatim immediately after completion.

Data analysis

Investigation of psychometric properties in C-CAP Part I (Studies I-III)

In Study I the psychometric properties of C-CAP Part I were investigated using the Rasch rating scale model (Bond & Fox, 2001). In the Rasch method a person is considered to have a

given ability based on the responses to a set of items with different degrees of challenges. The Rasch analysis is based on the assertion of what was expected and observed. The simple Rasch model asserts that (a) the more able the person is, the more likely it is that he or she will be able to pass harder items than will a less able person, and (b) the easier the item is, the more likely it is that it will be passed by all persons than will a harder item. The analysis therefore aims at investigating if the responses from the persons on the items follow what was expected in relation to this specific pattern. If the responses fit the assertions in the model the data can be transformed to interval measures and the scale can be considered as having acceptable psychometric properties (Bond & Fox, 2001). When conducting psychometric evaluations using Rasch analysis a number of aspects can be studied. The specific psychometric properties studied in this thesis were: internal scale validity, person response validity, and person separation reliability. *Internal scale validity* indicates the extent of fit of the items in scale to the assumptions in the Rasch model. According to the Rasch rating scale model a scale could be able to measure a single unidimensional construct in order to be considered to have acceptable internal scale validity. *Person response validity*, on the other hand, indicates the extent of fit between the person's responses and the assumptions in the Rasch model. Person response validity indicates that the scale can be used in a valid manner with persons similar to those in the tested sample (Bond & Fox, 2001). *Person separation* is an aspect of reliability indicating the estimation of the spread of the persons on a scale, considering also the individual standard error of the participants' person ability measures. It indicates whether a scale can reliably differentiate a group of persons into different levels of ability (Bond & Fox, 2001; Fisher, 1992).

The analysis were conducted using the FACETS computer program (Linacre, 1994-2005). In the analysis a number of Rasch statistics are generated.

As a first step before proceeding with the analysis of the psychometric properties the here different rating scales (i.e. independence, difficulty and safety) were investigated. The Rasch analysis for each of the three rating scales did not identify any measuring disorder or unacceptable rating scale category outfit values according to the criteria by Linacre (2002a). The analysis therefore proceeded to investigate aspects of internal scale validity, person response validity, and person separation of the three scales in C-CAP Part I.

The extent of internal scale validity and person response validity were investigated using *goodness-of-fit statistics*. Goodness-of-fit statistics are generated for both persons and items

providing information on the fit between the response of the persons and the items in relation to the assumptions in the Rasch model, i.e. the difference between what was expected and what was observed (Bond & Fox, 2001; Wright & Stone, 1979). In the study goodness-of-fit was indicated by an infit $MnSq \leq 1.4$ with an associated $z < 2$ (Wright & Linacre, 1994). The $MnSq$ is the squared mean of the difference of what was expected in the model and what was observed. The $MnSq$ has an expected value of 1.0, where values above 1 indicate a pattern that is too unpredictable, whereas values less than 1 indicate that the responses are too predictable and show less variation than the model expected. In this thesis the infit statistics were used. Infit statistics are weighted and more sensitive to unexpected responses to items near the person's ability. The z value ($Zstd$) is a t-test that provides an indication of the fit between the data and the model (Bond & Fox, 2001; Linacre, 2002b). Acceptable criteria for goodness-of-fit were indicated by 95% of the items and persons showing goodness-of-fit, as it is expected that 5% of the items and the persons could fail this criteria by chance at a $z < 2$, in accordance with previous research (Kottorp, Bernspång & Fisher, 2003). Misfit indicates that a problem exists between the construct investigated and the construction of the scale. *Person separation index statistics* were used in this thesis to determine the ability of three scales in C-CAP Part I to separate the distribution of persons into different strata (Bond & Fox, 2001). The estimation of separation can be interpreted similarly to Cronbach's α . Our criterion for minimal acceptable person separation was set at 1.5, representing Cronbach's α of .70, indicating that a scale may separate a sample into two strata (Fisher, 1992).

Investigating changes in everyday life after home modification

In Studies II and III the Rasch rating scale model was initially used in the analysis to transform the participants' raw scores (ordinal data) collected by C-CAP Part I to person ability measures (Studies II and III) and item difficulty calibrations (Study II), expressed in logits (log odds probability units) indicating the odds of success or failure (Bond & Fox, 2001).

Investigations of changes in perceived ability to perform everyday life tasks after home modifications (Study II)

In Study II a comparison of presumptive change in person ability measure on these three scales between baseline and follow-up for the intervention and the comparison groups separately was conducted. The comparison was conducted for both the intervention and the

comparison groups with the intention of detecting any change in self-rated ability, using paired sample *t*-tests, with a level of significance set at $p < 0.05$ (Petrie & Sabin, 2000). If a significant difference was noticed, the degree of difference between baseline and Follow-up 1 was calculated using effect size (*d*). According to Cohen (1992) an effect size of at least 0.2 indicates a small effect, 0.5 a medium and 0.8 a large effect size.

Investigation of changes in perceived task challenge after home modification (Study II)

The continued analysis in Study II was guided by models presented by Chang & Chan (1995). If a significant improvement was identified in self-rated ability on any of the three scales we proceeded to examine the scale on an item level to identify which specific tasks changed after the HM. A new series of analyses was conducted where the person ability measures were anchored, i.e. they were set at the ability measures generated from the first analysis, and the item difficulty calibrations for each task were allowed to float. In this way, it was possible to separately estimate the relative difficulty of each task for the participants at baseline and follow-up. A differential item functioning (Wright & Stone, 1979) was conducted. When the item difficulty calibrations are estimated, they define the relative linear hierarchy of task challenges on each occasion. However, as the relative difficulty estimation only provides a limited understanding of the task challenge, and does not take into account the increase in person ability between the data collection occasions, we continued to investigate the actual difference. This was done by adjusting the relative item difficulty calibration values in proportion to the overall mean difference in person ability between baseline and follow-up. The extent of difference in the actual task challenge between baseline and follow-up on tasks was finally calculated using a standardized *z* comparison (Wright & Stone, 1979), also considering the standard error (SE) of each item difficulty calibration. Here the item difficulty measures with an SE value < 0.15 had to have an actual difference of at least 0.43 logit to be considered clinically meaningful and to represent a significantly detectable difference ($p < 0.05$) (Kottorp, Bernspång & Fisher, 2003).

Investigation of changes in, and aspects impacting on perceived difficulty to perform everyday life tasks after HM (Study III)

In Study III the participants' individual changes of self-rated difficulty during the HM process and the confounding factors influencing this change were investigated. Each participant's regression line (time effect) was estimated using random coefficient models in order to investigate the differences in mean ability measures between the intervention group and the

comparison group. The intercepts and slopes of the regression lines were assumed to be correlated and have a random variation among the individuals. These random effects were then summarized as a mean response person ability measure over time and this was used to make conclusions of the population of interest (Fitzmaurice, Laird & Ware, 2004). Time was treated as a continuous variable in the analysis with each individual baseline chosen at the time point of entry in the study. Adjustment of the response profiles of the groups due to group differences at baseline was performed using the baseline ability measure as a covariate in the analysis. When performing the analysis the following confounding variables were controlled for: (1) age, (2) dwelling, (3) social situation, (4) person ability measure at baseline, (5) type of HM intervention, (6) number of applied HMs, (7) time after baseline and (8) number of months waiting for the HM intervention. All possible second-degree interactions between time after baseline and the confounders were controlled for and “*time after baseline in relation to age*” can be mentioned as an example. To assess which variables to include in the final model, a backward selection procedure was conducted and variables with associated *p*-values greater than 0.10 were used as criteria for exclusion. The process ended when all redundant variables had been excluded. The main effects – time between baseline to Follow-up 2 and the HM intervention – were set to be included at all times in the procedure regardless of statistical significance.

Furthermore, Studies II and III evaluated if the three scales in C-Cap were able to detect potential changes in older adults’ perceived ability after an HM process. These analyses also provide additional information to the psychometric properties of the C-CAP Part I by providing data of the scale’s responsiveness to change.

Software programs

All statistical analysis was performed using different software programs. The Rasch analysis was conducted using the FACETS computer program (Linacre, 1994-2005). The random coefficient model was performed using Mixed procedure in the SAS version 9.1.3 statistical software (SAS). Analyses on the demographic data and parametric statistics were conducted using the Statistical Package for the Social Sciences (SPSS) version 13.0 software program.

Safety and security in everyday life after home modification (Study IV)

The interview data on aspects influencing safety and security in everyday life after HM were analyzed using a comparative approach (Glaser & Strauss, 1967). A comparative approach is

characterized by making comparisons at each level of the analytic work. The purpose of going back and forth in the data is to find similarities and differences in the data.

In the first phase, all interviews were read very closely until the authors felt they had a good grasp of the data and were oriented in it. In the second phase each participant's data was coded. This analysis started with a line-by-line coding (Strauss & Corbin, 1998) of sequences that were of interest for this study. The aim of the study guided the coding process. Data that were not included in this analysis were related to other topics like data on family members' interests. During the line-by-line coding the data were labeled with active codes close to the participant's own wording; i.e. an attempt was made to describe what was going on and what this meant for the participant from an inside perspective. After coding all participants' data, the codes and contents were compared and similar codes were brought together. In the third phase of coding the most significant codes from all participants were identified through a comparison of the initial codes and the data. Codes were compared on the basis of similarity and the properties were explored and developed into categories. Each category represented a set of codes with a related context. This step included moving back and forth, constantly comparing and re-examining data and the properties within and across categories. This verification was done to make sure that the results remained close to the participants' experiences. By continuously moving back and forth between the data and the emerging categories and interpretations, the authors made sure that the findings were grounded in the data. In the next phase each category's properties were carefully examined and subcategories identified. The goal of this step was to make sure that there were no overlaps and that each category was homogeneously constructed. Three categories contributing to feelings of safety and security in everyday life were identified (Strauss & Corbin, 1998). As a last step in the analysis, an attempt was made to better understand the meaning of the categories and how they were related. For this purpose an approach from the hermeneutic tradition (Gustavsson, 1996) was applied to learn about possible interpretations related to the structure and relationship of the categories and their impacts on safety and security in everyday life. In this interpretative step of the analysis it became obvious that some of the findings could be seen as prerequisites for the other findings, and a relationship that could facilitate our understanding could be highlighted.

FINDINGS

In this chapter the main findings of the thesis will be presented. Findings from the four separate studies are presented together under the two following headlines: Psychometric properties of the C-CAP Part I, and Everyday life after HM.

Psychometric properties of the C-CAP Part I

The results from the Rasch rating scale analysis in Study I in combination with the intervention Studies II and III provided information of the psychometric properties of the three scales assessing perceived ability in everyday life in the C-CAP Part I. The findings showed that the scales had both strengths and limitations when used in the sample tested in this study. The results are summarized in Table V and will be further presented in this findings chapter.

Table V. *Summary of results concerning C-CAP Part I's validity and reliability*

	Independence scale	Difficulty scale	Safety scale
Internal scale validity (Criteria $MnSq \leq 1.4$ and $z < 2$, at least 95% of items should demonstrate goodness-of-fit to the model)	<i>Not acceptable, 78% (14 of 18) items met criteria</i>	Acceptable, 95% (17 of 18) items met criteria	Acceptable, 95% (17 of 18) items met criteria
Person response validity (Criteria $MnSq \leq 1.4$ and $z < 2$, at least 95% of persons should demonstrate goodness-of-fit to the model)	Acceptable 97% fit criteria	Acceptable 96% fit criteria	Acceptable 100% fit criteria
Person separation (Criterion: separation index ≥ 1.5)	Acceptable 2.11	Acceptable 1.94	<i>Not acceptable 0.90</i>

Internal scale validity (Study I)

Two of the three scales, the difficulty and safety scales, demonstrated acceptable goodness-of-fit of 17 items to the Rasch rating scale model. The bath/shower item failed to demonstrate goodness-of-fit on both the difficulty and safety scales. As only one item in each scale did not demonstrate acceptable goodness-of-fit, this was considered as preliminary evidence for the difficulty and safety scales as defining single unidimensional constructs. The independence scale, however, did not show preliminary evidence of internal scale validity. Four of the items – feed self, housework, medication, and leisure – failed to demonstrate goodness-of-fit to the Rasch model. It was therefore concluded, that the items included in the independence scale

cannot be considered to define a single unidimensional construct. In order to determine the effect of these four misfitting items on the estimation of the independence measure, these items were removed and a new analysis was conducted with the remaining 14 items (were all showed acceptable goodness-of fit) was conducted. When comparing the individual independence measures generated with or without the four misfitting items the independence measure differed by 0 to 1.63 logits ($M=0.23$, $SD= 0.26$), indicating no serious disruption of the misfitting items on the individual independence ability measures.

Person response validity (Study I)

Analysis of the goodness-of-fit of the person responses to the assertions of each respective Rasch rating scale model revealed acceptable values for all three scales, providing evidence for person response validity. Almost all of the 103 participants' response patterns demonstrated acceptable goodness-of fit (independence=97%, difficulty=96%, safety=100%). Examination of participants who failed to demonstrate acceptable goodness-of-fit to the Rasch rating scale model did not reveal any distinct pattern by item, gender, age, or requested HM. These results provide preliminary evidence of person response validity of the three scales in C-CAP Part I to be used for older adults in need of HM.

Person separation reliability (Study I)

The person separation indices for the independence and difficulty scales met the minimum criterion for separation. The person separation index for the independence scale was 2.11, indicating that the scale can separate the sample into at least three distinct strata (i.e., three different levels of perceived independence). The difficulty scale had a person separation index of 1.94, which indicated that the scale may separate our sample into two strata. The person separation index for the safety scale was 0.90. The safety scale did not meet the minimum criterion and, therefore, cannot be considered as being able to separate our sample into different levels of perceived safety.

Responsiveness to change in everyday life (Studies II & III)

In Studies II and III changes in self-rated ability to perform everyday life tasks was investigated using the scales in C-CAP Part I.

Analysis on the difficulty scale in Studies II and III indicated that this scale was sufficiently sensitive to detect changes in perceived ability to perform everyday life tasks after

the HM (see Tables VI and VII). In Study II the difficulty scale was able to detect changes in perceived ability between baseline and follow-up, where the participants in the intervention group reported a significantly ($p<.001$) lower level of perceived difficulty in performing everyday life tasks at Follow-up (see Table VI). The responsiveness to change was later also confirmed in Study III, where the difficulty scale was found to detect changes in perceived ability to perform everyday life tasks up to six months after HM (see Table VII).

The independence scale was, however, not able to detect any significant changes in perceived ability to perform everyday life tasks after the HM (see Table V) and can therefore not be considered as a sensitive outcome measure in relation to HM intervention in this study. This scale was therefore not applied in Study III.

Furthermore, despite the low separation that was found for the safety scale in Study I, this scale did detect significant ($p<.001$) differences in person ability measures in Study II (see Table VI). The safety scale was able to detect changes in person ability measures, even though the imprecision (SE values) of safety estimations were considered when evaluating changes between baseline and follow-up data. These results provide support for the responsiveness of the safety scale to HM intervention. However, due to the low separation of the safety scale this scale was not applied in Study III. These disturbances associated with the safety scale indicate an uncertainty of the relation between the latent and manifest variables, meaning that the construct of safety needs further exploration in order to be understood and also measured. This was later investigated in Study IV.

Table VI: Mean ability measures (logit) and difference between baseline and follow-up for intervention and comparison group

	Intervention group				<i>t-test</i>	<i>P</i>	<i>d</i>	Comparison group				<i>t-test</i>	<i>P</i>	<i>d</i>
	Baseline (<i>n</i> =73)		Follow-up (<i>n</i> =68)					Baseline (<i>n</i> =41)		Follow-up (<i>n</i> =37)				
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>				<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Independence	1.38	1.05	1.47	1.17	-0.630	0.531	-	2.27	2.04	2.35	1.91	-0.388	0.701	-
Difficulty	1.18	0.71	1.54	1.54	-3.353	0.001*	0.32	1.36	1.03	1.38	1.05	0.081	0.936	-
Safety	3.08	1.58	3.75	1.80	-3.820	0.001*	0.40	3.42	1.76	3.54	2.01	-0.090	0.928	-

* Significant difference in person ability measures between baseline and follow-up

Everyday life tasks after home modification

Everyday life tasks are perceived as safer and easier after HM (Studies II & III)

In Study II ability to perform everyday life tasks after HMs was investigated, using the three scales in C-CAP Part I. The study showed significant differences in perceived difficulty and safety to perform everyday life tasks for persons after HMs. No statistically significant change could be noticed on the perceived independence. The reports from the comparison group remained stable and no statistical significant changes between the two data collection occasions occurred (see Table VI for more information). For participants after HM the level of safety in everyday life was increased with an effect size (d) of 0.40 and level of difficulty decreased with an effect size (d) of 0.32, both indicating a small to moderate effect of the intervention on the ability to perform everyday life tasks.

The impact on perceived difficulty was later confirmed in Study III, where factors influencing the participants' perceived difficulties during the HM process (i.e. from baseline to Follow-up 2) were investigated. The confounding factors that were found to have a statistically significant impact on difficulty were group belonging ($p < .05$), reported difficulty at baseline ($p < .001$), and waiting time for the HM ($p < .10$) (see Table VII). This indicates that participants receiving HM experienced a decrease in difficulty in the performance of everyday life tasks, with a mean difference in person ability measure of 0.45 logit in everyday life up to six months after the HM installation, than did participants in the comparison group. The results further showed that the waiting time for the HM had an additional impact on experienced difficulties in the performance of everyday life tasks. The mean increase in difficulty per month waiting for the HM was 0.037 logit.

Table VII. *Analysis of change in ability measure (after baseline) as a result of baseline to follow-up.*

Effect	Logit	SE (estimate)	P-Value	95% C.I
Baseline personal ability measure ¹	0.807	0.078	<0.001*	0.623 - 0.991
Time after baseline (months) ¹	0.001	0.037	0.981	-0.074 - 0.076
Time from application to installation of home modification (months) ¹	-0.037	0.018	0.077*	-0.078 - 0.005
Intervention group vs. comparison group ²	0.450	0.156	0.023*	0.082 - 0.819

* P-value < 0.10 indicates statistical significance

¹ Mean change in the ability measures per measurement unit of confounding factor

² Mean difference

Perceived changes in task difficulty after home modification (Study II)

In Study II the participants in the intervention group demonstrated significant mean differences in person ability measures between baseline and follow-up on the difficulty and safety scales. Therefore these two scales were further investigated in order to determine whether there were any significant differences in the task challenges from baseline to Follow-up 1. On the difficulty scale six tasks related to transfers and personal hygiene (grooming, bath/shower, transfer to toilet, get in/out of house, walk a block, move in/out of bed) were perceived as being easier ($p < 0.05$) to perform at Follow-up 1. The comparison of the task challenge between baseline and Follow-up 1 for the safety scale indicated that nine tasks (grooming, bath/shower, walk indoors, get in/out of house, managing stairs, walk a block, prepare meals, do grocery shopping, leisure and social activities) were perceived as being safer to perform ($p < 0.05$) at Follow-up 1. However, one task “take medication” was perceived as more unsafe ($p < 0.05$) to perform after the HM intervention.

Experiences of safety and security in everyday life after home modification (Study IV)

In Study IV, experiences of safety and security in everyday life for older adults who had received HM were explored and described. The analysis identified three categories, all related to and affecting each other, that impacted on safety and security. Included here were “Prerequisites that make safety and security possible”, “strategies that enable safety and

security in everyday life”, and “use of and reliance on technology impacts on safety and security”. The participants’ experiences of what affected feelings of safety and security in their everyday lives were shown to be founded on and supported by what can be described as prerequisites. The prerequisites had three characteristics – to feel healthy, to have someone to rely on, and to feel at home. The present state of these conditions profoundly affected the possibility for feeling safe and secure. The participants used different strategies to ensure safety and security in everyday life. These were: limitation of tasks, continuation as before, and reconciliation and adaptation of tasks. In the analysis it was revealed that the prerequisites, i.e. feeling healthy, having someone to rely on and feeling at home, impacted on the participants’ choices of strategy. Persons whose prerequisites were fulfilled also told about how they chose to a greater extent to reconcile themselves with their new situations and adapt to them, whereas persons with unfulfilled prerequisites chose to limit and avoid their involvement in everyday life tasks. The participants also reported that technology (HM, assistive devices, mobile phones, etc.) could help to facilitate a feeling of safety and security. The technology was only regarded as beneficial among the participants who also reported that their prerequisites were fulfilled. Technology supported by prerequisites enabled the participants to perform tasks whenever they felt like it without support from another person.

GENERAL DISCUSSION

The findings in this thesis have contributed new knowledge related to impacts of HM on aspects of everyday life tasks for older adults who age at home with disabilities.

Conducting research on the impact of an intervention such as HM demands a clear definition of central concepts and a conscious selection of a suitable outcome measure. Hence, this thesis has not only contributed knowledge of impacts of HM; it has also provided knowledge and reflections on central concepts as well, and on the use of instruments to assess impacts in everyday life tasks. In the following chapter some of the most important findings related to impacts, concepts, and instrument development will be discussed.

Perceived ability to perform everyday life tasks

In this thesis aspects of everyday life tasks after HM were investigated, applying a perspective based on the persons' own perceptions. The thesis is built on a theoretical framework that stresses the importance of including the persons' own perceptions in order to understand their abilities to perform everyday life tasks (Kielhofner, 2008). This theoretical framework is consistent with the fundamental beliefs within occupational therapy practice and theory, which emphasize the importance of incorporating the client as an active partner in the occupational therapy process and basing the professional services on the client's perceptions, values, and needs (Canadian Association of Occupational Therapists (CAOT), 1997; Förbundet Sveriges Arbetsterapeuter (FSA), 2005; Kielhofner, 2008).

However, in a recently published literature review of occupational therapy research on older adults (Larsson, Haglund & Hagberg, 2008), some interesting results were identified. The authors found that there was a lack of studies in which the older adults had been included as respondents. Most research within occupational therapy on older adults is not based on the older adults' own perceptions of their situations. This finding indicates that despite the fundamental beliefs, as well as the ethical codes within occupational therapy stating that professional service must be based on the clients' values and needs (CAOT, 1997; FSA, 2005; Kielhofner, 2008), occupational therapists fail to incorporate the clients' perceptions in research on older adults.

This finding highlights the great need to conduct research that builds on the older adults' own experiences, views, and needs. To this end, this thesis has contributed increased knowledge on the older adults' own perceptions of their abilities to perform everyday life tasks in relation to receiving HM. The thesis is based on the older adult's perceived ability to perform everyday day life tasks, and this perspective may differ from performance-based

assessments conducted by professionals of the actual task performance (Reuben et al., 2004). It could therefore be assumed that the results of the studies would probably have generated other kinds of findings, and another type of knowledge, if they were based only on professional observations. However, it is important to gain knowledge of the older adults' own perceptions and experiences of their abilities in order to better understand and support the everyday life tasks and aging in place.

Impacts of home modification on everyday life tasks

The studies in this thesis have generated important findings of how HM impacts on the perceived ability to perform everyday life tasks, contributing additional knowledge to this area of research.

First of all, findings from this thesis have shown that perceived ability to perform everyday life tasks improves after HM, when older adults receiving HM reported decreased difficulty and increased safety in the performance of everyday tasks. This indicates that for older adults with disabilities, HMs are effective in improving perceived ability to perform everyday life tasks.

Furthermore, the impact on difficulty was sustained at the six-month follow-up, indicating that HM has a continuing impact on reducing difficulties in everyday life. These findings are consistent with the results of Gitlin and colleagues (2006a), who also found a reduction of perceived difficulty up to 12 months post-HM, and the ones from Heywood (2005) and Tanner and colleagues (2008), who found increased feelings of safety for older adults receiving HM.

In contrast to the results on difficulty and safety, Study II did not identify any improvements in perceived independence. This finding is also in line with previous research on environmental interventions, where functional independence has been used as an outcome measure (Fänge & Iwarsson, 2005; Gitlin et al., 2003; Mann et al., 1999). This finding is significant, as one of the aims of providing HM, according to Swedish law, is to facilitate greater independence (SFS 1992:1574). However, the results of the studies above do not support the claim that independence is improved.

Findings from the qualitative study (Study IV), exploring experiences of safety and security in everyday life, showed in contradiction to the results in Study II that the participants perceived their everyday life tasks as more independent after HM. The participants described that after HM they were both able to perform everyday life tasks with less support from other persons, and to a greater extent to make their own decisions and to

choose when and where to perform tasks. These findings indicate that perceived independence (defined both as functional independence and autonomy) can be changed after HM, although this change may not be detectable using C-CAP (Gitlin & Corcoran, 2000; Lilja, 2002) and perhaps not in other outcome measures that have been applied in previous research on HM impacts on everyday life tasks (Fänge & Iwarsson, 2005; Gitlin et al., 2003; Mann et al., 1999).

Furthermore, in this thesis it was found that HM seemed to have a direct impact on tasks specifically targeted by the HM such as bathing/showering, and getting in and out of the home. This further supports the conclusion that the improvement in ability to perform important everyday tasks was related to HM. The impacts were not investigated in relation to any specific HM, but the findings indicate the general impact of any HM and do not provide information of whether some HMs have more or less impact than others. Interestingly, an indirect impact of the HM was also detected by participants reporting on an increased level of safety in tasks not directly related to the HM, such as grocery shopping and leisure. This interesting finding could indicate that modifications made in the home environment may have an additional impact upon tasks performed outside the home and on participation in community activities.

However, some of the changes found are more unexplainable and questionable, such as the participants having experienced decreased safety in taking medication after HM interventions. Taking part in an HM process may affect the participants in multiple ways; new needs may arise or the participants may become more aware of other services available in the community. Previous research has argued that impacts of HM are individual and may be related to personal aspects such as age, living status, type of HM, civil status, and health (Fänge & Iwarsson, 2007; Gitlin, 2003; Golant, 2003; Johansson, 2008; Heywood, 2005; Wahl & Weisman, 2003). In this thesis Studies III and IV were therefore designed to allow investigation of personal characteristics of changes after HM.

The findings in Study III could only identify that some of the chosen personal variables (confounding factors) impacted on perceived difficulty after HM. The participants' age, living status, dwelling, or type of HM did not show any impact. However, time, expressed in months waiting for HM was found to have an impact on reported difficulty after HM. Time has been stressed as an important factor that influences person and environmental interactions (Cutchin, 2003; Golant, 2003; Kielhofner, 2008). The ability to perform everyday life tasks in an environment cannot be regarded as a static condition. People are constantly changing their

perceptions, values, needs, and actions in relation to their ongoing lives (Cutchin, 2003; Golant, 2003; Johansson, 2008; Kielhofner, 2008). In this thesis the findings indicated that the waiting time for the HM reduces the ability to perform everyday life tasks. For each month that a person has to wait for an HM, the difficulty in performing everyday life tasks increases, reducing any beneficial impact that the future HM might have. Although this finding did not show a strong statistically significant impact, it has clinical importance. Similar findings were also found in a qualitative study of older adults receiving HM in Australia (Tanner et al., 2008). The researchers found that a longer time taken from HM referral to completion impacted negatively on the older adults' perceptions of the HM. These findings indicate that it is of vital importance that the provision of HM is organized as efficiently as possible, as a long waiting time may decrease the HM impact. In addition, more knowledge is needed on how the waiting time for an intervention such as HM impacts on the person's everyday life.

The individuality and multidimensionality of impacts on everyday life after HM was further highlighted in Study IV by the use of open-ended interviews. These allowed the participants to describe more freely how their everyday lives had changed after HM than what was possible using the C-CAP Part I. The findings provided additional knowledge on the personal aspects, in this study labeled as prerequisites (i.e. to feel healthy, to have someone to rely on, and to feel at home) that influenced the person's perceived safety, security, and ability to perform everyday life tasks. The findings also provided more knowledge on the impact of HM. The prerequisites could be more or less fulfilled and the current state profoundly affected the participants' abilities to use and benefit from the HM. These findings support the claims in previous studies that impacts of HM are related to personal aspects (Fänge & Iwarsson, 2007; Gitlin, 2003; Golant, 2003; Johansson, 2008; Heywood, 2005; Wahl & Weisman, 2003). These findings together highlight the importance for occupational therapists to work client-centered in order to facilitate that the interventions provided such as HM has a positive impact in the clients' everyday life. The findings from Study IV can therefore provide guidelines for future research in relation to aspects that could be important to consider when investigating how technology such as HM could impact on older adults' everyday life tasks.

In conclusion, the findings generated in this thesis have contributed knowledge of HM impacts on ability to perform everyday life tasks for older adults with disabilities. After HM older adults report on a reduced difficulty and increased safety in performing everyday life tasks. Although the instrument used in this thesis, the C-CAP Part I, failed to identify any

change in perceived independence, the open-ended interviews identified that the participants experienced increased feelings of independence and autonomy after HM. When conducting research on impacts the outcome measure used, in this study the C-CAP Part I, and its ability to capture changes in everyday life is of vital importance and need to be critically discussed.

The use of outcome measures in occupational therapy

The findings generated in this thesis have highlighted the many challenges that can be faced in trying to find beneficial outcome measures to apply when investigating impacts of interventions in general.

In occupational therapy the need for an evidence-based practice is of vital importance (Kielhofner, 2008; Taylor, 2007; Unsworth, 2000). There is a need of more research on impacts of occupational therapy interventions such as HM. However, conducting evaluations of interventions demands the use of valid, reliable, and sensitive outcome measures (AERA, APA & NCME, 1999; Spector, 1992). Previous research conducted on HM has failed to show any great impact of the HM on older adults' everyday lives (Fänge & Iwarsson, 2005; Gitlin, 2003; Mann, 1999). The results from these studies could both indicate that HMs do not have any impact, or that the outcome measure applied to investigate changes is not sensitive enough for investigating changes after HM. Critical reflection and generally more attention should be given to the use of valid and reliable instruments with the goal of investigating changes, both in research and in clinical practice.

In this thesis (Studies II & III) the C-CAP Part I was applied as an outcome measure to investigate changes after HM in everyday life tasks for older adults. This instrument was selected based on two important aspects that were considered essential in this thesis.

First, the C-CAP is based on the persons' own perceptions of their abilities and second, the C-CAP assesses ability in relation to perceived difficulty, independence, and safety. The C-CAP was therefore selected despite its limitations. These limitations are related to being a newly developed instrument that has not previously been applied in research and therefore had uninvestigated psychometric properties. It should, for example, be noted that aspects of validity, reliability, and responsiveness to change of the C-CAP Part I had to be investigated and considered. In the process of developing and evaluating an instrument's psychometric properties it is important to apply and test the instrument using different contexts and methods. A diversity of methods and contexts contributes to more knowledge of an

instrument's psychometric properties that can be useful in order to make any conclusions on necessary future revisions and developments (AERA, APA & NCME, 1999).

It is of great interest to learn how the findings generated in the studies included in this thesis have contributed different information of the psychometric properties of the C-CAP; this has provided directions for future development. In this section some of the most important considerations of the ability to use the C-CAP Part I as an outcome measure of HM impacts will be discussed.

The C-CAP Part I – strengths and limitations

In Study I the psychometric properties of the C-CAP Part I, for use with older adults in need of HM, were investigated using the Rasch rating scale model. The results from this study indicated that the C-CAP Part I, like many other instruments that measure ability in everyday life tasks (Doble & Fisher, 1998; Linacre, Heinemann, Wright, Granger, & Hamilton, 1994; Nilsson, Sunnerhagen, & Grimby, 2005; Küçükdeveci, Yavuzer, Tennant, Süldür, Sonel, & Arasil, 2000), had both strengths and limitations. One of the strengths of the instrument was the acceptable person response validity for all scales. This indicates that the C-CAP Part I can be applied in a valid manner for older adults in need of HM. Another strength of the C-CAP was the difficulty scale. This scale showed acceptable person response validity, internal scale validity, person separation indices (Study I) and also a responsiveness to change (Studies II & III). However, the studies have also identified some limitations that need to be critically discussed in the C-CAP Part I, especially in relation to the safety and independence scales.

The safety scale

The safety scale showed both strengths and limitations. The positive aspects of the safety scale were the acceptable internal scale validity and the person response validity, indicating that the scale consists of one construct and is valid for use with this sample. However, the safety scale showed low personal separation indices (Study I), indicating that the scale has a reduced ability to separate people into different levels of ability. This is a major concern if a scale is to be used as an outcome measure, which was one of the aims with the C-CAP Part I. Low separation indices have, on the other hand, been found in other instruments that assess performance in everyday day life tasks, especially in measurements based on self-report (Doble & Fisher, 1998; Guralnik et al., 1989; Kielhofner & Forsyth, 2001; Reuben et al., 2004) and also in samples with a high ability, indicating that the item difficulty is not matched to the persons' abilities (Bond & Fox, 2001). The separation is therefore likely to increase

when applied to a more heterogeneous sample (Bond & Fox, 2001). Despite the low separation indices, in Study II the safety scales were able to detect changes after HM both related to person ability measures and item difficulty calibration. The scales were also able to detect changes when the SE values were taken into account, supporting the responsiveness of the scale to HM. The low separation indicated a disturbance in the scale that needed to be investigated, and the scale was therefore not further applied in Study III. Research has identified that older adults in need of HM often experienced unsafety (Gitlin et al., 1999; Heywood, 2005; Mann et al., 1994). The sample used in this thesis did not report on any larger safety problems when being assessed with the C-CAP Part I. This indicates that either the people in the sample in this thesis, in contradiction to previous research (Gitlin et al., 1999; Heywood, 2005; Mann et al., 1994), do not feel unsafe, or that the safety scale in C-CAP is not able to capture feelings of safety. This shows that the safety scale may have a lack of face validity. Face validity refers to the extent of relevance of the items and the rating scale in order to measure the specific construct (Kazdin, 2003). The problems with measuring safety in the C-CAP Part I could therefore be related to its theoretical framework. The theoretical framework of an instrument should be able to define central concepts, items, and provide a structure for how it should be captured in clinical practice. However, when conducting evaluations of a scale, empirical data can contradict the theoretical framework, indicating that the operationalization of a construct has a poor relationship with the empirical world (AERA, APA & NCME, 1999; Spector 1992). A possible explanation behind the problems in the safety scale could therefore be that the construct of safety in the C-CAP was not clearly defined when constructing the instrument and that the definition is not valid with older adults' perceptions of safety in everyday life.

The independence scale

The independence scale in C-CAP Part I showed acceptable person response validity and person separation indices, although it failed to show unidimensionality (Study I) and responsiveness to change (Study II). A lack of internal scale validity indicates that the items in a scale do not measure the same construct (Bond & Fox, 2001). The analysis in Study I showed that four items failed to meet the criteria of goodness-of-fit. Problems with unidimensionality have to a large extent been found in other instruments that also assess functional independence in everyday life, such as the FIM (Linacre et al., 1994; Nilsson et al., 2005) and the Barthel Index (Küçükdeveci et al., 2000). It is therefore of importance that the problems with the independence scale are further investigated and discussed. In order to

investigate the impact of the four misfitting items on the independence scale on the person ability measure, a new analysis without these items was conducted. This analysis showed that the difference with and without the misfitting items on the person ability measures changed with a mean of 0.23 logit ($SD= 0.26$), indicating no serious disruption of the misfitting items on the person ability measure. As these four items were not considered to be a great threat to the validity at this stage of the instrument development, the independence scale was therefore also applied in Study II. However, in this study the independence scale could not detect any changes in perceived independence after HM. As previously discussed, the participants described, in Study IV, increased independence and autonomy after HM. This change was not detectable in the C-CAP Part I and is hence a large limitation in the instrument. Further, previous research on HM impacts using the FIM (Gitlin et al., 2003; Mann et al., 1999) and the ADL Staircase (Fänge & Iwarsson, 2005) has also failed to demonstrate any changes in everyday life after HM. Together these findings raise important questions of the accuracy in using these instruments as outcome measures both in research and in a clinical setting. Measures of functional independence are commonly used both in occupational therapy (Birge James, 2008; Letts & Bosch, 2005) and in rehabilitation (Wade, 1992), and it is therefore of vital importance that the limitations of these methods are given attention and critical discussion.

It is important to consider the reasons for the lack of responsiveness to change of the independence scale in the C-CAP Part I. Possible explanations could be related to both the construction of the rating scale and to aspects of face validity of the construct in relation to the sample used. First the rating scale: in C-CAP Part I the level of independence is rated on a four-point scale, where 4=independent, 3=uses technical device or HM, 2=uses only help from a person, and 1= uses both help from a person and technical device and/or HM. Hence, according to C-CAP a person is defined as independent if he or she performs a task without any technical or social support. This definition is also in line with other instruments that also address functional independence such as the FIM (Keith et al., 1987), or ADL Staircase (Hulter-Åsberg, 1990). The structure of these scales creates problems when used as outcome measures and can provide an explanation to the lack of sensitivity to detect changes after HM. If a person uses his or her HM intervention to perform a task, he or she can never be able to reach the highest state of independence. In fact, if the person did not use any support before the HM the person would actually be regarded as having decreased ability after HM as they have gone from category 4 (independent) to category 3 (uses technical device or HM). This problem is apparent in samples with a high level of independence, such as the sample used in

this thesis. It is, however, possible that these scales could detect changes in level of independence after HM if they were to be applied to samples with greater dependency. Second, the reduced responsiveness to change of the independence scale could also be related to lack of face validity. In C-CAP Part I independence is defined in relation to use of technical or social support. In Study IV the improvements in independence were not only related to the reduction of support but also to the possibility to make their own decisions, i.e. aspects related to autonomy. These findings indicate that there is a gap between what the older adults perceived as changes and what can be captured in the C-CAP. These results indicate that the independence scale in C-CAP and also in other instruments of functional independence such as the FIM (Keith et al., 1987), ADL Staircase (Hultér-Åsberg, 1990) or the Barthel Index (Mahoney & Barthel, 1965) may have a lack of face validity when used on older adults. Hence efforts should be made to develop C-CAP to fit the targeted populations' needs in order to detect changes after interventions. Based on the results from these studies, the independence scale in C-CAP Part I can in its current version not be considered clinically useful or psychometrically sound enough to apply in research.

In summary, the C-CAP Part I has the potential to complement already existing instruments that focus on perceived ability to perform everyday life tasks, especially regarding the C-CAP Part I's combined focus on the client's perceived difficulty and safety. These two scales are considered to be the strengths of C-CAP Part I and showed acceptable internal scale validity and person response validity, although they did show a somewhat low person separation. Development of the C-CAP Part I is needed before further application in research or in clinical work. In the process of evaluating and developing instruments it becomes apparent that the use and definition of central concepts is of vital importance. Despite the fact that the C-CAP Part I considers well-known concepts such as independence and safety, questions related to the definitions of these concepts kept arising. Therefore a more in-depth discussion of the complexity of these concepts will follow.

Central concepts of ability to perform everyday life tasks

This thesis focuses both on measuring impacts of HM and on the development of an instrument that assesses ability to perform everyday life tasks, which in this thesis are specifically perceived to involve independence, difficulty, and safety. However, in order to investigate changes after an intervention such as HM, clear definitions of central concepts are

essential in order to understand what is being measured (AERA, APA & NCME, 1999; Spector, 1992). Findings in Studies I and II evoked questions and considerations related to the definition of central concepts in C-CAP Part I, and especially those of perceived independence and safety, as was previously discussed. Although ability to perform everyday life tasks has been investigated to a large extent in research and has been the focus of the theoretical framework of this thesis (Kielhofner, 2008; Lawton & Nahemov, 1973; Lawton, 1989), there is a lack of a clear definition and use of the central aspects such as independence. However, findings from this thesis and especially from Study IV have clarified this discussion and contributed additional knowledge of independence, difficulty, and safety, as well as of the relationship between these concepts as aspects of everyday life tasks.

The concept of difficulty

Perceived difficulty in the performance of everyday life tasks was found to be a beneficial outcome measure to apply in order to investigate changes after HM. The difficulty scale also had the best psychometric properties in the C-CAP Part I (Study I), and was able to identify changes after HM (Studies II & III). These findings indicate, in compliance with previous research (Gill et al., 1998; Gitlin et al., 2006a), that the conceptualization of difficulty is a suitable parameter to apply as a complement to other parameters such as independence, in order to investigate ability of older adults to perform everyday life tasks. Perceived difficulty has also been highlighted in MOHO (Kielhofner, 2008) as a suitable parameter for providing important information on a person's competence in performing tasks and to investigate change over time.

The sample used in this thesis reported on a high level of difficulty at baseline indicating that difficulty may be a reason for HM application. Hence, perceived difficulty could be an important indicator that a person experiences problems with the performance of everyday life tasks and has a need for services such as occupational therapy, assistive devices, home help services, or HM. In addition, findings in Study IV showed that feeling safe and secure in everyday life is characterized by performing tasks with no difficulty, being able to choose when and where to perform a task, and not having to wait on someone to help them. Hence, feelings of difficulty are closely related to safety, security, autonomy, and independence.

The concept of safety

In this thesis older adults' perceived safety in everyday life has been studied. Feeling safe was considered an important component in previous research in order to be able to perform everyday life tasks, and for enabling aging in place (Fonad et al., 2006; Mann et al., 1994; Socialstyrelsen, 2002; Zimmer & Chappell, 1999). Furthermore, HM has been found to increase feelings of safety and security (Arman & Lindal, 2005; Heywood, 2005; Tanner et al., 2008). However, when reviewing research that studied older adults and experiences of safety, some limitations can be found. These studies describe that older adults often feel unsafe in their homes but do not explain and define the concepts of safety and aspects that impact on their feelings (Fonad et al., 2006; Socialstyrelsen, 2002; Zimmer & Chappell, 1999). Hence, there is a lack of knowledge of how older adults perceive safety and of aspects that impact on their feelings of safety in everyday life tasks. This knowledge is needed both in order to be able to improve older adults' safety and also to be able to develop an instrument with appropriate items and rating scale that could actually measure safety. The safety scale in C-CAP Part I (Gitlin & Corcoran, 2000; Lilja, 2002) is an attempt to measure safety although the findings on this scale showed lack of precision of the estimates, which could indicate that there is an uncertainty of what is being measured. Findings from Study IV provided important and additional knowledge of aspects contributing to safety, and also the related concept of security in everyday life tasks after HM. The findings suggest that feelings of safety and security are founded on the fulfillment of prerequisites (i.e. feeling healthy, having someone to rely on, and feeling at home). In order for older adults to be able to feel safe and secure they need to have fulfilled prerequisites. This is an important finding as it both provides an understanding of the concept and feeling of safety and security for older adults and of beneficial clinical implications. The findings indicated that participants who experienced fulfilled prerequisites also described that they could benefit more from HM, meaning that the HM supported them to feel safer and more secure and could also use more active strategies for handling problems in everyday life. Hence, the most supportive state, or the ultimate condition for feeling safe and secure was characterized by fulfilled prerequisites – feeling healthy, having someone to rely on, and feeling at home. Feeling safe and secure in the performance of everyday life tasks was described by the participants as being able to perform a task without difficulty and when they wanted to, and not having to wait for someone to help them. Hence the construct of safety and security are strongly related to the constructs of difficulty and independence (expressed both as functional independence and autonomy). This

indicates that the construct of safety needs to be clearly differentiated from difficulty and independence in order to be able to be measured successfully in outcome measures such as the C-CAP. Findings in Study IV have therefore provided additional knowledge about aspects influencing safety and security in everyday life and how these aspects relate to each other, which can be useful for further development of the C-CAP and revision of the theoretical framework. These important findings need, however, to be further investigated in future research.

The concept of independence

In this thesis questions related to the definition and meaning of the concept of independence emerged during the psychometric evaluation of C-CAP and the investigation of impacts of HM as well as in the findings of the interviews on safety and security in everyday life tasks. First, as previously discussed, findings in Study II failed to detect any changes in perceived independence after HM. These findings are not that surprising, as they are in accordance with previous research on HM for older adults (Fänge & Iwarsson, 2005; Gitlin et al., 2003; Mann et al., 1999). However, in Study IV the participants did describe changes in independence after HM, both in relation to being able to perform everyday life tasks without support from other persons and in relation to an increased ability to decide when and where to perform everyday life tasks. These findings are also supported by other researchers who identified increased independence after HM using qualitative interviews (Heywood, 2005; Tanner et al., 2008). These findings indicate that older adults may perceive a change in independence after HM that is not detectable in instruments investigating independence. These findings are interesting and generate questions about the definition of independence and how it is operationalized in instruments focusing on ability in everyday life tasks. The concept of independence is defined in the Oxford English Dictionary (2008-09-22) as: *“the fact of not depending on another, exemption from external control or support; freedom from subjection, or from the influence of others; individual liberty of thought or action”*. This definition implies that independence means both: 1) that you don't need practical support, which can be related to functional independence, and 2) that you can make your own decisions without the intervention of others, i.e. autonomy.

In occupational therapy the view on independence has long been related to functional independence (Jackson, 1996; Russel, Fritzgerald, Willamsson, Manor & Whybrow, 2002). When investigating the definitions of independence used in outcome measures on older adults such as the C-CAP (Gitlin & Corcoran, 2000; Lilja, 2002) the FIM (Keith et al., 1987), the

ADL Staircase (Hulter-Åsberg, 2000) and the Barthel Index (Mahoney & Barthel, 1965), they all define independence as functional independence. However, the notion of independence as only being related to functional independence in everyday life has been criticized across disciplines (Cardol, De Jong, & Ward, 2002; Davies, Laker & Ellis, 1997; Grimby, 2002; Haak, Fänge, Iwarsson & Dahlin-Ivanhof, 2007; Jackson, 1996; Russel et al., 2002). Research conducted in recent years has identified that functional independence is not central for older adults with disabilities. Instead, research has found that when people age the goal of being independent is not related to performing tasks without help but rather to having control over their everyday lives and be able to decide when and how to perform tasks, i.e. aspects of independence related to autonomy (Haak et al., 2007; Jackson, 1996; Johansson, 2008). In Study IV it was found that to be dependent on someone to complete a task was not considered negative if the participant felt that their needs, values and autonomy were respected, these findings are also in accordance with previous research (Haak et al., 2007; Jackson, 1996). These findings, taken together, indicate that the operationalization of independence as only functional independence is problematic when used in today's society on older adults (Haak et al., 2007; Jackson, 1996; Russel et al., 2002). Information of a person's functional independence could of course be of importance, especially for planning future interventions (Birge James, 2008; Letts & Bosch, 2005; Wade, 1992), such as needs for home help services. It is important to consider that functional independence may not be able to detect impacts of interventions or be of any larger significance in the older adults' everyday lives (Haak et al., 2007; Jackson, 1996). The different perspectives on independence as being both related to the construct of functional independence and the construct of autonomy could provide an explanation of why changes are found in independence in qualitative studies (Heywood, 2005; Tanner et al., 2008) such as in Study IV, but not in studies where the construct of functional independence has been used as an outcome measure (Fänge & Iwarsson, 2005; Gitlin et al., 2003; Mann et al., 1999) as in Study II. The findings indicate that the view of independence as also being related to autonomy should be recognized and included, in both occupational therapy research and rehabilitation research that focus on everyday life for older adults (Grimby, 2002; Heywood, 2005; Pfeiffer, 2001; Tanner et al., 2008). An inclusion of the older adults' perceived autonomy would help to provide a client-centered practice (CAOT, 1997; Law, 1998) and may also provide new perspectives on impacts of interventions such as HM (Haak et al., 2007; Heywood, 2005; Jackson, 1996; Tanner et al., 2008).

In conclusion, this thesis has highlighted the great importance of defining central concepts in order to be able to investigate and state any conclusion on impacts of interventions on ability to perform everyday life tasks. The findings from this thesis indicate that central, well-known concepts of aspects of everyday life tasks such as independence, difficulty, and safety are complex and not clearly defined or differentiated either in research or in theory. Additional research is therefore needed to further explore the relationship between these concepts and to develop a theoretical understanding of its implications for older adults' ability to perform everyday life tasks.

Theoretical framework – critical remarks

In this thesis a theoretical framework consisting of the Model of Human Occupation (MOHO) (Kielhofner, 2008) and the competence-environmental press framework (Lawton & Nahemov, 1973; Lawton, 1989) were applied. The purpose of applying the theoretical framework was to provide an understanding of aspects influencing perceived ability to perform everyday life tasks, to define central concepts, and to provide guidelines in how to investigate ability to perform everyday life tasks after HM, as well as how to interpret the findings.

In general the theoretical framework assumes that the ability to perform a task is created through an interaction between the person, the environment, and the task. The environment can both enable and hinder the performance of a task. Older adults with disabilities are considered more vulnerable to environmental hindrances and are assumed to benefit from the reduction of environmental hindrances with, for instance, HM. The results of the thesis are partly supported by the theoretical framework. The findings showed that a reduction of physical environmental hindrances with the HM can increase the older adults' ability to perform everyday life tasks (Kielhofner, 2008; Lawton & Nahemov, 1973; Lawton, 1989). The findings in this thesis also provided insights of a more dynamic and complex interaction between the person and the environment than what was expected and described in the theoretical framework.

In the theoretical framework the person and the environment are viewed as separate parts (Kielhofner, 2008; Lawton & Nahemov, 1973; Lawton, 1989). However, the findings in this thesis have indicated that the person and environment cannot be viewed separately. Specifically in Study IV the participants described their feelings of safety and security as being strongly related to their trust in their environments, both physical and social. A change in the environment such as an HM or home helpers was not considered to have a direct impact on their ability to perform tasks unless they felt they could trust the service. Hence, the person

and the environment cannot be viewed as separate components, but rather as a unit that integrates one with the other. This line of reasoning where the person and environment are separated is common in both occupational therapy models (CAOT, 1997; Kielhofner, 2008; Law, Cooper, Strong, Steward, Rigby & Letts, 1996), and also in models related to environmental gerontology and psychology such as the early version of the competence-environmental press framework (Lawton & Nahemov, 1973). However, this view has been criticized for its lack of applicability in empirical research on older adults and their everyday life (Cutchin, 2004; Dickie, Cutchin & Humphry, 2006; Johansson, 2008; Tanner et al., 2008). Instead, a transactional perspective that views the person and the environment as a constantly changing and integrated whole has been considered beneficial when conducting research on older adults (Cutchin, 2003; Gitlin, 2003; Johansson, 2008; Tanner et al., 2008; Wahl & Weisman, 2003).

Furthermore, perceived ability to perform everyday life tasks and also impacts of HM were found to change over time. Perceptions of ability to perform everyday life tasks after HM were constantly changing in response to the person's ongoing life, which generated new goals, needs and problems. This lack of temporal aspects has also been highlighted by both Golant (2003) and Cutchin (2004), who have argued that theoretical approaches and research on older adults tend to ignore impacts of the person's ongoing life. It could therefore be concluded that research and clinical practice on older adults have to both recognize and apply theoretical guidelines that stress the person's ongoing life as an important aspect impacting on the ability to perform everyday life tasks.

This discussion indicates that the theoretical framework (Kielhofner, 2008; Lawton & Nahemov, 1973; Lawton, 1989) applied in this thesis has both strengths and limitations, in order to explain and provide an understanding of a person's perceived ability to perform everyday life tasks and impacts of HM. However, to give theoretical explanations that can provide guidelines for the individual, dynamic, and complex interaction between person and environment has been found to be problematic (Gitlin, 2003; Wahl & Weisman, 2003). The lack of beneficial theoretical guidelines for this purpose are widely recognized and highlighted (Cutchin, 2004; Fänge & Iwarsson, 2007; Gitlin, 2003; Golant, 2003; Johansson, 2008; Tanner et al., 2008; Wahl & Weisman, 2003). This lack of theoretical guidelines has been recognized as providing challenges for the researcher. The lack was also felt in this thesis, especially the absence of definitions of core constructs and guidelines on what to measure, and how and why, in order to capture changes in the person and environmental transactions (Gitlin, 2003). Hence, the problems faced and the questions generated when

investigating psychometric properties of C-CAP and impacts of HM could be partly related to the lack of theoretical guidelines to apply when investigating research on older adults and the environment.

To conclude, this thesis has generated new knowledge of HM impacts on older adults with disabilities' perceived ability to perform everyday life tasks. In the process of evaluating and developing an instrument it became apparent that the need of a theoretical understanding and definition of central concepts is of vital importance. This thesis has contributed reflections on the development of central concepts and an instrument that assesses ability to perform everyday life tasks for older adults. In addition, findings from this thesis show that perceived ability to perform everyday life tasks improves after HM. Older adults receiving HM report decreased difficulty and increased safety in the performance of everyday life tasks. Impacts of HM were found to be related to personal aspects. The ability to feel safe and secure as well as the possibility to benefit from HM was based on the degree of fulfilled prerequisites. In addition, the C-CAP Part I is considered a beneficial instrument to apply when investigating impacts of HM, although it needs to be revised. The C-CAP is further considered to have the potential to complement already existing instruments that focus on ability to perform everyday life tasks, especially regarding the C-CAP Part I's combined focus on the client's perceived difficulty and safety.

Methodological considerations

The four studies included in this thesis have applied diverse designs and methodological approaches, all contributing different perspectives to the findings of the thesis. Choosing suitable and beneficial methodological approaches to apply when conducting research is challenging. Thus, it is important to consider and reflect on how the methodological approaches used in this thesis may have affected the findings. In this chapter some of the main methodological considerations will be discussed and critically reflected upon.

The sample used in the thesis

One methodological consideration to be raised in this discussion is the inclusion of participants and the sample used in the studies.

First, in Studies I-III the sample were recruited from the HMP. In general, studies of aging people include persons over the age of 65. However in the HMP the sample consisted of older adults over the age of 40. Inclusion of persons from the age of 40 and upwards was based on the accelerating aging as found in research, where people living with chronic conditions can experience age-related decline as early as their 40s (Cambell et al., 1999; Kemp & Mosqueda, 1997). In this thesis no difference could be found between the participants under or over the age of 65 in relation to changes in ability to perform everyday life tasks after HM. Furthermore, the sample consisted of older adults who experienced problems in everyday life and requested HM related to getting in and out of the home, mobility indoors, or self-care in the bathroom. In order for a person to apply for a HM the problem in everyday life has to be related to a permanent functional limitation, although in this thesis the focus was on the ability to perform everyday life tasks and not on the causes of the problems. Thus, the basis for inclusion was related to experienced problems in everyday life and not to any specific medical problem or diagnosis, a situation which is often used as basis for inclusion in occupational therapy research (Gitlin et al., 2001b; Guidetti, 2008; la Cour, 2008). In addition to experiencing problems in everyday life, the presumptive participants had to meet other inclusion criteria. It is necessary to use inclusion criteria in order to create a sample of participants who have the possibility to participate in the data collection, but they also exclude people that might have contributed important aspects to the findings. The criteria used in this thesis may have contributed to including persons with better health than the normal group of older adults applying for HM. The criteria related to cognitive and mental state have excluded people with dementia, brain injuries, or mental disorders. This is a large limitation, as people with cognitive and mental problems to a large extent live and age in their home and are among those who apply for HM. Hence there is a need to study everyday life and HM for these people, using other methodological approaches. Furthermore, the criterion of being able to speak and understand Swedish excluded a part of the population of immigrants in Sweden. Hence, these criteria may result in a selected sample that does not fully represent the cultural diversity of Swedish society.

In Study IV the participants were recruited from the HMP using inclusion criteria specific for this qualitative study. The fact that this sample had received an HM has probably impacted on the findings of aspects influencing safety and security in everyday life. Despite this, though, the participants gave rich descriptions including aspects other than technology that facilitated and influenced safety and security in their everyday lives.

Aspects of representability and generalizability of the findings in Studies I-IV

The criteria for both inclusion and exclusion impact on the final assembly of the sample and of its representation of people who apply for HM in Sweden. The thesis has focused on the population in society that applies for the most HM, i.e. older adults (Arman & Lindahl, 2005), and on the areas of the home that have been found to contain some of the most common environmental barriers to performance of everyday life tasks (Gitlin et al., 2001a; Iwarsson & Isaksson, 1996; Mann et al., 1994; Stark, 2001). It is important to note that this study specifically examined the impact of HM related to getting in and out of the home, mobility indoors, and performing self-care in the bathroom, and not all possible HM that can be installed. Furthermore, the sample used was a limited sample of people living in an urban area who applied for HM at a specific AHM and may therefore not be generally representative of all people who are in need of, and who actively request and receive HM. Despite these characteristics unique for the sample included in this thesis, the findings provided are in accordance with other studies conducted both in Sweden (Fänge & Iwarsson, 2005) and internationally (Heywood, 2005; Gitlin et al., 2006a), supporting the generalizability of the findings of this thesis (Studies I-III) to older adults living at home who are in need of and receive HM.

Moreover, Study IV was based on a qualitative approach. In these studies the aim is not to make statistical generalizations that could fit a larger population of interest, but rather to facilitate a conceptualization of “how something is”. However the conceptualization should allow flexibility and accept new inputs, such as from other situations or populations (Kvale, 1996; Glaser & Strauss, 1967).

Choice of analysis methods

In this thesis different analysis methods have been applied. The applied analyses are both qualitative and quantitative by nature and have been chosen on their ability to answer the specific aims and research questions stated in this thesis. However, all analysis methods have strengths and limitations. This section provides a discussion of these issues.

In this thesis a combination of methods was used in the different studies in order to investigate psychometric properties of the C-CAP Part I. A combination of methodological approaches has been recommended when investigating an instrument’s quality (AERA, APA & NCME, 1999). In Study I modern test statistics were chosen with the use of Rasch analysis. This choice was based on several aspects. Rasch analysis is considered to be a suitable

method to use when investigating instruments that are based on ordinal data such as the C-CAP (Bond & Fox, 2001; Merbitz et al., 1989). Rasch analysis also offers a method for transforming ordinal data into measures (Bond & Fox, 2001; Wright & Linacre, 1989). By using Rasch analysis the researcher is provided with broad and detailed information of validity and reliability related to persons, items, and rating scales (Bond & Fox, 2001). Moreover, Rasch analysis has been applied in the development of other instruments focusing on ability to perform everyday life tasks, such as the OARS (Doble & Fisher, 1998), the Assessment of Motor and Process Skills (AMPS) (Fisher, 2005), Occupational Self Assessment (OSA) (Kielhofner & Forsyth, 2001), the FIM (Linacre et al., 1994; Nilsson et al., 2005), and the Barthel Index (Küçükdeveci et al., 2000). Here Rasch analysis made comparisons of common characteristics easier between instruments such as misfitting items and separation values. It could also be important to comment on the specific Rasch statistics applied in this thesis. The Rasch analysis was conducted using the FACETS computer program, which generates a broad range of statistics. The program generates both infit and outfit goodness-of-fit statistics. However, in Study I only the infit *MnSq* and *z* statistics were applied, using a criteria where *MnSq* values above 1.4 indicated misfit. There are different opinions on what criteria and statistics to apply when evaluating goodness-of-fit. Some researchers argue that outfit statistics have more power than infit (Smith, 1991, 2000; Smith, Schumacker & Busch, 1998). As Study I was the first study conducted on the C-CAP Part I, infit statistics was applied, because these values are weighted and do not reject an item as misfit based on a few unexpected responses. In Study I, we also chose the criteria of goodness-of-fit as a $MnSq \leq 1.4$ with an associated $z < 2$. This criterion rejected scores with too much variation as misfit, although scores with too little variation, i.e. under 1.0, were still considered acceptable. Low *MnSq* and *z* statistics are not considered a great threat to validity compared to high *MnSq* and *z* statistics. Low values indicate too little variations in the individual responses such as similar scores on items despite item difficulty. However, as these are the first studies conducted on C-CAP it was considered most important to reject items and persons that indicate more variation than expected, as it is considered a larger threat to scales validity (Bond & Fox, 2001; McNamara, 1996; Wright & Masters, 1982).

Previous research has indicated that impacts of HM can be connected to personal aspects such as type of HM and dwelling (Fänge & Iwarsson, 2005; Gitlin et al., 2006a). Therefore the aim in Study III was to investigate whether any of the chosen confounding factors influenced changes after HM. Hence methods that could incorporate the participants' individual patterns

during the process were sought. Moreover, as the intervention and comparison groups consisted of different sizes and differed in relation to time points of data collections, this created further challenges in finding a suitable analysis method. Finally, in Study III an individual-based analysis method (random coefficient model) was applied. Traditional statistical methods such as repeated-measures ANOVA would fail to incorporate the time aspect in an appropriate way. The reason is that time is treated as a fixed factor in ANOVA, which is impossible when the measurement occasions are unequal, as for the participants in this study. Instead, by using random coefficient models it is possible to fit regression functions for each person (random effect), and then use the average of these to make conclusions of the population of interest (fixed effect).

In Study IV the open-ended interviews used a comparative analysis, a method based on grounded theory. Grounded theory is considered suitable to apply in areas that lack knowledge and that have not been explored in research (Glaser & Strauss, 1967), such as aspects influencing safety and security in everyday life for older adults. The method allows an exploration of what is happening (Glaser & Strauss, 1967) and is therefore considered beneficial both in exploring what safety and security is, and in increasing the knowledge of what contributed to a safe and secure situation in everyday life as studied in this thesis. In the last phase of the analysis a hermeneutic approach (Gustavsson, 1996) was applied to interpret the data. The hermeneutic approach provided a possibility to make interpretations of the findings on the prerequisites influencing safety and security in everyday life that would not have been possible if applying only a comparative approach.

Challenges in conducting research on older adults in their home environments

Conducting research on older adults in their homes (Gitlin, 2003; Golant, 2003; Wahl & Weisman, 2003), and especially on changes after HM, has been considered challenging (Fänge & Iwarsson, 2007; Johansson, 2008; Tanner et al., 2008). These statements are first based on the vulnerability of the sample, secondly on the complexity and emotional aspects related to a home, and thirdly on the difficulty of investigating impacts of HM, as it is a multidimensional intervention applied in an ongoing life. These issues will be further explored in the following section.

First, to do research in the home environment is often time-consuming both for the researcher and for the participants (Gitlin, 2003). In Studies II and III drop-outs were noted

between data collection occasions. This is a serious problem when conducting outcome studies (Kazdin, 2003), but is not that uncommon when conducting longitudinal research on older adults. Older adults are a vulnerable sample; they can easily become ill, pass away, move, or have other problems with continuation in research projects (Avlund, Vass & Henriksen, 2007; Fänge & Iwarsson, 2007; Gitlin et al., 2006a; Iwarsson, 2005; Mann et al., 1999). However, the drop-out in Studies I-III could also be explained by other aspects related to the expectations of the HM. The drop-out was slightly larger in the comparison group. These participants did not know whether they would receive the HM, or when the AHM were going to investigate their application. This situation could have influenced the participants' attitudes and willingness to continue in the research project.

Secondly, conducting research in the home environment has been found to provide the researchers with various challenges. The home environment is considered a complex and highly individual setting influenced by the inhabitant's interest, values, and needs (Gitlin, 2003; Rowles, 2000; Rubenstein, 1989). There are also large variations in the structure and physical attributes of the home environment, in contrast to institutions such as nursing homes, where these attributes are more regulated and controlled. The characteristics of the home make aging in place a highly individual experience. Doing research in these setting demands that methods and designs be flexible and take into account the individuality of the home environment and its impact on the person's ability to perform everyday life tasks (Gitlin, 2003; Golant, 2003). However, there is no consensus on how these methodological challenges should be treated, and there is a lack of possible methods to apply (Gitlin, 2003; Golant, 2003; Wahl & Weisman, 2003). These challenges were also faced in this thesis. The research in this thesis was done in the homes of older adults who receive an intervention, i.e. the HM, in their ongoing life that changes their physical home environment. In order to receive an individual perspective on these changes the C-CAP Part I instrument was used in combination with open-ended interviews. By applying these methods it was possible for the participants to report on their own individual experiences of their ability to perform everyday life tasks after HM. Golant (2003) has argued that a focus on how older adults perform everyday life tasks in the home provides an outcome of impacts from the environment. Hence changes in the home environment should have an outcome in the older adults' ability to perform tasks in the home. However, evaluating impacts of HM intervention on ability to perform everyday life tasks could also be a challenge. The HM intervention is multidimensional and includes components that are more or less unknown (Fänge & Iwarsson, 2007). Besides the actual modification

made to the environment, such as the grab bar on the wall, the HM also includes other aspects that are not that apparent, such as communication with involved professionals like the carpenters installing the HM or the instructions received on how to use the HM. These aspects certainly affect the usability of the HM and its impact on ability to perform everyday life tasks (Fänge & Iwarsson, 2007; Johansson, 2008). When conducting research that aims at investigating changes after HM it could therefore be problematic to draw conclusions on what specific aspects in the HM process make the change in everyday life tasks. Hence more effort should be made to identify the different components included in the HM intervention and its importance in the overall impact on everyday life tasks.

Another significant methodological consideration is the difficulty of determining whether the perceived improvements in everyday life tasks were a direct consequence of the HM or were related to other aspects, such as perceived health, receiving technical devices, or just random variation. For these reasons a comparison group including a similar sample not receiving HM were included. Data from the comparison group were used to reduce threats to internal validity (Kazdin, 2003), which may have affected the results. We therefore used a group of participants waiting for their HMs and referred to this group as the comparison group. This group did not fulfill the requirements of a control group in a randomized controlled trial (RCT) (Kazdin, 2003), due to the uneven group sizes, lack of randomization, and different circumstances, particularly in relation to time since application. Despite these limitations, participants in the comparison group were considered to provide complementary information that was beneficial to Studies II & III. When conducting research on natural interventions that are used in the community, such as HM, it could be problematic to find a suitable comparison group that is ethically correct to use, as it would be unethical to deny people requested HMs. Another problem faced was to coordinate the data collection process schedule and to make sure that the data were collected at the right stage of the HM process. For example, the first follow-up was to be performed two months post-HM, in order to receive data on ability to perform everyday life tasks when a HM had recently been installed. However, in some instances when the first follow-up data collection was to be conducted the total HM had not yet been installed, and this resulted in a delay of the follow-up data collection. These situations emerge when doing research involving a natural intervention process that the researcher cannot control, and have also been found in other research projects investigating HM interventions (Fänge & Iwarsson, 2007). Hence applying RCT design in studies of HM intervention for community-living older adults could therefore be problematic.

In conclusion, conducting research on community-living older adults and impacts of interventions on ability to perform everyday life tasks has been found to be challenging. In this thesis the methodological choices made were based on providing as valid and reliable findings as possible. As in all research, this thesis has limitations impacting on the possibility to make generalizable conclusions. In the future, further efforts should be made towards developing methodological approaches to apply when investigating interactions between older adults and their home environments.

Ethical considerations

The Ethics Research Committee at Karolinska Institutet approved the HMP, including the four studies in this thesis. All participants included in the HMP received written information that was later complemented with oral information. The written material included information about the research project, information of their rights to end participation at any time, issues of confidentiality, and practical information such as duration of the data collection. All participants had to give their oral consent in order to be included in the research project. The inclusion criteria for the HMP were applied to make sure that the participants had the possibility (stamina and concentration) to take part in the extensive data collection. The HMP included a broad set of data collection instruments (of which only a limited part has been used in this thesis) that could be experienced as tiresome to complete. The data collectors were observant of signs of discomfort or fatigue, and offered in such situations to postpone the continued data collection until another occasion.

To conduct research in a natural setting involves methodological challenges, as described earlier, but also ethical considerations. The participants for the HMP were recruited through a local AHM, and hence included persons who had perceived needs for an HM and had applied for the intervention. Information was provided to the participants in both written and oral forms, that the involvement in the HMP would not affect their process or the decision made by the AHM. When conducting research that is based on a natural intervention context, it is problematic to find a suitable comparison group that is ethically correct to use. In this thesis the participants in the comparison group were recruited from the list of persons who had recently applied for their HMs. At the start of the HMP the waiting time for the application to be handled by this specific AHM was at least six months. This left the HMP with a natural waiting list group that would be suitable and ethically right to use as

comparison. However, during the recruitment process the administration routines at AHM changed, resulting in a decreased waiting time for the administration of applications. For the HMP this meant that some participants in the comparison group received their HMs before the data collection had ended. As it would be unethical to deny these participants their HMs, these participants were therefore, as previously described, transferred to the intervention group or excluded from the HMP.

CONCLUSIONS & CLINICAL IMPLICATIONS

The findings of this thesis have important clinical implications and provide knowledge to occupational therapy and also to other professionals or authorities that meet needs and provide services, not only HM, for older adults in the home environment.

The findings provide support for the use of HM in order to improve the ability to perform everyday life tasks for community-living older adults. The findings showed that after HM the older adults perceive their everyday lives as safer and less difficult. However, in order for the HM to make a change in the person's ability to perform everyday life tasks it has to be provided in reasonable time. This information is of great importance to occupational therapy as well as to society, to the politicians, and program planners who may have the possibility to affect the HM delivery process and to arrange it effectively.

The thesis further showed that the provision of services aiming at increasing older adults' abilities to perform everyday life tasks, such as home helpers, safety alarms, HM, and assistive devices cannot alone facilitate a safe and secure everyday life. Feeling safe and secure in everyday life was strongly related to the older adults' prerequisites (feeling healthy, having someone to rely on, and feeling at home). A lack of prerequisites reduced the participants' abilities to feel safe and secure, and also the possibility to benefit from technology such as HM. Therefore, to facilitate a safe and secure everyday life for older adults, more emphasis in the interventions should first be put on fulfilling the prerequisites, such as increasing a person's perceived health or facilitating a trust in someone, in order for services like HM to have any impact on safety and security. Furthermore, older adults described safety and security in everyday life in situations where they had influence and were able control how they were to be performed. Hence issues of self-determination or autonomy were strongly related to feeling safe and secure in everyday life tasks. Feeling autonomous is central for older adults who may have reduced abilities to perform tasks independently. It is

therefore of great importance that autonomy is given more attention in clinical work, both as an aspect included in the assessment process and as an outcome measure of interventions. Further these findings indicate the importance for occupational therapists to work client-centered. The need for a HM and the impact of the HM are related to individual aspects that can not be understood without the use of a client-centered approach that is based on the client's perceived problems and needs.

Finally, the thesis provides knowledge of the importance of critical reflections on the use of instruments to apply for assessing ability to perform everyday life tasks and evaluate impacts of interventions on everyday life tasks, both in occupational therapy and in rehabilitation. The instrument applied in this thesis (Studies I-III), the C-CAP Part I, is considered beneficial for occupational therapists working with older adults in the home environment. The C-CAP Part I has the potential to complement already existing clinical instruments that assess ability in everyday life tasks, especially regarding its focus on the client's perceived difficulty and safety. For people aging at home with disabilities, decreased difficulty and increased safety are critical even for those who are still able to perform the tasks independently. However, the identified limitations of the C-CAP Part I need to be addressed before the instrument can be applied in clinical settings.

FUTURE RESEARCH

Research on HM and on impacts on the performance of everyday life tasks is an important area that needs to be further explored. Conducting this research is a question that needs to be seriously discussed. This thesis has shown some of the challenges that researchers face in this process, including attrition, use of suitable comparison groups, and finding a good outcome measure. These methodological circumstances are problematic but not at all unique when researchers conduct outcome studies in real-life situations under normal conditions in the community. This thesis has generated new questions and considerations that would be interesting to investigate in future research.

First, in this thesis older adults receiving HM were followed up to six months after the installation. Six months is, however, a relatively short period of time when investigating changes after HM. It would therefore be interesting to follow people who receive HM for a longer period of time. A longer data collection would contribute to knowledge about HM and aging in place, and also about how HMs are used over time in relation to changes that occur

as people age. Furthermore, the findings identified that older adults perceived their everyday life tasks as less difficult after HM. A longitudinal approach would also contribute to illuminating potential impacts of living with a reduced difficulty in everyday life such as the impact on preventing the development of health problems, healthcare needs, and dependency. In relation to these potential impacts of HM it would also be beneficial to investigate health economical aspects and consequences of HM interventions. In this thesis the waiting time for a HM had a negative impact on the ability to perform everyday life tasks. It would therefore be interesting to further investigate how the waiting time for interventions affects the older adults' everyday life and also how it may impact on the effect of the intervention.

In order to investigate older adults' abilities to perform everyday life tasks longitudinally, some central aspects are essential to consider. First, we need to have an understanding of the central concepts related to ability in everyday life tasks, and second, we need to have a good outcome measure that can be used to investigate ability to perform everyday life tasks over time. Findings in this thesis indicated that experiences of safety and security in everyday life are connected to perceptions of difficulty and also to autonomy and independence. This raises questions of the definition of and the relationship between these constructs. In order to investigate the extent of safety, security, difficulty, independence, and autonomy in older adults' everyday lives, especially after intervention, these constructs need to be critically reflected on and discussed. More studies investigating these concepts, their relationship, and the experience in everyday life are needed. This would contribute both concept development and knowledge of everyday life in the aging process. Also, in order to study longitudinal changes after HM on the ability to perform everyday life tasks, good outcome measures are needed.

The C-CAP Part I is considered to be an interesting instrument that could be beneficial when investigating longitudinal changes after HM. However, based on the findings provided in this thesis, a revision of the original version is needed. The revision could include new, harder items and a potential addition of a scale that focus on autonomy. Analysis of the psychometric properties of the revised instrument for use in different populations and cultures would then be needed. In addition, it is important to stress that this thesis has only applied the first part of the C-CAP. Thus, the applicability of Parts II-IV remains to be investigated. It would therefore also be interesting to apply the whole C-CAP in future research in order to provide complementary information of a person's ability to perform everyday life tasks, through professional observation of task performance and the impact of the environment.

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REFERENCES

- Agahi, N., Andersson, L., Lagergren, M., Lennartsson, C., Piekut, D., Saletti, A., et al., (2008). *Hälsoläget hos länets ålderspensionärer*. Stockholm: Stiftelsen Stockholms läns Äldrecentrum.
- Ahacic, K., Kåreholt, I., Thorslund, M., & Parker, M. (2007). Relationship between symptoms, physical capacity and activity limitations in 1992 and 2002. *Aging Clinical and Experimental Research*, *19*, 187-193.
- American Educational Research Association (AERA), American Psychological Association (APA), National Council on Measurement in Education (NCME). (1999). *Standards for educational and psychological testing*. Washington: AERA.
- Arman, R., & Lindal L. (2005). *Nytan och värdet av bostadsanpassningar ur olika perspektiv. Delrapport 1*. [Benefits and value of home modifications from different perspectives. Interim report.] (In Swedish). Göteborg: FoU i Väst.
- Avlund, K., Vass, M., & Hendriksen, C. (2003). Onset of mobility disability among community-dwelling old men and women. The role of tiredness in daily activities. *Age and Ageing*, *32*, 579-584.
- Avlund, K., Vass, M., & Hendriksen, C. (2007). Education of preventive home visitors: the effect on change in tiredness in daily activities. *European Journal of Ageing*, *4*, 125-131.
- Beaton, D., Bombardier, C., Guillemin, F., & Bosi Ferraz, M. (2000). Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine*, *25*, 3186-3191.
- Birge James, A. (2008). Activities of daily living and instrumental activities of daily living. In E. Blesedell Crepeau, E. Cohn, & B. Boyt Schell (Eds.). *Willard & Spackman's occupational therapy*. (11th ed.) (pp.538-578). Philadelphia: Wolters Kluwer/Lippincott Williams & Wilkins.
- Bond, T.G., & Fox, C.M. (2001). *Applying the Rasch Model. Fundamental Measurement in the Human Sciences*. London: Lawrence Erlbaum Associates Publishers.
- Bostadsanpassningsavdelningen. (2004). Statistik för ansökningar om bostadsanpassningsbidrag 2003. [Statistics on applications for home modification grants, 2003] (In Swedish). Stockholm: Stockholms Stadsbyggnadskontor.
- Boverket. (2000). *Handbok för bostadsanpassningsbidraget*. [Handbook for the home modification grant] (In Swedish). Stockholm: Fritzes förlag.
- Boverket. (2007). *Bostadsanpassningsbidragen 2006*. [Home modification grants 2006] (In Swedish). Karlskrona: Boverket.
- Brenes, G., Guralnik, J., Willamson, J., Fried, L., Simpson, C., Simonsick, E., et al., (2005). The influence of anxiety on the progression of disability. *Journal of American Geriatrics Society*, *53*, 34-39.
- Campbell, M. L., Sheets, D., & Strong, P.S. (1999). Secondary health conditions among middle-aged individuals with chronic physical disabilities: Implications for unmet needs for services. *Assistive Technology*, *11*, 105-122.
- Canadian Association of Occupational Therapists (CAOT). (1997). *Enabling Occupation*. Ottawa: CAOT Publications ACE.
- Cardol, M., de Jong, B.A., & Ward, C. (2002). On autonomy and participation in rehabilitation: a response. *Disability and Rehabilitation*, *24*, 1001-1004.
- Chang, W.C. & Chan, C. (1995). Rasch analysis for outcome measures: Some methodological considerations. *Archives of Physical Medicine & Rehabilitation*, *76*, 934-939.
- Cheek, J., Ballantyne, A., & Roder-Allen, G. (2005). Factors influencing the decision of older people living in independent units to enter the acute care system. *Journal of Clinical Nursing*, *14*, 24-33.
- Cohen, J. (1992). A power primer. *Psychological Bulletin*, *112*, 155-159.
- Cutchin, M.P. (2003). The process of mediated aging-in-place: a theoretically and empirically based model. *Social Science and Medicine*, *57*, 1077-1090.
- Cutchin, M.P. (2004). Using Deweyan philosophy to rename and reframe adaptation to environment. *American Journal of Occupational Therapy*, *58*, 303-312.
- Dahlin-Ivanoff, S., Haak, M., Fänge, A. & Iwarsson, S. (2007). The multiple meaning of home as experienced by very old Swedish people. *Scandinavian Journal of Occupational Therapy*, *14*, 25-32.
- Davis, S., Laker, S., & Ellis, L. (1997). Promoting autonomy and independence for older people within nursing practice: a literature review. *Journal of Advanced Nursing*, *26*, 408-417.
- Dickie, V., Cutchin, M.P., & Humphry, R. (2006). Occupation as transactional experience: A critique of individualism in Occupational Science. *Journal of Occupational Science*, *13*, 83-93.
- Doble, S. & Fisher, A. (1998). The dimensionality and validity of the Older American Resources and Services (OARS) activities of daily living (ADL) scale. *Journal of Outcome Measurement*, *2*, 4-24.
- Ernst Bravell, M., Berg, S., & Malmberg, B. (2008). Health, functional capacity, formal care, and survival in the oldest old: A longitudinal study. *Archives of Gerontology and Geriatrics*, *46*, 1-14.
- Femia, E.E., Zarit, S.E., & Johansson, B. (2001). The disablement process in very late life: A study of the oldest-old in Sweden. *Journal of Gerontology: Psychological Sciences*, *56B*, P12-P23.

- Fillenbaum, G.G. (1988). *Multidimensional Functional Assessment of Older Adults: The Duke Older Americans Resources and Services Procedures*. Hillsdale: Lawrence Erlbaum Publishers.
- Fisher, A. G. (1993). The assessment of IADL motor skills: An application of the many-faceted Rasch analysis. *American Journal of Occupational Therapy*, 47, 319-329.
- Fisher, A. G. (2005). *Assessment of Motor and Process Skills. Vol. 1: Development, Standardization, and Administration Manual* (5th ed.). Fort Collins: Three Star Press.
- Fisher, W. P. (1992). Reliability statistics. *Rasch Measurement Transactions*, 6, 238.
- Fitzmaurice, G.M., Laird, N.M., & Ware, J.H. (2004). *Applied longitudinal analysis*. Hoboken: Wiley-Interscience.
- Folstein, M.F., Folstein, S.E., & McHugh, P.R. (1975) "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*, 12, 189-98.
- Fonad, E., Robin Wahlin, T-B., Heikkilä, K., & Emami, A. (2006). Moving to and living in a retirement home: focusing on elderly people's sense of safety and security. *Journal of Housing for the Elderly*, 20, 45-60.
- Fried, L. P., Young, Y., Rubin, G., & Bandeen-Roche, K. (2001). Self-reported preclinical disability identifies older women with early declines in performance and early disease. *Journal of Clinical Epidemiology*, 54, 889-901.
- Fänge, A., & Iwarsson, S. (2005). Changes in ADL dependence and aspects of usability following housing adaptations: A longitudinal perspective. *American Journal of Occupational Therapy*, 59, 296-304.
- Fänge, A., & Iwarsson, S. (2007). Challenges in developing strategies for housing adaptation evaluations. *Scandinavian Journal of Occupational Therapy*, 14, 140-149.
- Förbundet Sveriges Arbetsterapeuter (FSA).(2005). *Ethisk kod för arbetsterapeuter*. [Ethical code for occupational therapists]. (In Swedish). Nacka: FSA.
- Gill, M.T., Allore, H., & Guo, Z. (2003). Restricted activity and functional decline among community-living older persons. *Archives of Internal Medicine*, 163, 1317-1322.
- Gill, M.T., Robison, J.T., & Tinetti, M.E. (1998). Difficulty and dependence: Two components of the disability continuum among community-living older persons. *Annals of Internal Medicine*, 128, 96-101.
- Gitlin, L.N. (1998). Testing home modification interventions: Issues of theory, measurement, design and implementation. In R. Schulz, G. Maddox, & M.P. Lawton (Eds.). *Annual review of gerontology and geriatrics. Focus on interventions research with older adults*. (pp 190-246). New York: Springer Publishing Company.
- Gitlin, L.N. (2003). Conducting research on home environments: lessons learned and new directions. *Gerontologist*, 43, 628-37.
- Gitlin, L.N. (2005). Measuring performance in instrumental activities of daily living. In M. Law, C. Baum, & W. Dunn (Eds.). *Measuring occupational performance*. (pp. 227-248). Thorofare: SLACK Incorporated.
- Gitlin, L.N. & Corcoran, M. (2000) *Client-Clinician Assessment Protocol (C-CAP)*, Philadelphia: Thomas Jefferson University.
- Gitlin, L.N., Corcoran, M., Winter, L., Boyce, A., & Hauck, W.W. (2001b). A randomized, controlled trial of a home environmental intervention: effect on efficacy and upset in caregivers and on daily function of persons with dementia. *Gerontologist*, 4, 4-14.
- Gitlin, L.N., Hauck, W.W., Winter, L., Dennis, M.P., & Schulz, R. (2006b). Effect of an in-home occupational and physical therapy intervention on reducing mortality in functionally vulnerable older people: Preliminary findings. *Journal of American Geriatrics Society*, 54, 950-955.
- Gitlin, L.N., Mann, W., Tomit, M., & Marcus, S.M. (2001a). Factors associated with home environmental problems among community-living older people. *Disability & Rehabilitation*, 23, 777-787.
- Gitlin, L.N., Winter, L., Corcoran, M., Dennis, M., Schinfeld, S., & Hauck, W.W. (2003). Effects of the home environmental skill-building program on the caregiver-care recipient dyad: 6-month outcomes from the Philadelphia REACH Initiative. *Gerontologist*, 43: 532-546.
- Gitlin, L.N., Winter, L., Dennis, M., Corcoran, M., Schinfeld, S., & Hauck, W.W. (2006a). A randomized trial of a multicomponent home intervention to reduce difficulties in older adults. *Journal of American Geriatrics Society*, 54: 809-816.
- Glaser, B.G. & Strauss, A.L. (1967). *The discovery of grounded theory*. Aldine. Chicago.
- Golant, S.M. (2003). Conceptualizing time and behavior in environmental gerontology: A pair of old issues deserving new thought. *Gerontologist*, 43, 638-648.
- Grimby, G. (2002). On autonomy and participation in rehabilitation. *Disability and Rehabilitation*, 24, 975-976.
- Grimby, G., Andréén, E., Daving, Y., & Wright, B. (1998). Dependence and perceived difficulty in daily activities in community-living stroke survivors 2 years after stroke. A study of instrumental structures. *Stroke*, 29, 1843-1849.
- Guidetti, S. (2008). *Recapturing self-care after stroke or spinal cord injury*. Doctoral dissertation, Stockholm: Karolinska Institutet.

- Guralnik, J. M., Branch, L. G., Cummings, S. R., & Curb, J. D. (1989). Physical performance measures in aging research. *Journal of Gerontology*, *44*, M141-M146.
- Gustavsson, A. (1996). Att förstå människor – Tillämpning av den formella datastrukturanalysen. [Understanding people – Application of formal data structure analysis]. (in Swedish) Stockholm: Stockholm University, Department of Education.
- Haak, M., Fänge, A., Iwarsson, S. & Dahlin-Ivanoff, S. 2007. Home as a signification of independence and autonomy: Experiences among very old Swedish people. *Scandinavian Journal of Occupational Therapy*, *14*, 16-24.
- Hammel, J., Charlton, J., Jones, R., Kramer, J., & Wilson, T. (2008). From disability rights to empowered consciousness. In E. Blesedell Crepeau, E. Cohn, & B. Boyt Schell (Eds.). *Willard & Spackman's occupational therapy*. (11th ed.) (pp.868-887). Philadelphia: Wolters Kluwer/Lippincott Williams & Wilkins.
- Heywood, F. (2005). Adaptation: Altering the House to Restore the Home. *Housing Studies*, *20*, 531-547.
- Hulter-Åsberg, K. (1990). *ADL-trappan*. [The ADL staircase]. (In Swedish) Lund: Studentlitteratur.
- Iwarsson, S. (2005). A long-term perspective on person-environment fit and ADL dependence among older Swedish adults. *Gerontologist*, *45*, 327-336.
- Iwarsson, S. & Isaksson, Å. (1996). Housing standards, environmental barriers in the home and subjective general apprehension of the housing situation among the rural elderly. *Scandinavian Journal of Occupational Therapy*, *3*, 52-61.
- Jackson, J. (1996). Living a meaningful existence in old age. In R. Zemke, & F. Clarke (Eds.). *Occupational Science- the evolving discipline*. (pp. 339-361). Philadelphia: FA Davis Company.
- Jagger, C., Arthur, A. J., Spiers, N. A., & Clarke, M. (2001). Patterns of onset of disability in activities of daily living with age. *Journal of the American Geriatrics Society*, *49*, 404-409.
- Jette, A.M. (1994). How measurement techniques influence estimates of disability in older populations. *Social Science & Medicine*, *38*, 937-942.
- Johansson, K. (2008). Older Peoples' Home Modification Process. Doctoral dissertation. Karolinska Institutet.
- Johansson, K., Lilja, M., Petersson, I., & Borell, L. (2007). Performance of activities of daily living in a sample of applicants for home modification services. *Scandinavian Journal of Occupational Therapy*, *14*, 44-53.
- Katz, S., Ford, C. A., Moskowitz, R. W., Jackson, B. A., & Jaffe, M. W. (1963). Studies of illness in the aged. The Index of ADL: A standardized measure of biological and psychosocial function. *Journal of American Medical Association*, *185*, 914-919.
- Kazdin, A.E. (2003). *Research Design in Clinical Psychology*. Boston: Allyn and Bacon.
- Keith, R. A., Granger, C. V., Hamilton, B. B., & Sherwin, F. S. (1987). The functional independence measure: a new tool for rehabilitation. *Advances in Clinical Rehabilitation*, *1*, 6-18.
- Kemp, B. & Mosqueda L. (1997). Aging-related conditions. In M. Fuhrer. (Ed.) *Assessing medical rehabilitation practices- the promise of outcome research*. (pp. 393-411). Baltimore: Paul H. Brookes Publishing Co.
- Kempen, G., Steverink, N., Ormel, J., & Deeg, D. (1996). The assessment of ADL among frail elderly in an interview survey: Self-report versus performance-based tests and determinants of discrepancies. *Journal of Gerontology: PSYCHOLOGICAL SCIENCES*, *51 B*, 254-260.
- Kielhofner, G. (1995). *A Model of Human Occupation: Theory and application*. (2nd ed.). Baltimore: Williams & Wilkins.
- Kielhofner, G. (2008). *A Model of Human Occupation: Theory and application* (4th ed.). Baltimore: Williams & Wilkins.
- Kielhofner, G., & Forsyth, K. (2001). Measuring properties of a client self-report for treatment planning and documenting therapy outcomes. *Scandinavian Journal of Occupational Therapy*, *8*, 131-139.
- Kottorp, A., Bernspång, B., & Fisher A.G. (2003) Validity of a performance assessment of activities of daily living for people with developmental disabilities. *Journal of Intellectual Disability Research*, *47*, 597-605.
- Krause, J. & Adkins, R. (2004). Methodological issues. In B. Kemp & L. Mosqueda (Eds.). *Aging with disability: what the clinician needs to know*. (pp. 237-279). Baltimore: The John Hopkins University Press.
- Küçükdeveci, A., Yavuzer, G., Tennant, A., Süldür, N., Sonel, B., & Arasil, T. (2000). Adaptation of the modified Barthel Index for use in physical medicine and rehabilitation in Turkey. *Scandinavian Journal of Rehabilitation Medicine*, *32*, 87-92.
- Kvale, S. (1996). *Interviews*. Thousand Oaks: SAGE Publications.
- la Cour, K. (2008). *Activities and recourses when living with advanced cancer*. Doctoral dissertation. Stockholm: Karolinska Institutet.

- Larsson, K. (2006). *Kvarboende eller flyttning på äldre dagar- en kunskapsöversikt*. [Aging in place or moving in old age – A knowledge review]. (In Swedish). Stockholm: Stiftelsen Stockholms läns Äldrecentrum.
- Larsson, Å., Haglund, L. & Hagberg, L-H. (2008). A review of research with elderly people as respondents reported in occupational therapy journals. *Scandinavian Journal of Occupational Therapy*, 15, 116-126.
- Law, M. (1998). *Client-centred occupational therapy*. Thorofare: SLACK Incorporated.
- Law, M., Cooper, B., Strong, S., Steward, D., Rigby, P., & Letts, L. (1996). The person-environment-occupational model: A transactive approach to occupational performance. *Canadian Journal of Occupational Therapy*, 63, 9-23.
- Lawton, M.P. (1989). Environment proactivity in older people. In V. Bengtson & W. Schaie (Eds.). *The course of later life. Research and reflections*. (pp. 15-24). New York: Springer Publishing company Inc.
- Lawton, M. P., & Brody, E. M. (1969). Assessment of older people: Self-maintaining and instrumental activities of daily living. *Gerontologist*, 9, 179-186.
- Lawton, M. P., & Nahemov, L. E. (1973). Ecology and the aging process. In C. Eisdorfer & M. P. Lawton (Eds.), *The psychology of adult development and aging* (pp. 619-674). Washington: American Psychological Association.
- Lawton, M.P., & Simon, B. (1968). The ecology of social relationships in housing for the elderly. *Gerontologist*, 8, 108-115.
- Letts, L., & Bosch, J. (2005). Measuring occupational performance in basic activities of daily living. In M. Law, C.Baum & W. Dunn (Eds.). *Measuring occupational performance*. (pp. 179-226).Thorofare: SLACK Incorporated.
- Lilja, M. (2002). *Riktlinjer för användning av Client-Clinician Assessment Protocol (C-CAP)*. [Guidelines for use of the *Client-Clinician Assessment Protocol (C-CAP)*] (In Swedish). Stockholm: Karolinska Institutet.
- Linacre, J. M. (1994-2005). FACETS: Many-facet Rasch measurement computer program. (Version 3.54). Chicago: MESA.
- Linacre, J. M. (2002a). Optimizing rating scale category effectiveness. *Journal of Applied Measurement*, 3, 85-106.
- Linacre, J. M. (2002b). What do infit and outfit, mean-square and standardized mean? *Rasch Measurement Transactions*, 16, 878.
- Linacre, J.M., Heinemann, A.W., Wright, B.D., Granger, C.V., & Hamilton, B.B. (1994) The structure and stability of the Functional Independence Measure, *Archives of Physical Medicine & Rehabilitation*, 75, 127-32.
- Mahoney, F.I., & Barthel, D.W. (1965). Functional evaluation: The Barthel Index. *Maryland State Medical Journal*, 14, 61-65.
- Martin, F.C., Hart, D., Spector, T., Doyle, D.D., & Harari, D. (2005). Fear of falling limiting activity in young-old women is associated with reduced functional mobility rather than psychological factors. *Age & Ageing*, 34, 281-287.
- Mann, W. C., Hurren, D., Tomita, M., Bengali, M., & Steinfeld, E. (1994). Environmental problems in homes of elders with disabilities. *Occupational Therapy Journal of Research*, 14, 191-211.
- Mann, W.C., Ottenbacher, K.J., Fraas, L., Tomita, M., & Granger, C.V. (1999). Effectiveness of assistive technology and environmental interventions in maintaining independence and reducing home care costs for the frail elderly. A randomised controlled trial. *Archives of Family Medicine*, 8, 210-7.
- McNamara, T. (1996). *Measuring second language performance*. London: Addison Wesley Longman.
- Merbitz, C., Morris, J., & Grip, J. (1989). Ordinal scales and foundations of misinference. *Archives of Physical Medicine and Rehabilitation*, 70, 308-312.
- Nilsson, Å.L., Sunnerhagen, K. S., & Grimby, G. (2005). Scoring alternatives for FIM in neurological disorders applying Rasch analysis. *Acta Neurologica Scandinavica*, 111, 264-273.
- Oswald, F., Wahl, H-W., Schilling, O., Nygren, C., Fänge, A., Sixsmith, A., et al., (2007). Relationship between housing and healthy aging in very old age. *Gerontologist*, 47, 96-107.
- Pfeiffer, D. (2001). The paradox of changing the service delivery system in the field of rehabilitation. *Disability and Rehabilitation*, 23, 16-17.
- Petrie, A., & Sabin, C. (2000). *Medical statistics at a glance*. Oxford: Blackwell Publishing.
- Putnam, M. (2002). Linking aging theory and disability models: Increase the potential to explore aging with physical impairment. *Gerontologist*, 42, 799-806.
- Radloff, L.S. (1977). The CESD scale: A self report depression scale for research in the general population. *Applied Psychological Measurement*, 1, 385-401.
- Reuben, D. B., Seeman, T. E., Keeler, E., Hayes, R. P., Bowman, L., Sewall, A., et al., (2004). Refining the categorization of physical functional status: The added value of combining self-reported and performance-based measures. *Journals of Gerontology Series A – Biological Sciences & Medical Sciences*, 59, 1056-1061.

- Rowles, G.D. (2000). Habituation and being in place. *The Occupational Therapy Journal of Research*, 20, 52-67.
- Rubenstein, R.L. (1989). The home environment of older people: A description of the psychosocial processes: Linking person to place. *Journal of Gerontology*, 44, 45-53.
- Russel, C., Fritzergerald, M.H., Willamsson, P., Manor, D., & Whybrow, S. (2002). Independence as a practice issue in occupational therapy: the safety clause. *American Journal of Occupational Therapy*, 56, 369-379.
- SAS (software program), Version 9.1.3. SAS Institute Inc.
- Schultz, R., & Heckhausen, J. (1999). Aging, culture and control: Setting a new research agenda. *Journal of Gerontology Series B – Psychological Sciences & Social Sciences*, 54, 139-145.
- Shakespeare, T. (2006). *Disability rights and wrongs*. London: Routledge.
- Sherman, S.E., & Reuben, D. (1998). Measures of functional status in community dwelling elders. *Journal of General Internal Medicine*, 11, 817-823.
- Smith, R.M. (1991). The distributional properties of Rasch item fit statistics. *Educational and Psychological Measurement*, 51, 541-565.
- Smith, R.M. (2000). Fit analysis in latent trait models. *Journal of Applied Measurement*, 1, 199-218.
- Smith, R.M., Schumacker, R. E. & Bush, M. J. (1998). Using item mean square to evaluate fit to the Rasch model. *Journal of Outcome Measurement*, 2, 66-78.
- Socialdepartementet. 2008. *Äldres boende*. [Living conditions/housing of the elderly]. (In Swedish). Regeringskansliet. Stockholm. Available online at www.regeringen.se/sb/d/8088, 2008-01-30
- Socialstyrelsen. (2000). *Good housing for older people and people with disabilities*. Stockholm: Socialstyrelsen.
- Socialstyrelsen. (2002). *Äldre som flyttar till service och vård*. [Older people who move to service and care]. (In Swedish). Stockholm: Socialstyrelsen.
- Socialstyrelsen. (2007). *Trappan mellan kvarboende och flytt. Förutsättningar för äldre med rörelsehinder att bo kvar hemma*. [The staircase between staying at home and moving. Conditions for elderly with disabilities to stay at home] (In Swedish). Stockholm: Socialstyrelsen.
- Socialstyrelsen. (2008). *Vård och omsorg om äldre. Lägesrapporter 2007*. [Health care and services for the elderly. Progress reports 2007] (In Swedish). Stockholm: Socialstyrelsen.
- Spector, P. (1992). *Summated rating scale construction. An introduction*. Newbury Park: SAGE Publications.
- SPSS: Statistical Package for the Social Sciences (software program), Version 13.0. SPSS Inc.
- Stark, S. (2001). Creating disability in the home: the role of the environmental barriers in the United States. *Disability & Society*, 16, 37-49.
- Stark, S. (2003). Home modifications that enable occupational performance. In L. Letts, P. Rigby, & D. Stewart (Eds.). *Using environments to enable occupational performance*. (pp. 219-234). Thorofare: SLACK Inc.
- Stark, S. (2004). Removing environmental barriers in the homes of older adults with disabilities improves occupational performance. *OTJR: Occupation Participation and Health*, 24, 32-39.
- Strauss, A. & Corbin, J. (1998). *Basics of qualitative research. Techniques and procedures for developing grounded theory*. Thousand Oaks: SAGE Publications.
- Stuck, A.E., Walthert, J.M., Nikolaus, T., Bula, C.J., Hohmann, C., & Beck, J.C. (1999). Risk factors for functional status decline in community-living elderly people: a systematic literature review. *Social Science and Medicine*, 48, 445-469.
- Sullivan, M., Karlsson, J., & Ware, J.E. (1994). *SF-36 Hälsoenkät: Svensk manual och tolkningsguide (Swedish manual and interpretation guide)*. Göteborg: Sahlgrenska University Hospital.
- Svensk Författningssamling SFS 1992:1574. (1992). *Lag om bostadsanpassningsbidrag mm* [Swedish Act on Home Modification Grants, etc.]. (In Swedish).
- Tamm, M. (1999). What does a home mean and when does it cease to be a home? Home as a setting for rehabilitation and care. *Disability and Rehabilitation*, 21, 49-55.
- Tanner, B., Tilse, C., & de Jonge, D. (2008). Restoring and sustaining home: The impact of home modifications on meaning of home for older people. *Journal of Housing for the Elderly*, 22, 195-215.
- Taylor, C. (2007). *Evidence-based practice for occupational therapists*. Hoboken: Wiley Blackwell.
- Thompson, L. (2004). Functional changes affecting people aging with disability. In B. Kemp & L. Mosqueda (Eds.). *Aging with disability: what the clinicians needs to know*. (pp. 102-128). Baltimore: The John Hopkins University Press.
- Unsworth, C. (2000). Measuring the outcome of occupational therapy: Tools and resources. *Australian Occupational Therapy Journal*, 47, 147-158.
- Wahl, H-W., & Weisman, G.D. (2003). Environmental gerontology at the beginning of the new millennium: Reflections on its historical, empirical and theoretical development. *Gerontologist*, 39, 616-627.
- Wade, D.T. (1992). *Measurement in Neurological Rehabilitation*. Oxford: Oxford University Press.

- World Health Organization (WHO). (2001). *ICF: International classification of functioning, disability and health*. Geneva: WHO.
- Wright, B., & Linacre, J. M. (1989). Observations are always ordinal; Measures, however, must be interval. *Archives of Physical Medicine and Rehabilitation*, 70, 857-860.
- Wright, B., & Linacre, J. M. (1994). Reasonable mean-square fit values. *Rasch Measurement Transactions*, 8, 370.
- Wright, B., & Masters, G. (1982). *Rating scale analysis*. Chicago: MESA Press.
- Wright, B., & Stone, M. (1979). *Best test design*. Chicago: MESA Press.
- Zimmer, Z., & Chappell, N. L. (1999). Receptivity to new technology among older adults. *Disability and Rehabilitation*, 21, 222-230.