Demographics and Future Needs for Public Long Term Care and Services among the Elderly in Sweden

- The Need for Planning

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ABSTRACT

Long term care and social services (LTCaS) for older people are an important part of the Scandinavian welfare state. The fast growing number of elderly people in Sweden has caused many concerns about increases in future needs (and particularly costs) of age-related social programs such as LTCaS.

The general aim of this dissertation is to examine how projected demographic changes may affect future needs for long-term care and services in Sweden assuming different trends in morbidity and mortality. The following data sources are used: national population registers, register data on inpatient/outpatient health care from region Skåne, the Swedish National Survey on Living Conditions (SNSLC) for the period 1975-1999.

In this thesis we have presented three alternative methods (studies I, II and IV) to inform simple demographic extrapolations of needs for health and social care for the elderly. We have also developed a new method for demographic projections (study III) that will further improve the demographic base for our methods. This new method has also been combined with the method in study II in order to enhance alternative methods of demographic extrapolations of future needs for LTCaS with a socio-economic dimension (study IV).

According to our studies II and IV, the health of older people (measured as the prevalence of severe ill-health) has improved during the study period. Furthermore, we show that, around 6% of the total population with six or less remaining years of life accounts for nearly 37% of total costs for inpatient health care. Developments in morbidity and disability prevalence in recent years, and the question whether its decline will continue, have enormous implications for the future needs for LTCaS and for social policies in general. Policy response may include both changes to the LTCaS system and investments in public health in older people.

Taking into account health status, when projecting future needs for LTCaS, will result in a fairly substantial reduction of the rate of the demographically influenced increase in projected LTCaS needs. However, the size of the reduction is dependent on which health indicators are used and which time period is used as a foundation for data for health status.
The changes in population composition (that have already occurred or are projected) regarding education and mortality differentials per educational level may have a significant impact on the number of the elderly in the future. The population projection, where those factors are taken into account, results in a higher number of older people (ca 15% by year 2035) and a longer life expectancy than projected in official statistics.

We show that the projected increase in the number of older people suffering from severe ill-health, as a consequence of population ageing, may be counterbalanced to a large extent by changes in the educational composition towards a higher proportion of the population having a high educational level and lower prevalence of severe ill-health. On the other hand, a higher than projected increase in the number of older people could strain the pension system and will, according to a large majority of our scenarios, probably lead to increased needs for LTCaS.

Population projections by age, gender and educational level should be used when assessing how demographic changes affect needs for LTCaS. This may also hopefully influence discussions of alternative population projections in order to balance the systematic underestimation of the number of older persons, which has been more of a rule than an exception, when projecting the future number of older people in many countries including Sweden.

Improved methods of demographic extrapolations are important for both improving planning within LTCaS, and enhancing human resources policies for long term care. Those methods are furthermore crucial in order to design public policies that address the needs of aging populations, including planning, financing, and public health programs.

The value of scenarios and projections of this kind does not lie in their perfect match with the future. The fact is that forecasts most often are proven to be wrong. Nevertheless, it is crucial to know what will happen if the development continues in the same direction, or alternatively what may happen if the preconditions are changed.

Future developments in mortality rates, morbidity/disability rates, changes in population composition as regards to gender, age and socio-economic status are inevitably uncertain. There is also great uncertainty in regard to how the relationship between education, mortality and morbidity will develop. However, future needs are not only uncertain, but also affected by today’s actions. We need to improve our planning tools in order to support policy-makers to plan for uncertainty concerning future needs and demand for LTCaS.
There are few countries in the world that have as developed statistical registers as Sweden has. However, also as regards to statistics, there are some areas that need improvement. Lack of individual-based statistics concerning older people’s use of LTCaS and their health status and functional ability is a problem for monitoring and planning within the LTCaS system.
SAMMANFATTNING

Äldreomsorg är en viktig del av den skandinaviska välfärdsstaten. Det snabbt ökande antalet äldre personer och det faktum att vårdbehoven inte är jämnt fördelade på åldersgrupperna i befolkningen har lett till en del oro och funderingar hur framtida ökningen av behoven av äldreomsorg (och framförallt kostnaderna för densamma) kommer att påverka välfärdsstaten.


I avhandlingen presenteras tre alternativa metoder (artiklarna I, II och IV) för att utveckla den enkla demografiska framskrivningen av framtida behov av vård och omsorg. Dessutom presenteras en ny metod för befolkningsprognoser där prognosen baseras på antaganden gällande inte bara kön och ålder som i officiella befolkningsprognoser, utan också utbildningsnivå (artikel III) som stöd för vidare utveckling av våra framskrivningar.

Utvecklingen när det gäller dödlighet och sjuklighet under de senaste decennierna samt frågan om hur utvecklingen kommer att se ut framöver kan ha mycket stora konsekvenser för både framtida behov av vård och omsorg och hela välfärdspolitiken. Äldres hälsa mätt som andel personer med svår ohälsa har förbättrats under perioden 1975-1999 (artikel II och IV). I artikel I visas att ca 6% av den totala befolkningen som förväntas leva 6 år eller kortare svarar för ca 37% av de totala slutenvårdskostnaderna inom hälso- och sjukvården. Samhällets svar på de förväntade förändringarna när det gäller den åldrande befolkningen och dess betydelse för framtida behov av vård och omsorg kan handla om allt från förändringar inom ramen för äldreomsorg, via stark fokusering på ökade insatser av den arbetsaktiva befolkningen, till
folkhälsosatsningar. Därför är det viktigt att ha så bra bild av den framtidiga utvecklingen som möjligt.

Befolkningsprognoserna baseras vanligtvis på antagandet om att dödligheten fortsätter sjunka. Om vi i våra framskrivningar av framtida behov också tar hänsyn till den trendmässiga utvecklingen av hälsan, resulterar detta i relativ stark reduktion av ökningen av framtida behov av äldreomsorg. Den här typen av framskrivningar är dock känsliga för val av hälsoindikator. Framskrivningarna är också känsliga för vilken period som hälstrenden baseras på, i och med att hälsoutvecklingen varierat kraftigt sedan början på 1990-talet.

Förändringar i populationssammansättningen när det gäller andelen av äldre med hög utbildning och dödlighetsskillnader beroende på utbildningsnivå kan påverka prognoserna rörande antalet äldre personer i befolkningen. Om vi i våra befolkningsprognoser tar hänsyn till dessa förändringar resulterar detta i både ett högre antal äldre personer och högre förväntad medellivslängd än prognostiserat i enlighet med de officiella befolkningsprognosererna.

Vi visar att den prognostiserade ökningen av antalet äldre personer med svår ohälsa som resultat av ökat antal äldre personer kan dock i stor omfattning balanseras av förändringar i populationssammansättningen med ökad andel äldre personer med högre utbildning och lägre prevalens av svår ohälsa. Å andra sidan skulle en snabbare ökning av antalet äldre personer än prognostiserad leda till ett ansträngt pensionssystem.

Befolkningsprognoser per kön, ålder och utbildningsnivå skulle kunna användas i de demografiska framskrivningarna av framtida behov av äldreomsorg. Detta skulle förhoppningsvis stimulera diskussionen om behov av att ta fram alternativa befolkningsprognoser för att någorlunda balansera de ständiga underskattningarna av antalet äldre som varit mer regel än undantag under de senaste decennierna när det gäller både de svenska och många andra länder befolkningsprognoser.

Värdet av att ta fram och presentera olika scenarier som de som presenteras i avhandlingen är inte att försöka fånga upp den exakta utvecklingen i framtiden. Faktum är att de flesta prognoser träffar fel. Värdet av scenarierna är framförallt att kunna visa vad som kan komma att hända om en viss utveckling fortsätter eller om förutsättningarna förändras.

Antaganden om den framtida utvecklingen av dödlighet, sjuklighet och förändringar i populationssammansättningen per kön, ålder och utbildningsnivå är osäkra. Det finns bl.a. stora osäkerheter angående hur sambandet mellan utbildningsnivå, dödlighet och sjuklighet kommer att utvecklas. Trots detta är det viktigt att lyfta fram att framtida behov
av äldreomsorg är inte bara osäkra, utan de påverkas också av vad som görs idag. Därför behöver utvecklas olika typer av planeringsstöd för att understödja planering och beslut när det gäller den framtida utvecklingen av äldreomsorg.
LIST OF ORIGINAL PUBLICATIONS


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ABBREVIATIONS

ADL Activities of daily living, the persons having limitations in those activities need help to get up or go to bed, or to get dressed and undressed, or help with bathing or toileting.

EpC The Centre for Epidemiology (EpC) is a part of the Swedish National Board of Health and Welfare.

EU European Union

GDP Gross National Product

IADL Instrumental activities of daily living, the persons having limitations in those activities need help with cooking or cleaning or doing laundry or buying food.

LTCaS Long-term care and services for the elderly

OECD Organisation for Economic Co-operation and Development

SNSLC Swedish National Survey of Living Conditions

US United States of America

WHO World Health Organization
FIGURES

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1. INTRODUCTION

1.1. Population ageing

The world’s elderly population aged 65 and over is growing by 10 million per year (Kinsella and Welkoff, 2001). An increase in the number of people that live longer combined with a decrease in fertility rates will result in an ageing population in both developed and developing countries. Population ageing is a global phenomenon, with developing countries projected to age very rapidly (Kalache, Barreto and Keller, 2005). However, the population living in the European Union (EU) is also ageing. The number of people aged 65 and over is expected to increase by 70 percent between the year 2000 and 2050 (Eurostat, 2005). According to projections, the increase is going to be particularly rapid among those aged 80 years and over. Thus the number of persons aged 80 years and over in the European Union countries is projected to almost triple by year 2050 (Eurostat, 2005). The rapid population ageing in EU is illustrated by figure 1A and B.

Figure 1A. EU, population pyramid, 2004
Europe has the highest proportion of elderly population, and Sweden is one of the countries in the world with the highest proportion of its population older than 65 years. For many years Sweden had the highest proportion, but by year 2000, Italy became the demographically oldest of the world’s major nations - over 18 percent of all Italians are aged 65 or over (Kinsella and Welkoff, 2001). Around 17% of the Swedish population is 65 years and older and more than 5% are 80 years and older. Currently, Sweden and Italy have the highest proportion of people 80 years and older in the world (United Nations, 2007).
As in the other European nations, the number of elderly people in Sweden is set to rise sharply in the decades ahead (Figure 2 A-B). When the generation born in the 1940s passes retirement age there will, initially, be a rapid increase in the number of people aged 65–74. A decade later, a large increase in the number of people aged 75-84 will ensue. And finally just about one decade later the number of people aged 85-94 will start to increase. There is an age group that is increasing very fast over the next 40 years. The number of people 95 years and older is projected to almost triple, from 15,000 to 40,000!

Population development is projected to differ between women and men. The number of women in the ages up to 95 years will increase by 50 percent in the next 45 years, being relatively stable after 2035 (Figure 2 A). The corresponding development for men will be much steeper. In age groups 75-84 and 85-94 the number of men is projected
to increase by 92% and 152% (Figure 2B), compared to 51% and 70% for women respectively (Figure 2 A).

Figure 2 B. Demographic projections, increase in number of older people, men

Due to the very fast increase in the number of elderly men, the gender ratio (the number of women 65 years and older per 100 men) is projected to decrease from 130 by 2006 to 114 by 2025 and 111 by 2050.

1.2 Demographic changes and needs for long term care for the elderly

Aging populations combined with the fact that the number of very old people is set to rise so sharply in the decades ahead is often identified as one of the greatest societal challenges in the next 50 years. There are
many concerns about the increase in future needs (and particularly costs) of age-related social programs for health and social care for the elderly (OECD, 1998; Jacobzone, Cambois and Robine, 2000; Jackson and Howe, 2003; Cotis, 2003; Regling and Costello, 2003; Economic Policy committee 2001, 2006). Within the EU, the projected increase in the expenditure for those programs and its effects on public budgets is often described as the priority issue to be dealt with (Economic policy committee, 2001).

The primary reason why the change in the population’s age composition affects costs of health and social care is, of course, that care consumption is not evenly divided among age groups. It seems pretty obvious that information on the projected size of the future population by sex and individual age groups is essential, but not sufficient to understand the influence of the demographic shifts on future demand for LTCaS for the elderly. However it is exactly this rather narrow approach, where authors assume a direct relationship between the number of older people in population and demand for LTCaS that is often used when projecting future needs and demand for LTCaS (SOU 1996:163, Fölster, 1998). On the contrary, credible scenarios of future demand for LTCaS for the elderly or health services require a range of issues to be taken into account (Madden and Goss, 1998).

Developing methods for planning will hopefully stimulate decision making processes and give more stable conditions to further development of care. Ageing populations require all countries to estimate the future costs for long-term care for the elderly services at the population level. Currently many countries lack this kind of information and it is not available to policy makers. There is also a lack of a scientifically-based methodology for executing forecasts on future costs for long-term care. As mentioned above, in many cases only a direct (simple) demographic extrapolation is used.

1.3 Aims of the study

The main aim of this study is to examine how projected demographic changes may affect future needs for long-term care and services in Sweden assuming different trends in morbidity and mortality.
The specific purposes of the study are as follows:

1. To introduce and describe, using empirical data from Sweden, methods that can be used to estimate how demographic changes including mortality and morbidity changes can affect future needs for inpatient/outpatient health care and LTCaS for older people (studies I, II and IV).

2. To present projections of future demand for inpatient/outpatient health care and LTCaS for older people showing how projected demographic development may influence health and social care needs in Sweden in the period 2000–2030 (studies I and II).

3. To describe the connection between health care costs and remaining years of life in Sweden (study I).

4. To present trends (1975–1999) concerning the proportion of persons with severe ill-health in the 65–84 age group, divided by gender, age and educational level (studies II and IV). Those trends are compared with the development of mortality during the same period (study II).

5. To estimate the impact educational mortality risk differentials may have on the future size and educational composition of the elderly population in Sweden (study III).

6. To present projections of future needs for LTCaS using information on educational mortality and morbidity differentials as well as the projected changes in educational composition of the population 2000–2035 (study IV).
2. BACKGROUND - FROM DEMOGRAPHIC PROJECTIONS TO THE NEEDS FOR LTCaS

In this chapter the background of the thesis is described. A discussion of why tools for planning are needed is presented in chapter 2.1. In chapter 2.2 it is shown that population projections have systematically underestimated the number of older people. However, it is not only the number of older people that is uncertain; there is also a lack of information about the needs for LTCaS. Therefore it is discussed in chapter 2.3 how some approximation about the needs for LTCaS can be obtained. Demographic projections and needs for LTCaS both have in common that they build on health development. The mortality - morbidity/disability relationship is discussed in chapter 2.4. Chapter 2.5 emphasizes the importance of socio-economic status for mortality and its effect on population projections.

Mortality in Sweden is relatively easy to measure. On the other hand, the information on morbidity and disability heavily depends on the quality of the measures. In chapter 2.6 caveats are discussed concerning choice of indicator, study periods and issues concerning non-response when getting information on morbidity/disability from surveys.

2.1 LTCaS and planning

2.1.1. Long-term care and services for the elderly in Sweden

Long-term care and services for the elderly is regarded as an important part of the Swedish welfare system. Long term care and social services (LTCaS) is the term that will be used in this thesis when discussing Swedish care for the elderly. Sweden has a long history of delivering different care services to the elderly (Edebalk, 1990, 1991). The main objective as regards to long-term care and social services for the elderly defined by Riksdagen (the Swedish Parliament) is that older persons shall have access to good health care and social services (Government Bill 1997/98:113). The responsibility for achieving this objective is divided between three levels of government. At the national level, the
Parliament and the Government sets out policy aims and directives by means of legislation and economic steering measures. At the regional level, 21 county councils are responsible for the provision of health and medical care. Finally, at the local level, since 1 January 1992, Sweden’s around 290 municipalities are comprehensively responsible for long-term service and care for the elderly and people with disabilities.

The present Swedish system for LTCaS can be divided into:
- special housing accommodation (institutional care)
- home care (services and personal care)
- support programmes for family caregivers (respite and relief services, support and educational groups for carers and economic support for caring)
- provision of assistive devices according to the needs
- other services like: special transport services to persons that are unable to use public transport because of disability, rehabilitation, prescription drugs within special housing accommodation,…

Municipal expenditure on LTCaS for the elderly in 2005 in Sweden is estimated at upwards of SEK 80 billion (Swedish National Board of Health and Welfare, 2007). Care in special housing accommodations amounts to 64%, and care and services in ordinary housing are 34% of the total costs. According to the Swedish National Board of Health and Welfare, health care for older people, provided by County Councils, amount to SEK 81 billion.

LTCaS in Sweden are mainly financed by municipal taxes (Bergmark, Thorslund and Lindberg, 2000). In 2004, municipal taxes covered around 85% of expenditure on LTCaS, compared to 4 percent that was financed by fees. A smaller part of the elderly care is financed by state grants directed to the municipalities (Swedish Association of Local Authorities and Regions, 2006). The new rules (the maximum amount and the mandatory amount a care recipient should have to live on before starting to pay for services) introduced in 2002 resulted in an increased number of care recipients who do not pay any fees at all - from 14% in May 2002 to 33% in September 2004 (Swedish Association of Local Authorities and Regions, 2006).

In 2005, 6.4 per cent of people 65 years and older, and 25.2 per cent among those 85 years and older, were living permanently in special forms of housing accommodation (Swedish National Board of Health and Welfare, 2006). The majority of the population of elderly patients
in institutions comprises those with cognitive impairment (i.e. dementia) (Wimo and Jonsson, 2001).

Home help services (help with daily activities and personal care) provided by the municipality under the Social Services Act (2001:453, substitutes act 1980:620) constitute crucial services for making it possible for the elderly to continue living in their own homes as long as possible. In 2005, 8.6 per cent of the population (65 years and older) and 27.4 per cent among those 85 years and older, received home help services. Of those receiving home help services in 2005, almost half (46%) also received home health care¹ (Swedish National Board of Health and Welfare, 2006). Home health care is today in many cases highly specialised and includes qualified medical care, as well as palliative care (Lagergren, 2002). The proportion of older people receiving LTCaS has decreased during last 15-20 years (Trydegård, 2000; Szebehely, 2002; Larsson, 2004; Thorslund, 2005).

Informal care
Concerning support programmes for family caregivers, which still are a very small part of Swedish LTCaS, Jegermalm (2005, p. 51) points out that “the Swedish welfare state seems to be following an international trend by taking informal caregivers into consideration and investing in support services for them”. Those new trends in Sweden may also be seen in the light of the fact that in the late nineties an increasingly clear priority has been given to single people in the allocation of home help (Szebehely, 1998; Larsson and Thorslund, 2002; Larsson, Thorslund and Silverstein, 2005). A substantial share of informal care is provided by spouses for each other. It seems to be understood, that for couples, the spouse (foremost elderly wives) should provide the care (Szebehely, 2002). It has been argued that in Sweden, during the last years, the increase in LTCaS provided by families (most has been provided by spouses and daughters) partly match the decline of public services (Johansson, Sundström and Hassing, 2003).

In an international comparison Sweden is still a country with universal and extensive long-term care and services for the elderly (LTCaS). By the year 2000, Denmark (3.0% of GDP), Sweden (2.6% of GDP) and Netherlands (2.5% of GDP) were the EU countries with

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¹ Home health care is acute health care provided at home. The definition of what is home healthcare varies between municipalities. 145 municipalities have provided information to the Swedish National Board of Health and Welfare (SNBHW).
highest public expenditure for LTCaS (Economic Policy Committee 2001). All other countries had expenditures around 1% of GDP. However, international comparisons of public expenditures for LTCaS are rather difficult. For instance, it should be noted that in Sweden, LTCaS also contain a large part of long-term nursing home care for the elderly, which in other countries is a part of the health care system.

2.1.2 The welfare state and LTCaS

Welfare production may be organized in different ways. Organizations differ according to how much responsibility for the welfare production that is taken by market, family or the state. In the terms concerning the care for the elderly this may be described as how the responsibility for providing care is shared between formal, informal (family and friends) and private providers.

During the decades following the Second World War Sweden developed into a universal welfare state according to the Nordic model (based on public, mandatory social insurance and heavily subsidized health and social care services covering the whole population). Pointing out that redistribution is basis for the welfare state, Palme (2006) emphasized following goals for the modern welfare state: poverty reduction, reducing overall inequalities, providing social insurance and services of different kinds.

Esping-Anderson’s classic work concerning the three worlds of welfare capitalism grouped the Nordic welfare states in the social-democratic regime-type (Esping-Anderson, 1990) as compared to the conservative (e.g. Austria, France, Germany, and Italy) and the liberal (e.g. United States, Canada and Australia) welfare state regime-type. The indicators, chosen by Esping-Anderson when clustering different OECD countries, focus on social insurance schemes and health care. Social services (both child care and care for the elderly) have been emphasized as an important part of Nordic welfare in analyses of welfare states by Sipilä (1997). However, it should be pointed out that the expansion of services came at a later stage of Nordic welfare state development, compared to the social insurance and was partly related to the growing quest for gender equality, increasing female labour force population and the increasing number of older people (Palme, 2006).

If the welfare state is a way to manage the social risk, then the risks (old age infirmity) pooled by public LTCaS are “democratic risks” because they will afflict us all (Esping-Andersen, 1999). It is furthermore
very difficult to project how long the exposure (the time during which an old person needs LTCaS) will be and when it will start. Such risks are difficult to manage and that is why there are no existing wholly-private financed market solutions for LTCaS on a larger scale in the world. Financing LTCaS is particularly dependent on pooling the risk over the course of a life. Here, the welfare state, defined as the way to affect outcomes of, and conditions for market distribution by political decisions (Korpi and Palme, 2003), may be the needed solution. From this point of view it is very important to have LTCaS incorporated as a crucial part of welfare state.

Formal LTCaS is also important as regards contribution to gender equality. The introduction of social services in the welfare state (child care and LTCaS for elderly) is the result of active policy decisions committed to lessening the caring burdens of the family. It is also why, this kind of welfare state has been characterized as female-friendly (Hernes, 1987).

The increasing number of older people (and increasing older people’s share of the total population) poses challenges for social science as part of our obligation to analyse what will happen in the future (Lindh, Malmberg and Palme, 2005). Projections are important for planning purposes. As pointed out above, Sweden is an archetype of the Nordic welfare state with high levels of public spending and based on a high level of redistribution of financial resources amongst a large majority of the population, as well as different groups of the population that use different services during the course of their lives (Korpi and Palme, 1998). That means planning may be particularly important in Nordic countries where a large amount of resources pass through public budgets.

Not only public finances are calling for planning within the welfare state. Even access to human resources within Swedish long-term care and services (LTCaS) is crucial for the delivery of services and the welfare state’s ability to meet the needs of the elderly population. (Swedish Ministry of Health and Social Affairs, 1997 and 2000). Given the extent of redistribution between the groups within the welfare state and its reference to redistribution over a lifetime, many people feel that it is the welfare state’s duty to ensure that elderly in need of care or social services receive help of high quality (Svallfors, 2002).

### 2.1.3 Tools for planning for future LTCaS needs

Public policies are always prepared under uncertainty related to the future environment they will operate within. That means there is a
need to make a choice, when preparing public policies, which description of the future they will be based on. Public policies may be based on non-use of knowledge (i.e. naive extrapolation or ad hoc assumptions) or on use of knowledge (i.e. on elaborate extrapolations, behavioural models or simulation models). If the term “forecast” is used for a description of the future based on knowledge, then “forecasts” is what distinguishes reasoned planning from blind action” (Aaron, 2000). Projections and forecasts are useful tools for the development of public policies. That is particularly true when focusing on dynamic changes in demographics, as described above, and their relation to health care and long term care and services.

There is a need for comprehensive projections that combine demographics and health trends, because making projections of future mortality and disability is a useful aid in decisions on priorities for health research, capital investment, and training (Murray and Lopez, 1997).

The value of scenarios and projections of this kind does not lie in their perfect match with the future. The fact is that forecasts most often are proven to be wrong (Aaron, 2000). The strength of the forecasting approach, however, lies in the fact that different scenarios for future health trends that “are likely, or probable, or merely possible can have an important role in shaping public-health policy” (Murray and Lopez, 1997). Given the strong impact changes in the number of elderly may have on long term care needs, this is particularly true for policies on long term care services. It is important to know what will happen if the development will continue in the same direction, or alternatively what may happen if the preconditions are changed (Thorslund and Larsson, 2002). Models and scenarios are important tools for the design of public policies for LTCaS. The models may further be used when planning for future allocation of resources in order to meet the need for long-term care. In that case, these models constitute basic data for decision making concerning the future of public finances (Economic policy committee, 2006). Using models as a tool for planning avoids actual experiments that are too costly, time consuming or risky from a quality point of view (Lagergren, 1998).

Monitoring is another important area where models may contribute to an increased knowledge base. The use of models for monitoring may influence policy debate concerning the allocation of resources. Within the LTCaS, human resources, their quantity and qualifications, are the central resources (Edebalk, 2002). Also here, modelling (e.g. by
using different demographic extrapolations as a tool) the future demand for human resources may be crucial.

Long term care and services planners need tools for planning. Planning, which takes into account demographic changes as well as other changes in society that impact on the need for care in the population, will improve and refine health human resource policies (Birch, 2002). Projections and simulations based on developments concerning older people's functional ability as well as scenarios of the future development of economic resources are vital for development of LTCaS (Thorslund and Larsson, 2002).

A growing literature in Sweden shows that during the late 1980's and the 1990's the proportion of people using LTCaS has decreased considerably (Thorslund and Parker, 1997; Thorslund and Bergmark, 2000; Lagergren, 2002; Szhebehey, 2002). Turbulences in the Swedish system of care for the elderly have affected the organisation as well as the resources (Szheheley, 2000). The development of the care for elderly and the relatively huge differences between municipalities (Trydegård, 2000) shows a historical lack of central planning according to needs, but also illustrates the independence the local authorities have in planning and delivering LTCaS. Given the fact that the number of elderly people and need for long-term care vary from municipality to municipality (Swedish Association of Local Authorities, 2002), it is essential to develop planning according to needs at the local level. Planning is also emphasized in the Social Services Act which stipulates that the municipalities shall plan services for the older people.

Modelling the need for formal LTCaS gives us an opportunity to monitor if decreasing resources in LTCaS are the result of a decreasing share of the elderly population needing LTCaS or if it is the result of constraints in public economy and cutbacks in the supply of formal LTCaS. Batljan and Lagergren (2000) show that the decreasing proportion of LTCaS users (as a share of elderly populations) between the middle of the 1980's and the late 1990's hardly can be explained by a decrease in the number of those in need of LTCaS. Larsson (2005) arrives at the same conclusions regarding the development of the proportion of people reporting having home care and the share of the elderly suffering from functional limitations in IADL.

Using different models for policy prediction and planning may also influence our understanding of the role of different public policies within often complex and dynamic social systems (Levy, Bauer and Lee, 2006). Models are one important component for improvement in
planning and monitoring. The other is the data. As pointed out by Manton (1988) there is a need to have nationally representative studies with a long timeframe in order to have a better basis for planning policies for elderly people.

2.2. Demographic projections

One of the central points for our understanding of the future development of LTCaS is demographics and in particular demographic projections. It follows that demographic projections are given great importance in decision making processes. Importance and use of demographic projections has increased rapidly during the past decades. Population projections, or forecasts are drawn up every three years in Sweden, relate to long periods (usually several decades) and contain information on the size of the population by sex and individual age groups. There is also an annual revision of the projections taking into account population changes during the year before the original projections year (Statistics Sweden, 2005a). In Sweden like in most OECD countries, three different alternative population projections are estimated on each forecasting occasion: a basic forecast, accompanied by low and high alternatives. Nevertheless, it is the basic alternative that attracts most attention. As shown above, according to the last projections (basic alternative) Sweden expects a rapid increase in the number of elderly in the future.

2.2.1. Gender disparities

(faster increase in the number of the elderly men)

Development for men and women is projected separately (see figure 2 A-B above). The number of men is projected to increase faster than the number of women during the nearest decades. This is a result of a decreasing gender gap in life expectancy. The gender gap in life expectancy has been relatively large since the Second World War. On the other hand, the gender gap has decreased in many developed countries over the last 15-20 years. In France, England & Wales, Sweden, Switzerland, and Italy, the decrease in the gender gap is mainly related to the decrease in cardiovascular mortality (Mesle, 2004). The Swedish gender mortality differential has narrowed since 1980, mainly as a result from larger than expected reductions in male mortality due to heart disease, mortality from accidents and violence, lung cancer and
"other" cancers (Trovato and Heyen, 2003). Smoking plays an important role in the size of the gender gap in mortality (Bobak, 2003). However, as shown below in figure 3, the gender gap in life expectancy has been established since at least 160 years ago in Sweden.

2.2.2. Underestimation of the future number of older people

It seems it should be relatively easy to calculate the correct future number of older persons, since almost all these already live in Sweden today. Despite that, until now, the forecasts of the number of older people in Sweden done during the last twenty five years, have one thing in common – a systematic underestimation of the number of older people (Batljan and Lagergren, 2000). The main reason for this is the fact that mortality for older people has decreased considerably during the last decades of the 20th century, especially among the men and the oldest - in a way that demographers couldn’t or did not dare to imagine. This is no specific Swedish phenomenon, but a general international observation. Also in Australia, population projections have systematically underestimated the reductions in mortality among women and those 85 years and older (Booth and Tickle, 2003). Kielman (1997) found the same underestimation pattern in analysing population projections for the United Kingdom, Netherlands, Denmark, Canada and Norway. One of the reasons for this is probably to be found in different attempts by different researchers to launch a paradigm on the biological maximum length of life (see the discussion below). Thus, given the systematic underestimation of the projected number of older people, the number of older people may increase quicker than forecasted during the nearest 25 years.

2.2.3. Increasing life expectancy

Life expectancy in Sweden was 82.8 years for women and 78.4 years for men in 2005 (Statistics Sweden, 2006b) and has never been higher than today in Sweden (Swedish National board of health care and welfare/EpC, 2005). Compared to the year 2000 life expectancy has increased by more than a year for men (1.04) and three quarters of a year for women. Increased life expectancy must be seen as a great success. Life expectancy at birth for Swedish men ranks second in the world, behind Japan. In 2004 life expectancy at birth in Japan was 78.6 years for men and 85.6 years for women. Swedish women share with other
countries places 6\textsuperscript{th} to 8\textsuperscript{th} among OECD countries as regards to life expectancy at birth (OECD, 2006).

Figure 3. Life expectancy at birth, Sweden, 1841/1850-1991/2000.
2.2.4. Limits to life expectancy

There are no indications that we are approaching any biological limit to life expectancy in the decades studied here. Rather the opposite seems to be the case. White (2002) shows a steady increase in life expectancy for 21 OECD countries during the period 1955-1995, with an increase of 0.21 years of life per calendar year. Even more striking, Oeppen and Vaupel (2002) found that during the last 160 years life expectancy for the countries studied has increased steadily at an almost constant pace (compare with figure 3). Wilmoth and Lundström (1996) showed that the maximum age at death has increased for 5 countries analysed. Further as stated in Wilmoth et al. (2000) “National demographic statistics suggest that the maximum age at death has been rising steadily in industrialized countries for more than 100 years”. Wilmoth et al also show that in Sweden “more than 70 percent of the rise in the maximum age at death from 1861 to 1999 is attributable to reductions in death rates above age 70” and that “the more rapid rise in the maximum age since 1969 is due to the faster pace of old-age mortality decline during recent decades”. Using mortality data from Swedish population registers, Vaupel and Lundström (1994) have shown that mortality in Sweden has fallen steadily over the past 50 years in all age groups, including the very oldest of all, aged 100 and over. Grundy (1997) reaches the same conclusion on the basis of a summary of research findings from several countries — findings that do not support the notion of a biological fixed limit. Also Vaupel (1998) shows strong life expectancy improvements for the elderly (however, to a somewhat lesser extent for females). Based upon that, life expectancy is expected to continue to increase in Sweden (as in other OECD countries).

Discussion about the limits to life expectancy is important for how demographic projections are done and which assumptions are used. In that sense this discussion also has direct consequences for the assessment of future needs for health and long term care.

There are many cases of scientific articles pointing out some value as a limit to life expectancy, only to find that, just a few years after the articles were published, life expectancy in some country has passed the proposed limit. For instance Wilmoth (1998) compares an article from Bourgeois-Pichat (1978), where Bourgeois-Pichat argued that the biological limit to life expectancy was 73.8 years for men and 80.3 years for women, with the fact that Japanese men’s life expectancy passed the limit by 1982 and Japanese women by 1985. Comparisons with Sweden
show that Swedish men passed the limit in 1984 and Swedish women in 1989. Another example, also emphasized by Wilmoth (1998), concerns a study (Olshansky et al, 1991) where 35 years was pointed out as a biological limit for further life expectancy at 50. Also this limit was passed only 6 years later in 1996 by Japanese women. One important message from those stories is that the burden of evidence speaks against those advocating that we are approaching the biological limits to life expectancy. However, one explanation behind these stories, despite the clear development of life expectancy at birth shown in figure 3, may be found in that increases in life expectancy during some periods of time used to slow down (in some cases even showing signs of stabilising at a certain level (see figure 4).

Figure 4. Life expectancy at 65 years of age, Sweden, 1841/1850-2001/2005.

From figure 4, we may also observe that the gender gap increased very fast after the Second World War and the following 30 years.
2.3 From need to use of formal LTCaS

In Sweden there is no official statistical information about the needs for formal LTCaS. Information about the needs of those using LTCaS is also lacking. The statistical information concerning older people’s use of LTCaS is only available in age and gender group terms. The fact that the question: “Who gets what care?“ cannot be answered by the official statistics, reflects the lack of basic information concerning LTCaS (Lagergren, 2005a). Neither do we have any information concerning the educational level or household composition (married or single-living persons) for users of LTCaS.

2.3.1 Association between use of LTCaS and ADL limitations

The increase in the number of older people is expected to result in an increase in the number of people that will need LTCaS. Nevertheless, ageing in itself is not a disease and what matters is to what extent older persons need long term care, support and assistance. The concept of needs is particularly important for Swedish public LTCaS. According to the Swedish Social Services Act, any person who is unable to provide for his or her needs or to obtain provision for them in any other way is entitled to assistance for their livelihood and for their living in general. In Sweden, the municipalities are responsible for the needs assessment and to provide social services and care for older people according to their needs. Under the Social Services Act, home care and services cover personal care (including assistance with eating and drinking, getting dressed and undressed and personal hygiene) and home help services (including e.g. cleaning and doing laundry, help with shopping, post office and bank errands and preparation of meals etc.). The Social Services Act also requires the municipalities to establish special forms of housing accommodation with service and care for older persons in need of special support round the clock. The needs of older people for LTCaS are not easy to define. The person in need, the relative, the assistance assessing person, the doctor, the nurse, the care assistant; all can experience or see various needs in the same person (Rothman et al, 1991; Rubenstein et al, 1984; Magaziner et al, 1988; Thorslund and Wärneryd, 1990). In Sweden, the municipalities are responsible for the individual needs assessment (done by social workers).

As pointed out above, Swedish statistics on LTCaS focus on older people as a group not on individuals, and we do not have data on
health status and functional ability among LTCaS recipients. Also other essential information such as if home care recipients have other services, their social network and family circumstances, is lacking (Trydegård, 2000). Lack of individual-based statistics is a problem for both monitoring and planning within LTCaS system.

Indicators on functional limitations in activities of daily living (Katz et al, 1963), often defined as functional limitations in activities of daily life – ADL (need help to get up or go to bed, or to get dressed and undressed, or help with bathing etc.) and functional limitations in instrumental activities of daily life – IADL (need help with cooking or cleaning or doing laundry or buying food), have been pointed out as suitable for assessment of needs for LTCaS (Robine, 2003). As emphasized above care and help with the tasks mentioned here are also specified in the Social Services Act.

Figure 5. Age and gender distribution of use of LTCaS compared to share of older people reporting having functional limitations in IADL, year 2003.

A. Men.
In figure 5 and 6, the data from aggregate statistics on LTCaS recipients are combined with data from the Swedish survey of living conditions in order to compare age and gender distribution of use of LTCaS with functional limitations variables.

Figure 5 shows the relationship between use of LTCaS and the share of population reporting having difficulties with IADL. There is also, according to figure 6, an apparent relationship between the share of the population reporting ADL limitations and proportion of people living in special housing accommodation (receiving institutional care).

The differences between the share of population that receives LTCaS and the share of the population that reports IADL limitations may be a result of the development emphasized by the Swedish study.


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2 Here, it should be emphasized that we are comparing only share of population using LTCaS, and not how many hours of home help services, those using LTCaS, have received.
that showed that the number of people in Sweden receiving home care and services has declined very fast during the period 1988-2003, and that this was only partly explained by improvements in functional ability as measured by IADL (Larsson, 2005). Furthermore, it should be pointed out here that the relationship between the share of population that were recipients of LTCaS and the share of population reporting IADL is age and gender dependent. Given the same level of ill-health, very old persons (i.e. persons 85 years and older) and older women have more functional limitations than old people younger than 85 years and older men (Lagergren, 2004).

Figure 6. Age and gender distribution of people living in special housing accommodation compared to share of older people reporting having functional limitations in ADL, year 2003.

A. Men.
2.3.2 Needs – Demand - Use

In order to project future needs for LTCaS and due to lack of direct information about the needs it is important to discuss the relationship between terms as needs, demand and use (or utilization or consumption). Starting with the concept of need, which is central for this thesis, it should be pointed out that often, also given the discussion above, the basis on which needs are assessed is a perception of health and functional ability — subjectively experienced or objectively established. Furthermore, the fact that persons with the same functional limitations may be assessed to have or even feel different needs, emphasizes that the concept of need is more of a relative rather than an absolute concept (Thorslund and Larsson, 2002).

According to Bradshaw (1972) there are four main categories of need. **Felt need** is need which people feel - that is, need from the perspective of the people who have it. Those needs do not fully result in demand. **Expressed need** is the need which people say they have. Peo-
people can feel need which they do not express and they can express needs they do not feel. **Normative need** is need which is identified according to a norm (or set standard); such norms are generally set by experts. Benefit levels, for example, or standards of unfitness in houses, have to be determined according to some criterion. **Comparative need** concerns problems which emerge by comparison with others who are not in need. One of the most common uses of this approach has been the comparison of social problems in different areas in order to determine which areas are most deprived.

Which need category is assessed in Swedish LTCaS? Concerning Swedish LTCaS, the pathway from having for example functional limitations to having your needs assessed as needs includes probably all four categories. Often the process starts with a person (or often a relative to that person) experiencing (feeling) the need. In the next step the need is expressed to the municipal needs assessment person. This expressed need may also be seen as “demand” for LTCaS. An assessment person then assesses the need using standards and norms as comparisons. The standards and norms may be affected by available resources. Assessed needs often do not result immediately in LTCaS use. Often the older persons have to wait some months before getting access to a place within special accommodation. Finally the assessed need results in use of LTCaS.
Figure 7. A care consumption model.

Figure 7 above presents a schematic conceptual model of care consumption – a model partly published by Thorslund and Larsson (2002) - and different factors affecting needs for care (and use of LTCaS). The model shows the needs in relation to other factors helping us to distinguish and understand how different parts of the model are affecting each other.

Larsson (2004) found the following factors as predictors of LTCaS use: age, functional limitations, household composition (civil status), education, psychiatric health and social networks. Given our model those factors may affect both need and demand for LTCaS. On the other hand as illustrated in Figure 7 and pointed out by Batljan and Lagergren (2000) among others – available resources affect care consumption (even more than projected needs in population do). Thus it should be emphasized that LTCaS supply is an important predictor of demand (Miller et al, 2005). Many people do not demand what they realise they are not able to obtain. However there are also other supply mechanisms like high charges or low quality of the services that do not affect the need, but will reduce demand. In a study of elderly people who had withdrawn from the home-help service, the National Board of Health and Welfare found that, in two out of five cases, the cause was dissatisfaction with charges or quality (Swedish National Board of
Health and Welfare, 1998). In summary, given the complexity of the concept of need, and the way needs assessment is done in Sweden, it is difficult to distinguish in practice between need and demand. In this thesis, bearing this discussion in mind, we use health indicators as an approximation of needs.

2.4 Mortality – Disability/Morbidity

Future needs for LTCaS for older people depend on old people’s health and their functional ability. Thus, mortality development, disability development and the relation between those two are among crucial issues for projections of future needs for LTCaS. The question then becomes how is the observed decrease in mortality associated with older people’s state of health and functional ability, in age-group terms. This has been a highly controversial question for several years.

2.4.1. Morbidity and mortality – different hypotheses

Several hypotheses (Figure 8) concerning the relation between mortality and elderly people’s state of health and functional ability have figured in the international literature (Robine and Michel, 2004):
- compression of morbidity
- expansion of morbidity
- dynamic equilibrium (even described as postponement of severe morbidity).

One central issue involved in all these hypotheses is the trend in the number of years of healthy life expectancy in relation to total life expectancy (Robine, Romieu and Michel, 2003). These hypotheses point out the importance of including disability (or chronic morbidity) in the analysis of future needs, emphasizing the connections between mortality and disability/morbidity. Furthermore, given the fact that population projections are often considered as given, the hypotheses remind us that there are assumptions behind this, assumptions that need to be discussed and analysed. Following just the existence of three hypotheses, no matter which development they emphasize, contributes to a base for analyses of the demographic impact on future needs for LTC.
According to the hypothesis of compression of morbidity, originally propounded by James Fries (1980; 1983; 1986), improved living conditions and healthier ways of life cause the onset of chronic illnesses, such as cardiovascular diseases, cancer, etc. to be postponed to an increasingly high age. In addition, also the fact that more and more chronic diseases may be dealt with successfully cause the onset of disability to be postponed to an increasingly higher age. According to this hypothesis, humankind has a genetically determined — albeit individually variable — maximum age. The hypothesis therefore entails the assumption that chronic morbidity/disability is “compressed” into the last years of life. Fries (1980) cited 85 years as the mean biological maximum age and, accordingly, considered this the theoretical limit for the possible increase in mean life expectancy. The final result of a trend complying with this hypothesis would be that everyone “died healthy” or following a very short period of illness at an advanced age; in other words, the number of years in health would tend to become the same as the number of years in life, and the average number of years in poor health would decline towards zero.

On the other hand, in a modern definition of the compression of morbidity (Fries, 2003), there is no assumption on life expectancy approaching the natural limit. In this definition, the hypothesis is presented as a positive concept, where healthy life expectancy grows faster than total life expectancy and the number of years spent in bad health decreases.
Some empirical support for the compression hypothesis has been provided by Stout and Crawford (1988), who analysed admissions to a geriatric unit in the years 1954–86 and found that the patients’ average age when they became heavily dependent on care had risen, and also that their active-life expectancy had increased. But they also found a rise in the proportion of years of life spent in geriatric care, which conflicts with Fries’ hypothesis. A similar study by Henderson, Goldacre and Griffith (1990), nevertheless, showed that the rise in the number of life years had not resulted in any increase in the time spent in hospital during the last years of life. The Swedish H70 study was able to demonstrate substantial improvements in health for 70-year-olds over a ten-year period in the 1970’s, but no major differences for people aged 80 and over (Svanborg, 1984). Using data on disability-free life expectancy and comparing them with life expectancy data for men and women in France between 1981 and 1991, Robine, Mormiche and Sermet (1998) provide additional empirical evidence for the modified compression of disability hypothesis. Healthy lifestyle is correlated both with increasing survival and compression of the disability into a few years at the end of life (Vita et al, 1998; Ferrucci et al, 1999; Nusselder et al, 2000; Hubert et al, 2002). Doblhammer and Kyrit (2001) provided empirical evidence for the compression of morbidity hypothesis in their study on trends in healthy life expectancy in Austria.

A directly opposed hypothesis, expansion of morbidity, was proposed by Olshansky et al. (1991). Their argument was that medical inputs for the elderly result in a higher proportion of people with health problems surviving to an advanced age. Age-related morbidity thus increases: severely ill old people no longer disappear by death. This is also the content of the “medical paradox” that the more people whose lives are saved, the more health problems the health-care services must subsequently deal with. Broadly the same argument had previously been put forward by Gruenberg (1977). Gruenberg emphasized that the new potential for arresting infectious diseases with antibiotics was most significant when it came to saving the lives of the chronically ill, but that it did not cure their chronic illnesses. Thus, in its pure form, the hypothesis postulates that active life expectancy is unchanged despite increased life expectancy and what increases, instead, is the number of years of ill-health.

Support for the expansion hypothesis has been provided by various researchers, including Guralnik (1991) and Kaplan (1991). In a review of the literature on compression and expansion of morbidity, Hum and
Simpson (2002) conclude that additional years of life will probably occur in a moderately impaired health state. Some relatively new Swedish studies (Rosén and Håglund, 2005; Parker, Ahacic and Thorslund, 2005; Thorslund et al, 2004) support the expansion of morbidity hypothesis.

The last hypothesis, dynamic equilibrium (also referred to as postponement of severe morbidity), was launched by Manton (1982). This hypothesis states that the time spent with severe morbidity and disability remains approximately constant when life expectancy increases. This is due to the fact that medical treatments and improvement in lifestyles reduce the rate of progression of chronic diseases. It thus assumes that the postponement of death to higher ages due to falling mortality is accompanied by a parallel postponement of severe morbidity and/or disability. The hypothesis was built on evidence showing that the prevalence of several chronic diseases given age group declined in the USA in the 1980s. The diseases that have become less prevalent given age and gender include dementia, stroke and circulatory disorders. On the other hand, hip fractures and Parkinson’s disease have become more common. These trends are explained by improvements in underlying factors, such as higher educational level, better nutrition, increased physical activity, etc. Since these factors continue to develop favourably, Manton, Stallard and Corder (1995) found it reasonable to assume that the elderly population’s state of health will continue to improve and active life expectancy would rise.

According to the “postponement of morbidity” hypothesis, the age-specific prevalence of ill-health and functional disabilities in old people would decline and, at the same time, overall health and social care consumption would remain unchanged.

Survey results reported by Manton, Stallard and Corder (1997) and Manton and Gu (2001), based on the National Long-Term Care Survey (NLTCS) showed a clear, significant decrease in the age-standardised proportion of functionally disabled older people in the USA in 1982-1999. Similar results have been reported in the work of Crimmins et al. (1997) and Freedman and Martin (1998). In an overview of international trends of elderly people’s functional ability, Waidman and Manton (1998) conclude that the proportion of functionally disabled old people is decreasing in most industrialised countries. Empirical evidence for the dynamic equilibrium hypothesis has also been provided in different studies from the Nordic countries (Batljan and Lagergren,
One crucial point in the discussion concerning these three hypotheses has been the epidemiological background to the observed changes in the prevalence of morbidity and functional disabilities. During recent years the discussions concerning the postponement of severe morbidity and compression of disability have been focused more on measures of disability. It is important to distinguish between morbidity and disability when discussing different hypotheses (Parker and Thorslund, 2007). In a systematic review of disability trends among older adults during the late 1980s and 1990s in the USA, Freedman et al. (2002) show consistent evidence of a decline in IADL disability and conflicting evidence of decline in basic ADL disability. Crimmins (2004) emphasises that the effect of increased survival may be balanced by the reduction in the incidence of disease, and by the fact that having a disease appears to be less disabling than in the past. Concerning IADL disability, less-disabling diseases may be the result of environmental improvements and particularly access to assistive devices (Spillman, 2004; Freedman et al, 2004).

2.5. Socio-economic composition

Mortality rates have declined at relatively constant rates during the last 160 years in Sweden as shown above. At the same time, disentangling the role of the different factors behind the reduced mortality is a difficult task. Cutler, Deaton and Lleras-Muney (2005) emphasized the following factors as crucial in reduced mortality: nutrition, public health interventions, health insurance programs, income changes, social policies and medical care. One other important force affecting demographic changes is probably changes in the socio-economic composition of the populations (Lutz, Goujon and Doblhammer-Reiter, 1999). Effects from such changes on the population projections are seldom analysed because of lack of data. Education is the indicator that has been most often studied in this context. The association between low educational level and morbidity (Winkelby et al, 1992; Parker et al, 1996; Karp et al, 2004) and mortality (Kitagawa and Hauser, 1973; Valkonen, 1989; Pappas et al, 1993; Vågerö and Lundberg, 1995; Elo and Preston, 1996; Kunst, 1997; Mackenbach et al, 1997) is well established. Consequently, changes in the educational composition of the population have been
pointed out affecting both prevalence of disability and mortality levels (Waidmann and Liu, 2000; Fredman and Martin, 1999; Manton and Vaupel, 1995; Preston, 1992). In a Canadian study where one year health status changes were assessed, Buckley et al. (2004) show that for elderly who are initially in good health, the probability of remaining in good health was lower for the low-educated than for the high-educated. The probabilities of remaining in good health decline with age at almost the same pace among different educational levels.

2.5.1 Education as indicator of socio-economic position among the elderly

Winkleby et al. (1992) argues that education, rather than income or occupation, is the best socio-economic indicator for the health of the elderly. Education has even been pointed out as the most frequently used socio-economic indicator in health research (Miech and Hauser, 2001). However, it should be pointed out that there are different traditions in different parts of the world as regards to the use of different indicators of socio-economic position. In Sweden and Europe social class, based upon occupational status, is used more often than education as an indicator of socio-economic composition, contrary to the USA, where education has been the main indicator of socio-economic composition (La helma et al, 2004).

A weakness of education as indicator of socio-economic position among the elderly is that the majority of the elderly in many countries used to receive only compulsory schooling when they were young (Valkonen, 2001). Another weakness may be convergence in the rates of mortality (Elo and Preston, 1996; House et al, 1994) and health status (Thorslund and Lundberg, 1994).

All socio-economic indicators are, furthermore composite indicators where "parts of the effects of each socio-economic indicator can be either explained by or mediated through other socio-economic indicators" and those "socio-economic indicators are not interchangeable but partially independent and partially inter-dependent determinants of health". (La helma et al, 2004). Nevertheless, it is worth emphasizing, that different socio-economic indicators measure different phenomena and that their association with health status is the result of different causal mechanisms (Geyer et al, 2006). Still, education is acquired relatively early in life and is not likely to change in older ages, which has
the clear advantage of income and social class for prediction and planning purposes.

2.5.2. From education to mortality

Several hypotheses regarding the nature of the relationship between education and mortality have been presented. One way to structure different hypotheses is to start with the fact that, as pointed out by Goldman (2001), there are three overall categories of explanations for the association between socio-economic position and health. Causal mechanisms are those “through which socio-economic status and social relationships potentially affect health status and the risk of dying”. Selection or reverse causation “refers to a set of pathways whereby unhealthy individuals may reduce their social position or become socially more isolated as a consequence of their inferior health status”. Artefactual mechanisms represent measurement errors. However as pointed out by Cutler and Lleras-Muney (2006), there may be also a fourth factor that may affect both education and health. This factor may be seen as an indirect selection, where the socio-economic position is not selected by health in itself but, rather by determinants of health. “Genetic determinants of personal attributes (cognitive ability, personality, bodily and mental fitness, …) that influence educational and occupational achievement, and also determine adult health, either directly or through health-related behaviours” (Mackenbach, 2005) may represent one possible pathway concerning indirect selection. Goldman (2001) emphasizes that there seems to be consensus among researchers from different disciplines that the observed inequalities in health are driven largely (although not entirely) by a complex set of causal processes, rather than by direct selections or artefactual mechanisms. Lleras-Muney (2002) also shows clearly the causal effect of education on mortality. In an attempt to structure different explanations regarding the relationship between education and health, Mackenbach (2005) labelled material, psychosocial and stress-related, and behavioural factors as belonging to the “specific determinants” perspective. This perspective is one of the three complementary perspectives Mackenbach (2005) points out as explanations behind socio-economic health inequalities. The other two are selection perspectives (both direct and indirect) and the “life course perspective”.

The life course perspective focuses on time dependency. There are at least three different models explaining the effect of education on health.
within the life course perspective. The first model is mainly a biological, critical period model, or the fetal origins hypothesis of adult diseases, and it emphasizes exposure to health risks during the critical time period early in life. According to this model discrete events in early life affect both health and educational attainment in later life. A second model - the pathway model, predominantly social, may be that negative social factors in the early-life environment set individuals onto life trajectories that negatively affect their later health. Early life exposures to socio-economic disadvantage or specific health determinants to later life health, may affect both school performance and create “the unhealthy life career” - unemployment, poor economic conditions, poor housing, environmental and occupational toxins, risky jobs, risky behaviour, may be important to explain health inequalities (Lundberg, 1993; Kåreholt, 2001; Hayward, 2004). Consequently, the health inequalities partly result from the accumulation of exposure to hazards over the life course. The socio-economic circumstances in early life may have a particular influence on the risk of cardiovascular disease and mortality from cardiovascular causes (Davey Smith et al, 1998). On the other side it should be pointed out that “the characteristics on which indirect selection occurs could either be innate characteristics that are independent from the circumstances in which individuals grow up, or factors that are largely determined by socio-economic and other circumstances in early life (Mackenbach, 2005).

A third model within life course perspective focuses on the accumulation of repeated exposure to negative factors adversely affecting health status either through a biological process or through a social process.

Within the specific determinants perspective, there are three important causal pathways from level of education to mortality (or ill health) that have been emphasized by Ross and Wu (1995) and Van Oort, van Lenthe and Mackenbach (2005). Those mechanisms work through material factors, psychosocial or stress-related factors, and behavioural factors. Material factors may affect mortality either directly or indirectly, via behavioural and via psychosocial factors. Psychosocial factors may also exert a direct and an indirect effect, through behavioural factors.

Comparing material factors, (type of health insurance, financial problems, and housing tenure), psychosocial factors (life events and external locus of control), and behavioural factors (smoking habits and physical activity) Van Oort, van Lenthe and Mackenbach (2005) found
that material factors contributed most to the educational differentials in mortality in the Netherlands.

Psychosocial factors (life events, job strain, lack of control over living and working conditions, lack of social support, ...) concern a person’s relative position in a society. Relative position or rank within the social distribution have been found to affect health in animals (Sapolsky, 1998) and in humans (Marmot, 2002). The exact mechanisms by which psychosocial factors related to education are transformed into morbidity and mortality via biological processes or organ dysfunctions are still unclear. However, those mechanisms have been explained by the fact that “individuals at the lower end of the hierarchy have lower control over their lives and are constantly subjected to arbitrary demands by others, causing increases in stress and subsequently resulting in stress-related diseases” (Cutler and Lleras-Muney, 2006). This means that different stressors such as lack of self-efficacy, competence and lack of control (or a sense of control) of own life circumstances in general (both at work and at home) could lead to increased vulnerability with a negative impact on health status (Swedish Council for Social Research, 1998). Increased vulnerability may be even higher for people with lower education who are also exposed to other risk factors (Ericsson, 2001).

Behavioural factors (smoking, diet, alcohol misuse, lack of physical exercise, ...) are commonly emphasized as an important link between education and health. High-educated people have a better ability to receive information about health-promoting behaviour and adopt healthier lifestyles. Smoking-related diseases have been found to contribute significantly to the total educational level disparity in potential life-years lost (Wong et al, 2002). Nevertheless, Lantz et al. (1998), found that four important behavioural risk factors (cigarette smoking, alcohol drinking, sedentary lifestyle, and relative body weight) explain a rather modest proportion of the association between socio-economic factors (income and education) and mortality.

Finally, there are two other hypotheses that may be complementary to the above. Grossman (1975) argued that education makes people better decision-makers and Fuchs (1982) argued that people who are interested in benefits on a long term basis invest both in education and health. Although it is not established which of the pathways discussed in different hypotheses “matter more for health, they each are likely to contribute to the overall pattern of higher years of schooling being associated with better health status” (Hernandez and Blazer, 2006, p. 28).
2.6 Data - indicators, time periods and survey non-response

There are many problems when trying to move further in the discussion related to hypotheses and theories about the connection between mortality and morbidity and summarizing findings from different countries. One problem is the use of different health indicators (different health dimensions). Brønnum-Hansen (2005) argues that trends in healthy life expectancy at 65 years depend on the choice of health indicator. The importance of focusing on “health indicators” when assessing health trends among the elderly and particularly comparing different studies has also been emphasized by Parker and Thorslund (2007).

The fact that different studies cover different periods of time and often include only two time-points may also affect our chances to select and understand the actual trends. The following figures may give different pictures despite that they are based on the same data and show development for the same indicator, with the only difference that the figures cover different periods of time (Figure 9 A, B). Figure 9 A shows that the prevalence of poor health has decreased for both men and women aged 65-84 years between 1980/81 and 2005. Focusing on the period 1980/81 – 1996/97 (Figure 9 B) shows an even stronger decrease in the prevalence of poor health, among the 75-84 age group.

However, focusing only on the period 1998/99-2005 presented in the figure 9 B gives us a completely different picture concerning the age group 75-84 years. Instead of a strong decrease in the prevalence an increase in the prevalence of poor health was observed among both men and women. It should be observed that despite the shorter period analysed in the figure 9 B, this time series is still longer than those used in many other studies.
Furthermore, what is obvious from the figures is that the estimated prevalence rates have large fluctuations between the years. Both Swedish (Lagergren, 2004) and American studies (Crimmins, Saito and Reynolds, 1997) have emphasized sensitivity in conclusions about trends from only two time points.


The quality of data often emerges as the most important problem. Wen (2004) emphasized, for example, that changes in the wording of questions and changes in the type of survey (face to face, telephone) can influence the trend results.
Increasing non-response rates have been pointed out as a possible explanation behind different health trends within the elderly population observed in Swedish studies (Parker, Ahacic and Thorslund, 2005). Also, Van Loon et al. (2003) pointed out that non-response may lead to a bias in estimates of the prevalence of morbidity. In a study on Iowa women aged 55-69 years with only 43 percent response rate, non-respondents were found to have higher rates of myocardial infarction, substantially higher attack rates for lung cancer, slightly higher attack rates for all-site cancer and higher all-cause mortality than respondents (Bisgard et al, 1994). Non-respondents older than 75 years have been found to have a higher prevalence of ill-health than respondents (Rockwood et al, 1989). Analyses of data for 27 countries from the World Health Organization (WHO) MONICA (multinational MONitoring of trends and determinants in CArdiovascular disease) study show that there is a risk that estimates of population health trends based on respondent data may be biased (Tolonen et al, 2005). Non-response has also been found to affect the associations between disease and functional status and self-rated health (Hoeymans et al, 1998), as well as estimates of registered health care utilization (Reijneveld and Stronks, 1999). Also Ives et al. (1994) found that the estimates are affected by non-response and they further point out that different causes behind the non-response may have different effects on the estimates.

2.7 Implications from previous research for the present study

Previous research has emphasized the important influence demographic changes will have on future needs for long term care and services. But there is also a need for alternative demographic projections. Furthermore, the impact of socio-economic inequalities in health and changes in population composition need to be addressed when exploring how demographic changes will affect the need for LTCaS in the future. This study will further develop some aspects already pointed out earlier in this chapter. The focus is on the deepening of our knowledge related to mortality, morbidity, last years of life and health care costs, educational mortality and morbidity differentials, connections between mortality and morbidity and finally on the question of how demographic changes will affect needs for LTCaS during the next two - three decades in Sweden.
3. MATERIALS AND METHODS

3.1. Subjects and procedures

In this thesis, the following available Swedish data are used: national population registers, register data on inpatient/outpatient health care from region Skåne and Swedish National Survey on Living Conditions for the period 1975-1999.

3.1.1. National population registers

Sweden has a long tradition of population statistics (Statistics Sweden, 2000). The Swedish population registers contain accurate demographic data (stock and flows) for the whole population based on the use of personal identity numbers for all citizens in Sweden. The registers are continuously updated with such events as births, deaths, immigration and emigration. The quality of Swedish population registers is good, even though there is some overcoverage because of the fact that the population register is not always informed about departures from Sweden (Statistics Sweden, 2003).

For the purpose of our study III, population registers were linked with a national educational register (Statistics Sweden, 2004) containing educational data for the population aged 16–74 from 1985 and onwards.

The educational register is based on the population register and

- self-reported educational level in the censuses of 1970 and 1990
- reports of degrees conferred from the main Swedish educational system from 1970
- self-reported educational level collected intermittently by surveys from immigrated people.

Furthermore, using cohort information, the educational register has been enlarged by adding one-year age group for each calendar year from 1986 for the purpose of the study III. That means, that in the year 1986 we have educational data for the population aged 16–75, in 1987 the data for the population is 16–76 years, and so on. In 1999 the age interval has been extended to 16–88 in the enlarged educational register.
3.1.2. Skåne data

The tradition of using total registers has also been developed in the field of health care (Swedish National Board of Health and Welfare/EpC, 2003). However, individual-related health care utilisation data covering all population and going back a number of years are available in Sweden at present only from the Skåne region (formerly Malmöhus County Council). This is also why Skåne data are widely used as a source of data in Swedish studies concerning health care utilisation (Merlo et al, 2003; Swedish National Board of Health and Welfare, 2002; SOU 1996:163) and why we use those data in our study I.

The fact that all citizens in Sweden have a special personal identification number makes it possible to connect information on health care utilisation with death register data and in that way create data on costs per number of remaining years of life. Costs included in our analysis are total costs for inpatient and outpatient health care. We have had access to individual-related cost data for inpatient care in the years 1992–1997, while for outpatient care the corresponding figures have been available only for the year 1997. Individual-related cost data were calculated as a function of the patient’s own health care utilization, and almost every health care contact has been linked to a specific cost. It has thus been possible to link 95% of the total costs for health care to a specific individual.

Skåne data do not include the information on costs of prescription drugs (drugs used in inpatient care are included). Nor have costs of long-term nursing home care been included. In Sweden most of the long-term nursing home care was transferred to municipal elderly care in 1992 and is since that time regarded as a part of social care for the elderly (Lagergren, 2002). Through this reform, around 10% of total health care costs were transferred. Taking that into account and considering out-patient care costs for pharmaceutical agents, the health care costs covered by our study constitute around 70% of total health care costs in Sweden as reported by OECD (OECD, 2003).

The population of the Skåne region accounts for 13% of the Swedish population. Skåne region’s population distribution and distribution of inpatient/outpatient health care costs has been assessed as fairly representative of Sweden as a whole by the 1996 Swedish commission on funding and organisation of health services and medical care (SOU 1996:163).
3.1.3. Swedish Survey of Living Conditions

The data used in study II and IV are based on the Swedish National Survey of Living Conditions (SNSLC or in Swedish: ULF). The SNSLC is annual, a nationally representative sample and has been conducted by Statistics Sweden every year since 1974. The SNSLC was established by the Swedish parliament as a continuous cross-sectional survey with the purpose of social monitoring and using many indicators. Since 1986, there is also a panel section (25%) that is repeated every 8 years. When focusing on health, the SNSLC included questions concerning health conditions — individuals’ self-assessments of their own general state of health, ADL, IADL, the prevalence of chronic illness, ailments and other forms of infirmity, and impaired mobility, need for assistance etc.

The sample frame for the SNSLC covers the whole population living in Sweden, both community-living and institutionalized persons. Given the existence of population registers, described above, the sample universe is well known and undercoverage and/or overcoverage are probably very small problems for this survey. Concerning older people, unfortunately, during almost all years the SNSLC has had an upper age limit. Between 1975 and 1979 the upper age limit was 75 years. Between 1980 and 2001 the corresponding limit was 85 years. However, surveys done in 2002-2005 as well as a special survey from 1988/1989 include all ages above 64.

Data used in study II and IV were taken from the annual surveys carried out in the period 1975–1999 and covering in total 32,502 older people aged 65-84 years. That means the number of yearly observations is on average 1300. To provide a more stable selection and in particular to give the opportunity to analyse different age groups by gender, the surveys have been collated in 5-year intervals in study II and IV.

Ethical considerations

All participating interview subjects were informed that the register of individuals would be complemented with certain information including data from the death register. SNSLC is since 1995, also regulated by law.

3.1.4. Non response rate in SNSLC

Concerning our study II and IV, the non-response rate varied between 18.5% in 1975–1979, 20.0% in 1985–1989 and 22.0% in 1995–1999. The non-response rate varied between men and women, between different
age groups and for different causes (data not shown). The non-response rate was lower among men than women. Also, the increase in non-response rate over time was lower among men than among women. Among persons aged 65-74 years the increase in non-response rate was moderate compared to the relatively large increase among those 80 years and older. The reasons behind non-response are possible to decipher according to three different types: refusers, non-contacts and the persons unable to participate because of sickness. The main reason for an increasing non-response rate was an increased number of people not available for interviews. The proportion of those that were sick or institutionalised has been found to be relatively stable over time, with a minor increase during the last years (Johansson et al, 2006).

Adjustment for non response rate in SNSLC

The problem of non-response is dealt with differently in different surveys. Adjustment for the non-response rate in SNSLC is done by post-stratification by sex, age, civil status and H-region (regional distribution in Sweden). After adjustment the data used represents the total population in these regards.

3.2. Study variables

3.2.1. Future volume of hours worked

The main outcome measure in studies I and II is demographically determined demand in terms of volume of required number of service hours. The assumption is that the current gender and age group utilisation profiles—as expressed in cost terms—are a good approximation of the average number (by gender and age group) of hours worked required by the public LTCaS for older people.

The volume of hours worked can easily be transformed to assess future demand for human resources for LTCaS given provider mix and average number of working hours per provider.

It should be emphasized that gender and age group utilisation profiles can be expressed in different ways, e.g. by average costs or average number of service hours or average number of nurses, assistant nurses, aides and home helpers currently giving services per capita for each

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3 Utilisation profiles represent consumption per capita by gender and age groups.
gender and age group. Gender and age group utilisation profiles are approximations of how resources in the form of working hours or number of nurses, assistant nurses, aides and home helpers are allocated between gender and age groups. This method is independent of measurement unit. In our studies, we are using cost per capita for each gender and age group (II) or number of remaining years of life (I) as weights when expressing current utilisation of services. Gender and age group utilisation profiles are used practically as weights, when making demographic extrapolations of future requirements on human resources.

3.2.2 Number of older people

The number of older people is an important variable in all the studies. Older people or elderly are in Sweden often defined as people 65 years and older. The number of older people is taken from Swedish population statistics. Swedish official population projections are used concerning the future number of older people per gender and age group in study I and II. However in study III, we generated our own projections of the future number of older people per gender and age group and for each of the three educational level categories. Population projection scenarios by age, gender and educational level are our main outcome measure in study III. Those new population projections have then been used in study IV.

3.2.3 Health indicators

Severe ill-health according to the Statistics Sweden’s health index was used in study II and IV. The future number of older people (65 years and older) suffering severe ill-health is the main outcome in study IV.

Statistics Sweden’s health index is a composite index based on questions concerning individuals’ self-assessments of their own general state of health, the prevalence of chronic illness, ailments and other forms of infirmity, and impaired mobility and need for assistance. Combining the answers to the questions covering those dimensions, a health index with four degrees was constructed—full health, slight ill-health, moderate ill-health and severe ill-health. A detailed description of Statistics Sweden’s health index can be found elsewhere (Statistics Sweden, 1989; Swedish National Board of Health and Welfare, 1997; Bostrom and Persson, 2001).
Self-reported health as one of the dimensions in the health index is an indicator of overall health status reflecting many aspects of health not captured in other measures. Global self-perceived health is a strong predictor of mortality (Idler and Benyamini, 1997; Sundquist and Johansson, 1997). The relationship between global self-perceived health and mortality is strong even when controlling for "objective health status" derived from physician and self-reported conditions and health service utilization data (Mossey and Shapiro, 1982). There is also a dose-response association between self-perceived health and mortality (Idler, Kasl and Lemke, 1990; Burström and Fredlund, 2001).

3.2.4 Socio-demographic factors

Information on socio-economic status is presented in study III, where educational level is used as a main variable for mortality analyses and study IV, where educational mortality and morbidity differentials as well as changes in educational composition of population were used. The education level used covers three categories, indicating the extent of school attendance: low: <=9 years (i.e. comprehensive school), medium: 10 and 11 years, and high: >=12 years. A similar categorization of educational level has been used in other epidemiological studies (Iglesias et al, 2003; Sundquist et al, 2004) building on Swedish data. The distribution of the Swedish population by age and educational level in 1999 is presented in Figure 10.
Figure 10. Swedish population aged 35 – 85 by age and educational level by the year 1999.

Source: Extended data from the educational register (Statistics Sweden, 2004).

Proportion of missing data on education is low, only 0.5 – 2.0 per cent in the ages 35–73 and 2.5 – 4.5 in the ages of 74 to 85. In the population census of 1990 all persons born 1926–1974 received an extract from the educational register. If the information in the register was wrong or missing each person had the opportunity to correct the information in the register. People of age 65 or older (born 1925 and before) have not been updated in the register. That is the reason for the higher level of missing data in ages over 73 in 1999. The persons with missing data on education were coded as having a low education level. Tests have shown that those persons had a similar mortality pattern to those having a low level of education.

3.2.5 Costs

Costs included in our analysis in study I are total costs for inpatient and outpatient health care. We have had access to individual-related cost data for inpatient care in the years 1992–1997, while for outpatient care the corresponding figures have been available only for the year 1997.

LTCaS costs used in study II are estimated by the Swedish Association of Local Authorities (2002) using survey information from 10-15
municipalities and official statistics on the total number of hours and total number of persons receiving LTCaS per November 1st for a given year.

3.3. Statistical methods

3.3.1 Scenarios, proportions and descriptive statistics
In studies I, II, and IV we use descriptive statistics. In study II and IV we use data based on respondents. Those data are prepared for descriptive statistics by post stratification of the observations according to age, gender, civil status and H-region (regional distribution of Sweden) based on register data of the Swedish population.

Scenario technique (Schwartz, 1996; Royston, 1997) is used in all studies. To model prevalence for future years, it is assumed that population prevalence of severe ill-health (as an indicator for need of care) in studies I and II was associated with both the demographic profile and mortality. In study I, assumed mortality development is also used as a health indicator. In study IV, different assumptions concerning development of severe ill-health by gender, age group and educational level were analysed. In study II and IV, the above described data from SNSLC 1975–1999 were utilized to model the logarithmic extrapolation of observed health trends related to the proportion of old people with severe ill-health. Because the SNSLC has an upper age limit (85 years), prevalence of severe ill-health among age groups 85-89 and 90+ was extrapolated using the assumptions that improvement in terms of prevalence of severe ill-health in the 85–89 age group is half of that in the 80–84 group and that prevalence rate in the 90+ age group is constant.

In our scenarios we combine assumptions on mortality and morbidity development with and without taking into account socio-economic health inequalities. Furthermore, we present own population projections in scenarios from study III.

3.3.2 Estimation of mortality
Standard procedures were used for estimation of mortality rates (Shryock et al, 1973):
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\[ n^m_x = \frac{D_x}{n^R_x}, \]

where \( D_x \) is the number of deaths, \( x \) is the initial age group, \( n (=1) \) is the number of years in the age group, and \( n^R_x \) is the corresponding exposure time. The mortality rates were transformed into probabilities to die by assuming piecewise constant intensities.

The estimates on mortality for men and women by educational level in study III was done for aggregated age groups (5-year intervals) in order to arrive at more robust estimates.

### 3.3.3 Demographic projections

Demographic projections presented in study III were performed by projecting the population at the end of 2000 into the future. The projection was done without external migration. The projection method is the standard cohort-component method (Statistics Sweden, 2000).

The population was calculated for a one-year period by:

\[ P_{x+1} = P_x \cdot (1 - q_x^t) \]

- \( P_x \) = Population aged \( x \) at the end of calendar year \( t \)
- \( q_x^t \) = Probability to die for a person \( x \) years of age during calendar year \( t \)
- \( t \) = Time from the end of the year 2000 to the end of 2035

The population projections in study III were made for a period of 35 years by means of assumed probabilities of death. Changes in fertility rates do not have an impact on our projections, because we are only studying the size of the elderly population for a limited period in this study. The population projections presented in study III were used in study IV.
4. RESULTS

4.1. Impact of inclusion of health status

In study I and II we compare simple (direct) demographic extrapolation of future number of working hours within LTCaS with extrapolations according to our methods (Figure 11 and 12). Our methods take into account not only changes in the number of older people in different age group but also health changes (measured by health care cost by number of remaining years of life in study I and changes in proportion of people suffering severe ill-health in study II).

Figure 11. Volume-index trends for inpatient/outpatient health care demand in Sweden, 2000-2030.

Source: study I
Note: Simple demographic extrapolation: health care cost per capita for each gender and 5-years age group are multiplied with the projected number of older persons per gender and age group. Mortality-adjusted demographic extrapolations: health care cost by gender and number of remaining years of life are multiplied by the projected number of persons per gender and number of remaining years of life.

Figure 12. Volume-index trend for LTCaS demand in Sweden, 2000–2030.

Source: study II.

Note: Simple demographic extrapolation: LTCaS cost per capita for each gender and 5-years age group are multiplied by the projected number of older persons per gender and age group. In revised extrapolation simple demographic extrapolation is adjusted by multiplication by trend index according to data on health changes per gender and age groups from SNSLC.

The first observation is that no matter which method is used there is a projected demographically influenced increase in both health care and LTCaS demand. Increase is modest for health care compared to LTCaS.
One reason for this is that, as pointed out above, in Sweden most long term nursing homes are a part of Swedish LTCaS. Long term care is more heavily concentrated on the very old than acute health care. Thus the remaining acute care has a less pronounced age profile. The result of our estimates of the growth in volume of working hours presented in study II, obtained from direct demographic extrapolation assuming unchanged needs per age group and gender and the corresponding growth given expected health improvements, show that the average yearly increase drops from 1.5% to 0.9% or, altogether for the period 2000–2030, from 58% to 30%. Thus the projected increase in the volume of demand for LTCaS for older people in Sweden by year 2030 will be almost halved, compared with the increase as calculated assuming unchanged age/gender-specific health and functional ability.

Extrapolation of health care costs assuming a constant cost per remaining years of life, age and sex also results in a fairly substantial reduction of the rate of the demographically influenced increase in health care demand in Sweden compared to the results from direct demographic extrapolation method. The average yearly increase drops from 0.6% to 0.4% or, altogether for the period 2000–2030, from 18% to 11%. The increase in health care demand in the period 2000–2030 arrived at, by means of our method, will be around 37% lower than estimates done with a direct demographical extrapolation, which does not take the decreasing mortality pattern into account.

4.2. Demographic projections and the impact of inclusion of educational status

In study I and II, we use official population projections when comparing direct demographic extrapolation with extrapolations used by our method. However taking demographic projections as given may affect projected demand. As we pointed out in chapter 2, official demographic projections have for a long time underestimated development in the number of older people. In study III we show that changes in population composition regarding education and mortality differentials per educational level have a significant impact on the projected number of the elderly in the future. Four different scenarios have been presented. In scenario 4 (assumed mortality decline and educational mortality differentials taken into account), the number of elderly (65+) in Sweden will increase by 62% during the period 2000–2035, compared
to a projected increase of 54% in scenario 3 (assuming the same mortality decline as in scenario 4) where educational mortality differentials are not taken into account (figure 13).

Figure 13. Projected increase in number of elderly people in Sweden (65+) 2000–2035 according to alternative projections (index 2000=100).

Source: study III.

Note: Population projections in scenarios 1 and 2 are based on unchanged mortality rates by gender, age groups (in scenarios 1 and 2), and educational level (scenario 2). In scenarios 3 and 4, population projections are based on declining mortality by gender, age groups (in scenarios 3 and 4), and educational level (scenario 4).

Even assuming unchanged mortality as in scenarios 1 and 2, the number of elderly people will most probably still continue to increase over the next 35 years. The increase of 32 percent between the year 2000 and
2035 is a result of changes in the size of cohorts and reduced mortality at all ages in the past (which results in a growing number in a cohort surviving to an advanced age). The inclusion of educational level in our analyses in scenario 2 has significance for the development among both gender and different age groups (results not shown), as well as for the total number of older people in the future that is projected to increase by 38 percent by year 2035 (figure 13).

Life expectancy varies widely by gender and educational level. The inclusion of educational level mortality differentials in our projections results in a strong increase in life expectancy at 65. An increase in life expectancy at 65 years for men during the next 35 years is projected to 5.1 years in scenario 4 compared to 4.1 in scenario 3. The corresponding increase for women is 3.6 and 2 years.

Life expectancy will increase at a different speed for women and men with different educational levels, which further widens the gap between the educational groups. Furthermore, given assumed mortality reductions per age, sex and educational level, socio-economic differentials in life expectancy will increase both for men and women. For instance, the average highly-educated female person by 2035 is in scenario 4 projected to have a life expectancy at birth of 88.6 years, compared to 83.7 years for an average low-educated female. This result may be compared with 84.1 years and 81.0 years of life expectancy at birth for an average highly-educated and average low-educated female in 2000 respectively.

According to scenario 4, there will be a dramatic shift in the socio-economic structure of the elderly population during the next 35 years. Today 4 out of 5 women older than 80 years have a low level of education. In scenario 4, by year 2035 only 1 out of 5 women will have a low level of education. The change in socio-economic structure is similar for older men (from 7 of 10 in the year 2000 to 1 of 4 with a low level of education by the year 2035).

4.3. The impact of taking into account educational mortality and morbidity differentials as well as changes in educational composition of the population

In our study IV, we present 8 different scenarios where educational mortality and morbidity differentials as well as changes in the educa-
tional composition of the population were taken into account. We group our scenarios into 2 groups as regards the assumptions on mortality development by gender, age and educational level. The first group of scenarios that we analyze are those where the population projection is based on the assumptions on constant mortality rate (the corresponding increase in number of older people is according to scenario 2 from study III) and those are presented in figure 14.

Figure 14. Development in the projected number of older people suffering ill-health 2000-2035, scenarios based on population projections with constant mortality.

Source: study IV.

Note: In scenarios “Simple/const.mortality” and “Const.edu/Const.mortality” the number of older persons suffering severe ill-health by gender, 5-years age group (“Simple/const.mortality” and “Const.edu/Const.mortality”) and educational level (“Const.edu/Const.mortality”) is multiplied with the projected number of older persons per gender and age group. Scenario “Trend.edu/Const.mortality” is based on scenario “Const.edu/Const.mortality” that is adjusted by multiplication by trend index according to data on health changes per gender, age groups and educational level from SNSLC.
The assumed decreasing prevalence of severe ill-health following the observed trend and given the assumption of constant mortality will result in an 11% decrease in the number of persons suffering ill-health in scenario “Trend.edu/Const.mortality” (Figure 14), despite a 37% projected increase in the number of older persons (the corresponding increase according to the simple demographic extrapolation was 40% in scenario “Simple/const.mortality”).

Figure 14 shows, furthermore, that according to scenario “Const.edu/Const.mortality” (constant morbidity rates during the next 35 years) the inclusion of educational mortality and morbidity differentials together with projected changes in population composition by educational level result in a more than halved increase (18% compared to 40%) in the number of persons suffering SIH compared to the corresponding increase as a result from the scenario based on simple demographic extrapolation.

Results from the second group of scenarios, where the population projection is based on the assumptions of decreasing mortality rate (the corresponding increase in number of older people is according to scenario 4 from study III), are presented in figure 15.
Figure 15. Development in the projected number of older people suffering ill-health 2000-2035, scenarios based on population projections with decreasing mortality

![Diagram showing development in the projected number of older people suffering ill-health 2000-2035, scenarios based on population projections with decreasing mortality.](image)

Source: study IV.

Note: Scenarios “Simple/trend.mortality”, “Const.edu/Trend.mortality” and “Trend.edu/Trend.mortality” are similar to scenarios presented in the figure 14. The only difference is that the population projection used is based on the assumptions on declining mortality rates. Scenarios “Converg.low.edu/Trend.mortality” and “Converg.high.edu/Trend.mortality” are based on scenario “Const.edu/Trend.mortality” that is adjusted by multiplication by assumed health changes per gender, age groups and educational level. In the “Converg.low.edu/Trend.mortality” we assume increasing prevalence of SIH among those having medium and high educational level. Among those who have medium educational level the prevalence of SIH is assumed to increase by 1.5 percent yearly until arriving at the same prevalence of SIH as among those with low educational level. Equivalently, those having high educational level are assumed to arrive at the same prevalence as those having medium educational level. In the “Converg.high.edu/Trend.mortality” we assume in a corresponding way the decreasing prevalence of SIH among those having low and medium educational level, until they arrive at the same prevalence level as the above educated group.
The number of elderly suffering SIH in Sweden will increase according to our scenario “Trend.edu/Trend.mortality” (following observed trends on mortality and morbidity in the different educational groups) by 14% during the period 2000-2035, compared to the 73-percentage increase in the scenario “Simple/trend.mortality”.

Taking educational morbidity differentials into account counter-balances the increases in the prevalence of ill-health by more than half, even in our scenario “Converg.high_edu/Trend.mortality” compared to “Simple/trend.mortality” (Figure 15).

Despite assumptions of dramatically reversed health trends (worsening of health status, see note under figure 15 above) during the next 35 years compared to the period 1975-1999, used in our scenario “Converg.low_edu/Trend.mortality”, the future number of persons suffering SIH is not projected to increase more than in the scenario “Simple/trend.mortality” based on simple demographic extrapolation (Figure 15), because of the dramatic changes in the population composition by educational level.

4.4. Health development

According to analyses presented in the study II and IV, the prevalence of severe ill-health among the elderly in age group 65–84 years declined from 22% in 1975/1979 to 17% in 1995/1999. The improvement in health status was most pronounced in the 65–74 age group among women, and in the 65–79 age group among men. The improvement was greater for men than for women. The proportion of women aged 65–84 suffering severe ill-health decreased by 1.4% per year (regardless of the analysed period being 1975/1979–1995/1999 or 1985/89–1995/1999). For men, this proportion decreased by 2.8% per year for the period 1975/79–1995/1999, and by 2.5% per year for the period 1985/89–1995/1999.

Concerning socio-economic inequalities, we show in our study IV some increase in the health gap between people having different educational levels. However, the prevalence of severe ill-health has decreased considerably among all educational categories during the period 1975/79-1995/99.
4.5. Mortality

During the period 1975/79–1995/1999, mortality among Swedish women aged 65–84, decreased by 1.4% per year (the same decrease was observed during the period 1985/89–1995/1999). Among Swedish men in age group 65–84, the mortality rate decreased by 1.2% per year for the period 1975/1979–1995/1999, and by 1.6% per year for the period 1985/89–1995/1999. In other words the mortality rate has been falling faster among men than women in the latest time period. Concerning the oldest old people, the decrease in mortality rate during the period 1975/1979–1995/1999 in the 85–89 age group was 0.8% among men and 1.2% among women. The mortality rate decrease in the open-ended interval age group 90+ has been about 0.3% per year for both men and women during the period 1975/1979–2000/2004 as pointed out in study II.

Our estimates of (yearly) changes in the mortality rate for men and women aged 35–79 by educational level used in study III show that mortality has declined among all educational categories for the population studied during the period 1992–1995 to 1996–1999. Analyses concerning people up to 74 years older show the same development for the extended period 1985-1999.

We are assuming that mortality will continue to decline in two of our four scenarios in study III. It should be pointed out that official Swedish projections are also based on the assumption that the mortality rate will continue to decrease, but at a slower rate than the trend. For example as emphasized in our study I, over the next 30 years, the probability of an 80-year old man dying within five years is expected to fall from 43% to 36%, while the expected decrease for a 65-year-old is relatively even larger—from 11% to 7%, or more than one-third.

4.6 The connection between mortality and morbidity/disability

4.6.1 More people – fewer suffering ill-health

The connection between declining mortality and morbidity during the period 1975/1979-1995/1999 is apparent from the results in our studies II and IV, where we show that despite an increase in the population aged 65–84 years from about 670,000 (average per year) in 1975/1979 to
750,000 in 1995/1999, the number of people suffering from severe ill-health decreased from about 150,000 to 130,000 persons.

4.6.2 Acute health care costs are concentrated to the last year of life

The connection between mortality and severe morbidity may also be analysed by the association between high health care costs as an indicator of severe morbidity and the number of remaining years of life. According to the estimates in study I, less than 1% of the population that died during the last calendar year (having zero remaining years of life) accounted for circa 11% of the total annual expenditure for inpatient health care. This group with zero remaining years of life thus has 14 times higher share of the total annual expenditure for inpatient health care than their share of the population. Furthermore, around 6% of the total population with six or less remaining years of life accounts for nearly 37% of total costs for inpatient health care. Total per capita inpatient and outpatient health care costs are 11 times higher for deceased (during a calendar year) than for survivors.

There are clear differences between men and women in the distribution of health care costs in terms of remaining years of life. Over the whole life span women have higher per capita costs than men for both inpatient and outpatient health care. Nevertheless, men have between 11% (outpatient) and 13% (inpatient) higher per capita health care costs during the last year of life (calendar year).
5. DISCUSSION

5.1. Main findings

The main findings from this thesis can be summarized in the following points:

**Alternative methods**
- We have developed three alternative methods to improve direct demographic extrapolations of need for health care and LTCaaS for the elderly: 1) Taking into account the distribution of cost by number of remaining years of life, 2) Including not only changes in the number of older people in different age groups but also health changes by gender and age group, 3) Taking into account educational mortality and morbidity differentials and changes in the educational composition of population.
- Our methods emphasize the importance of including indicators of health status when projecting future needs of care.
- We present new alternative methods for population projections taking into account socio-economic mortality differentials.

**Health development**
- Health care consumption is, to a substantial extent, concentrated to the final phase of life.
- The proportion of older people with severe ill-health among people aged 65-84 years decreased steadily in Sweden during the period 1975/1979–1995/1999 in all age groups, for both genders—male and female, and for all educational levels.

**Population composition**
- The socio-economic composition of the elderly population will change significantly during the next decades.
- Changes in the composition of the population (that have already occurred or are projected) regarding education and mortality differentials per educational level have a significant impact on the projected number of the elderly in the future. This leads to a higher number of older people and a longer life expectancy than projected in official statistics.
- The projected increase in the number of older people suffering severe ill-health, as a consequence of population ageing, may be
counterbalanced to a large extent by changes in the educational composition towards a higher proportion of the population having a high educational level (and low prevalence of severe ill-health).

5.2. Discussion of the findings

The knowledge about demographic changes is crucial in order to plan and prepare for ageing population (Economic policy committee, 2006). Our methods emphasize the importance of including indicators of health status when projecting future needs of care. In that way we acknowledge that the prevalence of ill-health is significant in modelling and not just the number of people per age group. The inclusion of health status in our model may also emphasize the value of health interventions at population level over a long time, giving arguments to advocates of public health interventions.

5.2.1 Morbidity/disability – mortality

The key issue of how population ageing will affect future needs for LTCaS is the morbidity/disability – mortality relationship, as discussed in chapter 2. Given our results that show decreasing mortality among both men and women, and across socio-economic groups, the empirical evidence relating the development of morbidity/disability should be taken into account. The analysis presented in our studies I (high health care costs as proxy for severe morbidity) and II and IV (prevalence of severe ill-health as an indicator of severe morbidity) supports the hypothesis about postponement of severe morbidity. The fact that health care consumption is directly connected to the number of remaining years of life may be explained by the relationship between changes in severe morbidity and changes in mortality. The strong connection between the number of remaining years of life and health care costs have been shown from studies done in different countries and covering different time periods (Roos, Montgomery and Roos, 1987; Lubitz and Riley, 1993; Zweifel, Felder and Meiers, 1999; Cutler and Meara, 1999; McGrail et al, 2000; Hogan et al, 2001; Batljan and Lagergren, 2004).

Even more striking and relevant for our use of the indicator (health care costs by number of remaining years of life) and for connections between severe morbidity and mortality is the fact that the share of
health care costs concerning the last years of life in relation to total health care costs has been found to be stable over time (Lubitz and Riley, 1993), for the period 1976-1988 and Garber, MaCurdy, and McClellan (1998) for the period 1988-1995, and Hogan et al (2001). As pointed out by Miller (2000) “Despite changes over the last two decades in medical technology, in the Medicare program itself, and in the characteristics of Medicare enrollees (age and disability), time-until-death has remained a consistent indicator of costs.”

The results from our studies I, II and IV are based upon the period from the middle of the 1970s to the late 1990s. However, the picture seems more mixed when looking at other studies (Johansson et al, 2006; Parker, Ahacic and Thorslund, 2005) which also cover the first years of the new Millennium and include different health indicators – not only Statistics Sweden’s health index. As shown in figure 9 B health development varied a lot also during the 1990’s.

So, which conclusions may be drawn from the observed health trends in study II and study IV? As pointed out in the chapter 2, the choice of indicator (meaning which dimension of health is studied) is crucial for the understanding of the development.

The development described in study II and IV is measured by an indicator of severe ill-health. This indicator - health index by Statistics Sweden - is a composite measure that combines both measures of disability as well as measures of self-perceived health status (as a part of global health measures). According to study II and IV, the prevalence of severe ill-health has declined during the period 1975/79-1995/99. Behind this decline there is a different development for measures of disability (decline) and the global health measure (unchanged to small decline). There are different developments for the different dimensions of health also when comparing the prevalence of disability which has decreased and the prevalence of chronic diseases (e.g. high blood pressure and diabetes) which has increased (Johansson et al, 2006).

The similar trends related to prevalence of disease (increase), global health measure (small decline) and prevalence of a disability (relatively large decrease) have been shown in a study of healthy life expectancy based on Danish data, covering the period 1987-2000 (Bronnum-Hansen, 2005). Some evidence from the USA is also pointing in the same direction concerning the decrease in disability rates among the elderly (Crimmins, 2004; Freedman, Martin and Schoeni, 2002; Cutler, 2001; Manton and Gu, 2001; Crimmins and Saito, 2000) and increase in prevalence of chronic diseases (Crimmins and Saito, 2000; Freedman
and Martin, 2000). The trends from US data, show particularly a strong decline in IADLs (Spillman, 2004). There is also some decline in the prevalence of ADLs, and this trend is also close to the observations from another US study (Freedman et al, 2004). Thus the answers to questions about the health development of older people are strongly dependent on the choice of health dimensions studied.

How to understand different developments for different health indicators?
Following a discussion related to different hypotheses - compression, expansion, and postponement of severe morbidity, we could draw the conclusion based on the study by Johansson et al. (2006) that, regarding disease, we are observing an expansion of chronic morbidity. However, there also seems to be an opposite compression of disability. To explain these two, at first glance seemingly contradictory conclusions, is important in order to understand the causes and relations of the two trends. The fact that the expansion of chronic morbidity does not lead to an expansion of disability may be the result of effective health care technologies including (new drugs) and environmental changes. Due to these developments, having a disease may have become less disabiling (Spilman, 2004; Freedman et al, 2004; Costa, 2000). The physical environment in which older people live has changed and may have affected disability rates.

On the other side, it is possible that the increasing prevalence of disease is a result of changes in diagnostics and changed threshold for what is considered a disease. It is well known that the threshold for hypertension has changed the last thirty years. Also the threshold for diabetes has been lowered the last decade (Freedman et al, 2006). Furthermore, it is plausible that attitudes and lower educational levels could have affected reporting of diseases in the past.

Higher educated persons may be better at verbalizing their symptoms than lower educated persons (Larsson, 2004). Changes in attitudes and higher educational levels may then have resulted in relatively higher prevalence of diseases than there would have been otherwise with the old perception of disease. If changes in diagnostics and changed threshold indeed explain increasing chronic morbidity, then it is possible that the association between disease and disability may not have changed over time. Improved diagnosis of symptoms, conditions and diseases as well as diagnosis at an earlier stage may also affect disability rates by way of early detection preventing development of a
severe disability. No matter which explanation seems credible, it is only by empirical data that we can get the answer.

Usually, we compare prevalence of disease and disability at the same point of time. Nevertheless, diseases observed in the past may cause today’s disability, as a consequence of the disablement process. Thus it is possible that there is a time lag effect that should be analysed. If the time lag is playing a role (meaning that today’s disease may cause disability in the future), and the changes in diagnostics and changed threshold have not affected the prevalence of disease, then the disability prevalence may change in the future in the same direction as disease prevalence during the last years. Time dimensions are also important with regard to the fact that disability is not a permanent status (a certain proportion is moving in and out see: Wolf, Mendes de Leon and Glass, 2007; Cai, Schenker and Lubitz, 2006).

Disability reflects both presence and – particularly - severity of chronic disease. However, it is important to distinguish between diseases or health conditions that cause disability from those that co-occur (comorbidity) with a disability (Freedman et al, 2006) or those that have been disability-induced. It should be pointed out here that we lack studies concerning incidence of disability.

The other dimension that needs to be dealt with concerns which age groups that should be taken into consideration. In our studies II and IV we have analysed older people 65-84 years old. Different trends may be observed for different health indicators in different age groups, at different points of time (Parker and Thorslund, 2007).

The importance of different indicators for assessment of needs for LTCaS, or needs for inpatient/outpatient health care varies. Concerning LTCaS, the most suitable indicators are likely functional limitations in ADL respectively IADL. The information about ADL and IADL has not been available for all years during the period 1975-1999. Severe ill-health according to Statistics Sweden’s health index is an alternative indicator (available for the study period) that has been used in our studies II and IV as well as elsewhere (Lagergren, 2005a; Lagergren, 2005b). Unfortunately, we do not have information on health status or/and functional ability for older people that use LTCaS (except than in new special studies as for example SNAC study (Lagergren et al, 2004)). Lack of individual-based statistics concerning older people’s use of LTCaS and their health status and functional ability is a problem for both monitoring and planning within LTCaS system.
The planning of the Swedish public LTCaS is dependent on an improved information base. Furthermore, the strong association between inpatient/outpatient health care costs and number of remaining years of life needs to be further analysed. This analyses needs to be expanded to include costs for LTCaS and also be traced over time. In summary, analyses of morbidity trends should be combined with analyses of mortality trends.

5.2.2. Demographic projections and educational health inequalities

In chapter 2 we pointed out the fact that demographic projections up till now have underestimated the future number of older people. One of the explanations behind this underestimation lies in the ever ongoing debate about limits to life expectancy. The demographers, as well as people in general, had difficulty to imagine that the tremendous success regarding increasing life expectancy could continue at the same “speed”. In the future, changes in population composition regarding education and mortality differentials per educational level may lead to further underestimation of the future number of older people. In study III a new alternative method for population projections taking into account socio-economic mortality differentials was presented. This new method resulted in much higher numbers of older people in the future than projected by official projections. Higher numbers of older people, as a result of faster increases in life expectancy than projected in official statistics, may also have a significant impact on future needs for LTCaS at population level.

An answer to the central question concerning limits to life expectancy and the continuing mortality decline is provided by the conclusion from an international comparisons study of the annual average reduction in the mortality rates in advanced ages for 27 developed countries (Kannisto et al, 1994). Kanisto et al. pointed out that life expectancy wasn’t approaching a limit. Reductions in the mortality rates in advanced ages have accelerated since the years 1950, the pace of decline of the mortality rates in countries with low mortality has been on average as high as the reduction in countries with high mortality levels, and the mortality rates between different countries have not been converging over time.
We showed (study III) that mortality rates among all educational and demographic groups declined between 1985 and 1999. We have also showed that prevalence of severe ill-health among all educational, gender and age groups declined between 1975/79 and 1995/99 (study IV). Similar trends, concerning disability rates among socio-economic groups, were shown by Schoeni et al. (2005) based on US data. Another similarity between our results concerning educational mortality and morbidity differentials and the result of Schoeni et al. (2005) is that the rate of decline (for both mortality and disability trends) was larger for older people having more years of education. As a consequence, increasing disparities between socio-economic groups develop. Furthermore, a large US study covering more than 300 000 people aged 55 years and older (Minkler, Fuller-Thomson and Guralnik, 2006) has shown that disability rates given level of education, measured as long-lasting functional limitation in walking, climbing stairs, reaching, lifting, or carrying, have decreased among all age groups.

Demographic extrapolation by age, gender and educational level, as well as information on disability rates by age, gender and educational level can thus be used for assessing the effects demographic changes may have for the needs for LTCaS.

In summary, understanding underlying trends is not only important for a discussion related to the three hypotheses concerning relationship mortality – morbidity/disability, but also in order to understand how the changing educational composition of the elderly population will influence both morbidity/disability and mortality development. Good planning and monitoring requires alternative demographic projections that allow for even faster increases in life expectancy than the established methods. Introducing educational level mortality differentials seems to be one step in improving the field of demographic projections.

*The causal relationship between education and health?*  
Taking into account educational mortality differentials may help to understand some underlying trends behind demographic changes. However, the association between education and mortality is not simple and straightforward, but rather a complex one. Different causal mechanisms behind the association may have different effects on future mortality and the number of older people. The effect of education on mortality in the coming decades will depend on the nature of the association between education and mortality. Consequently, the next important step concerning this thesis, is to discuss the future association
between educational level, mortality and functional limitations. Will projected future changes in education composition affect both mortality and morbidity in the same way? Will these associations change when the number of highly educated people surges during the coming decades?

Given different possible causal mechanisms, we can expect different results concerning how changes in educational composition may affect the future number of older people. In chapter 2, we discussed different hypotheses (according to life-course perspective, selection – both direct and indirect – perspective and specific determinant’s perspective) regarding the association between educational level and mortality. We also argued that there is evidence for a causal effect of education on mortality in accordance with results from several studies (Cutler and Lleras-Muney, 2006). Possible explanations behind this causality could be found using both the life-course perspective (Ben-Shlomo and Kuh, 2002) and different material, psychosocial and behavioural factors (Van Oort, van Lenthe and Mackenbach, 2005) – as parts of the specific determinant’s perspective (Mackenbach, 2005). Below we will discuss how these different explanations may affect our results.

Material and behavioural explanation will probably have a direct effect from increasing educational level to lower mortality and better health. In Sweden, better educated older people have greater material resources (higher pension income) than those with primary education (Alm Stenflo, 2002). Middle-aged people with higher levels of education in Sweden (future elderly) smoke less, eat better, and exercise more than those with less education (Swedish National Board of Health and Welfare/EpC, 2005).

The relationship is much more complicated regarding the psychosocial explanation. The status syndrome (capturing psychological experience of inequality, but also adverse conditions at work, in residential areas, and in general, to lack of empowerment and lack of control over own life) has been shown to be a persistent factor behind inequalities in health (Marmot, 2004). However, this status syndrome may be affected in at least two different ways when a large share of the population is highly educated. Firstly, those without a higher educational level may tend to be even more marginalized in a society where a relatively big share of the population is highly educated. Secondly, the perception of “belonging to the privileged part of the society” may be weaker when a majority of the population is highly educated. Not only the perception, but also the direct benefits of “belonging to the privileged part of the society” may be constrained by competition for scarce
resources (no matter if the resource is new treatment, good working conditions or a good environment). Therefore, there is a possibility that signs of decreasing marginal utility of the effect of education on health may appear. At the same time, the status syndrome has been shown to be a persistent factor behind inequalities in health (Marmot, 2004).

Concerning the life course perspective it seems that our result will be relatively stable given the development observed after Second World War, in which all new generations have enjoyed better living conditions as children than their predecessors. In a cohort study with data from seven European countries, Janssen and Kunst (2005) found that factors such as living conditions in childhood and smoking in adulthood may be an important driving force in determining the recent trends in mortality among the elderly.

As pointed out by Marmot (2004), there is evidence for three broad conceptual models of life course perspective: the latent effects, pathway model, and cumulative life course models and their effect on health. The results by Seeman et al. (2004) from the study done on the MacArthur Successful Aging cohort (initially selected to represent the top third of those aged 70–79 in terms of physical and cognitive functioning) clearly support both the life course perspective as well as our assumptions that education is a persistent significant predictor of differential mortality and morbidity risks in cohorts of older men and women.

Life course perspective may be an explanation behind the fact that new cohorts have lower mortality by gender, age group and educational level than older cohorts. For example even though the share of people in age group 70-74 having high education almost tripled between 1985 and 2002 in Sweden for both men and women, mortality decline shows no signs of decline in marginal utility (Statistics Sweden, 2005b). The same development among middle aged may be illustrated by the development for women in age group 50-54. The share of women having post secondary education in the age group 50-54 years increased from around 13% to around 34 percent between 1985 and 2002. During the same period the mortality declined by 1.1% per year in this age group (Statistics Sweden, 2005b, author’s own calculations). Those highly educated women that were 50-54 years in 2002 will be 83-88 years in 2035 and it seems plausible they will have better health and lower mortality than today’s elderly women in the same age group.

On the other hand, mortality and morbidity may be affected in a negative way by the obesity epidemic among young adults, the re-emergence of infectious diseases, wars, and health effects of ecological
changes (Olshansky et al., 2005). At the same time, increased investments in the appropriate preventive measures and the new health technologies may alleviate at least some of those risks. Finally, better educated people act faster as regards to adapting to new technologies, are better prepared to comply with treatments (Goldman and Smith, 2002), and are able to manage chronic conditions better (Goldman and Lakdawalla, 2001). Therefore, all other things being equal, the dramatic changes in educational composition of the elderly populations will probably have a strong effect on mortality and morbidity in the future.

To sum up, there is an abundance of evidence about socio-economic gradients in mortality and morbidity (using different indicators of socio-economic position) among men and women, among children, adults and elderly, for different causes of death, from different periods, countries and populations and those gradients have been long-lasting during long periods of time (United States National Research Council, 2001; Swedish Council for Social Research, 1998). Nevertheless, we would like to underline that an overall understanding of the causes to educational level mortality and morbidity differentials is far from clear. The future and further research will give us more answers.

Education and demand for services

Education may also have a direct impact on demand for a service and then the use of it. Elderly people’s expectations and attitudes towards applying for help vary widely from one person to another. Having a high educational level often means having a good knowledge about different types of care and knowing how to use resources in order to obtain formal care. Portrait, Lindeboom and Deeg (2000) show using Dutch data that higher education levels increased the probability of obtaining formal in-home care, at the expense of informal care. A higher percentage of people having higher educational level may lead to an increase in LTCaS demand, no matter how the needs for care are changed. Swedish studies do not support Portrait, Lindeboom and Deeg (2000), with regard to the use of public home help nor use of institutional care (Palme et al., 2003). However, Szehely (2002) has shown that cutbacks in formal LTCaS during the 1990’s in Sweden have been partially compensated by an increased reliance on relatives among low-educated, as well as an increase in the use of private market services among high-educated people.
5.3 Methodological considerations

Mechanistic extrapolations will always be mechanistic no matter the level of sophistication of methods used in order to get a good input for simulations. On the other hand, when a mechanistic extrapolation is based on a sound knowledge that takes different possibilities into account, policy makers will be given an opportunity to get a broader picture of possible outcomes. That is also why we often use the term “scenario” throughout this thesis. This means that we focus on the question “what if?” in order to understand possible directions for the future.

As pointed out above, we do not have information about the distribution of needs for LTCaS. We therefore used consumption data as a starting point for our extrapolations. It is possible that today’s consumption of care may not be answering the actual needs. Formal rejections of applications for LTCaS as well as appeals against negative decisions are (relatively) rare in Sweden (Swedish National Board of Health and Welfare, 2000). On the other hand, the relevance of a demographic extrapolation may also be affected by changes in people’s propensity to seek care and assistance, given the degree of ill-health and impairment of functional ability. Changes in this propensity may be based on changes in attitudes, revised expectations or new opportunities. The need a person experiences is never an absolute quantity. The experienced need is influenced both by concrete, material circumstances, and by more subjective variables, such as attitudes and expectations. People do not demand what they believe they cannot, in any case, obtain. Refraining from applying for assistance may be caused by excessively high charges, or because one considers the offered quality of the services to be too low. In a study of elderly people who had withdrawn from the home help service, the National Board of Health and Welfare found that, in two out of five cases, the cause was dissatisfaction with charges or quality (Swedish National Board of Health and Welfare, 1998).

One issue related to the assessment of future health trends is which indicators should be used. The use of Statistics Sweden’s health index in study II and IV, as a composite measure, complicates the analysis and our chances to understand concepts behind the observed changes. However, Statistics Sweden’s health index has been found to be associated with LTCaS use and is used as an indicator in the Swedish system of municipality cost equalisation (Lagergren, 2003). As pointed out by Robine (2003) the indicators of functional limitations are often seen as more suitable for assessment of needs for LTCaS. On the other hand,
already today, cognitive impairment is the main reason for people moving to around-the clock-care in special accommodation. This may be even more true in the future. Nevertheless, in the assessment made by the municipal decision makers (needs assessment persons) it is still most common to measure particular physical impairments.

One of the limitations concerning this thesis is that we do not analyse household composition despite that this has been shown to be an important predictor of use of LTCaS (Larsson, 2004). This socio-demographic factor is not analysed directly in study II. In that study, we extrapolate trends in health using trend extrapolations of the observed proportions with severe ill-health by age and by gender group. Mortality development, as emphasized in chapter 2, with a decreasing gender gap may result in more people cohabitating. At the same time, the increasing number of divorces in the last decades may to some extent counterbalance the higher number of men surviving to higher ages. On the other hand, the decreasing gender gap in life expectancy should also lead to more men being available for the divorced women and the widows.

There is a need for making a number of underlying assumptions based on behavioural modelling, in order to capture new trends among people 65 years and older. However, other studies have modelled marital status. Lagergren (2005b) has presented a model, where age groups, gender, marital status, degree of ill-health or disability is used in connection to LTCaS use according to four different levels. Our study II, without taking into account marital status yields similar results to Lagergren (2005b).

Concerning study I and the conclusions related to the distribution of cost of health care on the remaining years of life, it should be pointed out that data on costs of prescription drugs have not been included in our study. That may, to some extent, affect results due to the fact that public spending on prescription drugs in Sweden has been increasing rapidly during last years and now amounts to circa 10 percent of the total health care costs.

Also, in our population projections, we have not taken into account the fact that some individuals may have raised their educational level after the age of 35. Another limitation in our projections is that we have not analysed the convergence in rates of mortality by educational level among higher age groups, older than 80.

As we see it, these limitations cannot influence our projections in any significant way. The main limitation, as pointed above, is the uncertainty regarding whether any association between educational status
and mortality will persist in the same way as it has over the last decades. This question needs to be further analysed.

Finally, the focus in this thesis lies on formal care. Future demand and need for LTCaS will also be highly affected by the development of informal care. Our projections assume that informal care will develop in the same way as formal LTCaS. Assuming that informal care will be unchanged at today’s absolute level may affect our results significantly (Thorslund and Larsson, 2002). Sensitivity analyses concerning other countries have shown that the effect of shifts from informal care to formal care depends on which sorts of formal care that may substitute informal care (home help services or institutions) and on the starting point for scenarios as regards how much a country relies on informal care (Comas-Herrera et al, 2006).

It follows that there is a need to further develop methods that take into account and quantify informal care that is provided to older people.

Furthermore, in this thesis, despite the fact that information about both men and women has been used as an input in analyses, the main results are presented and discussed in aggregate form. That may have resulted in hiding gender differences. This is particularly important to be aware of when we know that women are both main users and main carers within LTCaS. On the other hand, the careful planning may from that perspective be particularly important for women. It is also why we need more research concerning gender differences as regards to both health trends and LTCaS needs.

The question whether the same health indicators should be used for men and women when assessing future needs for LTCaS is also an issue that should be further analysed.

5.4. Policy options

5.4.1 Improved planning

The methods we are discussing in this thesis may help the further development of social policies in Sweden. Improved assessment of future needs and demand for LTCaS is one contribution. A second contribution is improved monitoring. Yet another contribution is improved methods for population projections. Estimates of future needs and demand for LTCaS are crucial preconditions for pro-active, and not simply responsive, planning for LTCaS needs for tomorrow’s older
population (Jagger, 2000). The instruments presented here may then help the development of a better quality of LTCaS and more stable preconditions for ordinary people’s expectations for the future. The population projections are furthermore essential for the development of policies concerning the pension system. The methods presented here and the trends that have been discussed may further contribute to more reliable input to projections of future requirements on public finances.

5.4.2 Case for prevention

Including health changes when modelling demographically determined needs for LTCaS, make a case for prevention. This kind of model may then be used as advocacy for the development of different health interventions. Understanding the driving forces behind different trends and the association between morbidity and mortality may help in addressing causes behind disease and disability, giving us a better base for advocating for public health interventions. Furthermore, policy interventions that address the higher prevalence of health problems in the lower socio-economic groups and incorporate strategies to reduce health inequalities may contribute to minimising the negative consequences of health disparities and ageing in European countries during future decades (Avendano, Aro and Mackenbach, 2005).

As pointed out above, one explanation behind the different trends for diseases and disability may be changes in physical environments. That means the investments in improving physical environments for older people both inside and outside the home may affect disability levels and, as a consequence, the need for LTCaS.

One other perspective is interventions within health care that may affect needs for LTCaS. While much of today’s discussion concerns survival interventions within health care, it is possible that investments within health care may affect needs for LTCaS, through successful treatment of ill-health and functional impairment. High quality rehabilitation and aftercare, new medical technologies and new drugs may have a positive impact on LTCaS needs by curbing the trend towards increased care dependency. A breakthrough in the treatment of dementia would, for example, be immensely significant in economic terms, as well as in terms of human suffering.
5.4.3 Research and statistics

This thesis points out some directions for further research that may have important influence on social policies and public finances. It should be a policy concern for decision makers at national level to stimulate research concerning future studies and planning, demographic changes, connections between mortality and morbidity, as well as socio-economic differentials.

Concerning access to data and statistical development, there is a growing need, as shown in this study, to have access to better statistical data. Lack of individual-based data concerning use of LTCaS and health care and their direct connection to health status, disability and living arrangements is a vital policy concern in order to make better informed decisions.

5.4.4 Some insights concerning EU countries

The Swedish case can for different reasons be interesting for other (particularly EU) countries from more than only the methodological perspective. Many factors exist that show that there is a large need for more formal long-term care in European countries. Trends towards an increasing number of women in paid work, is one. The low fertility rate experienced by many European countries during the last decades, with the result that the number of children per elderly person in need for care - often considered as potential caregivers - will decrease, is another.

Moreover, as European countries become more global and developed, children are more likely to live further away from their parents, resulting in a reduced number of available potential caregivers. To some extent Sweden has gone through some of these situations already. Since the late 1980s Sweden is one of the countries with the highest labour force participation among women in the OECD countries (OECD, 2000). Furthermore, a great majority of older persons in Sweden live alone or with their spouses. Only about 2% live with their children.

Finally Sweden has already gone through a rapid demographic transition. For the last 40 years, the proportion of people older than 80 years has increased dramatically, compared to an almost “zero development” for the next coming decade. Sweden is also among the countries with highest life expectancy (as pointed out in chapter 2) in the world. Sweden’s experience in moving through different stages of the demographic transition is being repeated in other industrial countries,
and this is projected to occur almost throughout the entire world in the next 50 years (Thorslund, 2004).

5.5 The new paradigm: The elderly = 75 and older?

This thesis is done within an empirical tradition (Sohlberg and Sohlberg, 2002) and is quantitatively oriented and focuses on statistical associations. The theoretical base discussed here is a number of different hypotheses concerning the mortality and morbidity/disability relationship, given the definition that older people are people 65 years and older. Our research question is then closely related to the question: “How old are elderly people?” This question opens up alternative methods for our analyses. Below, we will attempt to provide a short discussion and point out some important trends in the construction of models for analyzing older people and their needs.

In the research as well as in public debate in Sweden and other OECD countries we assume that people 65 and older constitute older people. Accordingly, the increasing number of older people means that the number of persons older than some age, often 65 years and older, will increase. However, the categories “older people” and/or “old age” are social constructs (Achenbaum, 2005). This social construction correlates to conditions in, and dimensions of, different parts of society. Furthermore, social constructions change over time. The change of social construction in the term “to be old” may be illustrated by data from Norway showing that a majority of people surveyed in the year 1969 characterized age 72-73 as “to be old” compared to 77 years among those surveyed from the year 1993 (Daatland, 1994).

The social construct of older people, in today’s developed countries, is connected to regulations within two vital areas related to people’s participation in labour market. Firstly, the mandatory retirement age has been the age of 65 during many decades both in Sweden (since 1976) and in other western countries. The retirement age was 67 years in Sweden between 1913 and 1976 despite an increase in life expectancy at birth from 58 years for women and 56 years for men to 77 years for women and 72 years for men (Statistics Sweden, 1999). The mandatory retirement age was abolished in 2003 in Sweden when the new pension system with flexible retirement age was introduced (Holzmann and Palmer, 2006). Nevertheless, in Sweden the right to get the basic
pension is still connected to 65 years of age (Swedish Social Insurance Agency, 2005). Secondly, according to international standards (ILO conventions) 64 years of age is emphasized as an upper age limit for the labour force. Usually many people leave the labour force 4-5 years before the age of 65 in OECD countries (Andersson, 2003). However, during the last years we have found evidence of a new development in Sweden. According to Batljan (2005), the employment rate has increased substantially among both men and women in the age group 60-64. Furthermore, more and more people are continuing working after the age of 65 (Nygren, 2005).

According to our data concerning 1975/1979, the proportion of people that reported severe ill-health in the age group 65-69 years was around 15 percent. The same proportion is today found among the age group 75-79 years (SNSLC data concerning 2002/2003). Analyses of SNSLC data show that it is difficult to find significant differences in self-perceived health between the age groups 65-74 and 55-64 (Batljan, 2005).

Finally, the use of different definitions over time also underlines the overall picture of social construction of the categories “older people” and "old age". For example Shryock and Siegel (1976) pointed out that a population is considered “old” if it has a median age of 30 years or over. That should be compared with the fact that already in the year 2000 the median age in the world was 26 years (United Nations, 2002). The United Nations uses 10% or more of the population beyond the age of 60 or 65 years as the measure of an aged population allowing different thresholds for developing and developed countries (McPherson, 1990). In different documents related to developing countries the terms ’older people’ and ‘elderly persons’ often refers to people aged 60 years and older (ECLAC, 2004). In developed countries we normally refer to people aged 65 years and over as “older people” and “elderly persons”.

Because the nature of aging is an individual process, it is practically impossible to have a precise definition related to specific age. It is also well known that a 65 year old low-educated person in many cases has worse health status and higher mortality risk (as pointed out in study III) than an older high-educated person (see e.g. Elo and Preston (1996) ).

As mentioned above, the SNSLC has had an upper age limit for many years. This upper age limit was as low as 75 years until 1980. The increase to 85 years in 1980, and the fact that the upper age limit was banned until recent years, may also be an indication of the changing picture of older people and the social construction of ageing.
Given the discussion above, it looks like it is time to reconsider the use of the term “older people” and “old age” in Sweden for the people 65 years and older. The threshold age could be increased to 70 years already today in order to be replaced by another threshold in 30-35 years going forward. In the science tradition within which this thesis is written, we could show then that increase in number of older people (using different threshold ages for different years) between 2000 and 2035 will only be 9 percent (compared to the usual assumption where the number of older people, 65 years and older increases by 57 percent), from 1 153 000 (70 years and older assumed older people by 2000) to 1 253 000 (75 years and older assumed older people by year 2035). According to the scenario methodology that has been used in this thesis, we could then do comparisons between two scenarios: 1) unchanged social construction of the older people and 2) changed social construction of the older people to be defined as 70 years and older by year 2000 and (assumed changed social construction of the older people) 75 years and older by year 2035. Given that “older people” need LTCaS, projections of future needs will be considerably different if the definition of “older people” is people 65 years and older, or if the definition is changed according to the discussion and as shown above.

The other connection to the discussion in this thesis may be by stating that the increasing threshold age is in some sense supporting the postponement of morbidity hypothesis. This is due to the use of the term “older people” or “old age” in the context that these terms in fact often are used: persons with worsening health and increased morbidity and disability. However this relationship is not straightforward, given that there are some signs that health among those 80-85 years and older is not improving, rather there are some tendencies towards worsening health status during the last 5-10 years (Parker, Ahacic and Thorslund, 2005).
6. CONCLUSIONS

In this thesis we have presented three alternative methods (studies I, II and IV) to improve direct demographic extrapolations of needs for health and social care for the elderly. We have also developed a new method for improvement of demographic projections (study III) that will further improve the demographic base for our methods. This new method has also been combined with the method in study II (could be applied on study I too) in order to enhance alternative methods of demographic extrapolations of future needs for LTCaS with socio-economic dimensions (study IV).

Population projections by age, gender and educational level should be used when assessing how demographic changes affect needs for LTCaS. This may also hopefully influence discussions of alternative population projections in order to balance the systematic underestimation of the number of older persons that has been more of a rule than exception in many countries including Sweden.

Information on the future size (the ageing of the population) and socio-economic composition of the elderly population, as well as assumed changes in the prevalence of functional limitations by age, gender and socio-economic status have substantial implications for future needs. Thus, this information should be used in LTCaS for elderly planning, for monitoring purposes or when assessing financial sustainability of long-term care in the future. We show that the projected increase in the number of older people suffering severe ill-health, as a consequence of population ageing, may be counterbalanced to a large extent by changes in the educational composition towards a higher proportion of the population having a high educational level and lower prevalence of severe ill-health. On the other side, an increase in the number of older people that is much higher than projected will strain different pension systems.

It is crucial for today’s policy makers, planners and researchers to have access to high quality information on population development, public health trends and health status among older people. According to our studies II and IV older people’s health (measured as the prevalence of severe ill-health) has improved during the study period. Developments in morbidity and disability prevalence in recent years and the question whether its decline will continue has enormous implications for the future needs for LTCaS and for social policies in gen-
eral. Policy response may include changes of the LTCaS system, measures to increase employment and investments in public health among older people.

Improved methods of demographic extrapolations are important for both improving planning within LTCaS, and enhancing health and long term care human resources policies. Those improved methods are furthermore crucial in order to design public policies that address the needs of aging populations, including planning, financing, and public health programs.

The value of scenarios and projections of this kind does not lie in their perfect match with the future. The fact is that forecasts most often are proven to be wrong. Nevertheless, it is important to analyse what will happen if the development continues in the same direction or what may happen if the preconditions are changed.

Future developments in mortality rates, morbidity/disability rates, changes in population composition as regards to gender, age and socio-economic status are inevitably uncertain. There is also great uncertainty how the association between education, mortality and morbidity will develop. On the other hand, future needs are not only uncertain, but also affected by today’s actions. We need to improve our planning tools in order to support policy-makers to plan for uncertainty concerning future needs and demand for LTCaS.

There are few countries in the world that have as extensive statistical registers as Sweden. However, also as regards to statistics there are some areas that need improvements. Lack of individual statistics concerning older people’s use of LTCaS and their health status and functional ability is a problem for both monitoring and planning within LTCaS system.
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Mårten Lagergren and I published in early 2000 a report with the title “Will there be a helping hand?” (Batljan and Lagergren, 2000). At that time, it was still more coincidence than rule, to question the demographic projections, as a single determinant of future cost for long term care. Health trends and their importance were often omitted. In that sense working with the dissertation has also been a journey were I have had the opportunity to follow the increase in interest on the health of older peoples, also as a factor that will play a role for the future of public finances.

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When working with modelling, simulation and research in general, academics are many times wondering if their work is going to be used in policy making. In my career I have had the opportunity to operate both supporting policy makers at central level within the ministry, and at an international level within the Inter-American Development Bank and OECD, and as a policy maker at national and local level. However, despite hands-on experience, I am not able to reveal the secret and answer this question. As a researcher I do believe that every step forward counts and that is why I enjoyed working long nights with this thesis. I do believe that science may improve our world to the better. My hope is that this thesis may be found useful when planning for the future of long term care.

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In a first draft of this thesis I wrote “Thank you Mia (my daughter) for eating biscuits and drinking milk by my side when I was working with this thesis during the Easter of 2006”. Since then I have many times considered deleting that sentence, nevertheless the sentence tells the reader something that has been significant for the work behind this dissertation and that is that I and my family have lived with it in a very special way (during the evenings, nights, weekends and summer vacations). During all the years I have had at least one full-time job and my PhD studies plus my curiosity to know more about ageing, demographics and public health.

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