

# Trends in the use of home care services among Norwegians 70+ and projections toward 2050: The HUNT Study 1995-2017

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Main Text word count: 4410 (abstract, introduction, methods, results, and discussion)

Number of tables: 3 tables

Number of figures: 2 figures, 1 appendix figure

Number of references: 43 (Vancouver reference style)

Number of manuscript pages: 23 (with front page)

**Key words:** Life expectancy, health care services, home help, home nursing, older adults, Activity of daily living (ADL), Projected use of home care services.

**Running title: older HUNT cohorts and home care services use (38 characters)**

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**Acknowledgements:** The Trøndelag Health Study (the HUNT Study) is a collaboration between HUNT Research Centre (Faculty of Medicine and Health Sciences, Norwegian University of Science and Technology, NTNU), Trøndelag County Council, Central Norway Health Authority and the Norwegian Institute of Public Health.

**Declaration of conflicting interests:** The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

**Funding:** The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: this work was funded by the Norwegian Directorate of Health.

**Research ethics and patient consent:** This study was approved by the Regional Committee for Medical and Health Research Ethics (REC 2019/149 South East). HUNT2 and HUNT3 was approved by the Regional Committee for Medical and Health Research Ethics and all participants signed a written consent to participate. HUNT4 was licensed by the Norwegian Data Protection Authority in 2017.

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1 Abstract

2 **Background**

3 Life expectancy (LE) is increasing worldwide, while there is lack of information on how this affects  
4 older individuals' use of formal home care services.

5 **Aim**

6 We aimed to decompose LE into years with and without home care services and estimate projected  
7 number of users towards 2050 in Norway for people 70 years or older.

8 **Methods**

9 This study is based on a sample of 25,536 participants aged 70 years and older in the Trøndelag  
10 Health Study (HUNT) survey 2 (1995-97), 3 (2006-08), or 4 (2017-19) linked with national data on  
11 mortality. Prevalence of home care services were standardized to the Norwegian population by age  
12 and sex. The Sullivan method was used to estimate expected years with and without home help  
13 services and nursing services for the years 1995, 2006 and 2016. Data from HUNT4 and Statistics  
14 Norway were used to estimate projected use of these services between 2020 and 2050.

15 **Results**

16 During 1995-2017, the use of home help services decreased from 22.6% to 6.2% ( $p<0.001$ ), and  
17 6.4% to 5.5% ( $p=0.004$ ) for home nursing services. Adjusted for age and sex the use of home help  
18 services decreased significantly over time ( $p<0.001$ ), while home nursing services was stable  
19 ( $p=0.69$ ). LE at age 70 increased from 11.9 to 15.3 years in men ( $p<0.05$ ), and 14.7 to 17.1 in  
20 women ( $p<0.05$ ). The expected years receiving home help decreased from 2.6 to 1.1 in men  
21 ( $p<0.05$ ), and from 4.4 to 2.1 in women ( $p<0.05$ ). The expected years receiving home nursing  
22 increased from 0.6 to 0.9 in men ( $p<0.05$ ), and from 1.3 to 1.7 in women ( $p<0.05$ ). Projected  
23 numbers of people 70+ in Norway in need of either of these services were estimated to rise from  
24 64,075 in 2020 to 159,753 in 2050.

25 **Conclusion**

26 While overall life expectancy increased, the expected years receiving home help have decreased and  
27 home nursing slightly increased among the Norwegian population aged 70 years and older during  
28 1995-2017. However, the substantial increase in the projected number of older adults using home  
29 care services in the future is an alert for the current health care planners.

30 **Key words:** Life expectancy, health care services, home help, home nursing, older adults, Activity  
31 of daily living (ADL), Projected use of home care services.

32

## 1 INTRODUCTION

2 The Nordic countries are well known to provide formal care and help for older adults, with  
3 good access to medical and social services including assistance with household chores (1). It is based  
4 on the theoretical framework of home health care services “universalism” in Nordic countries where  
5 its main feature is that community living older adults who require home healthcare services to  
6 remain at home as long as possible before moving into a nursing home (1,2). Formal care is defined  
7 as services provided for older adults at home and paid by the individual or by the state and  
8 municipality while informal care is defined as help provided by family members or friends without  
9 payment (3). Both types of care often occur in parallel and complement each other (4). In Norway,  
10 the municipality evaluates the eligibility for receiving formal care based on functional status in  
11 activities of daily living and cognitive impairment (2).

12 Aging is associated with a decline in physical function which is further linked to health  
13 consequences including loss of independence, disability, institutionalization, and mortality  
14 (5,6). However, recent evidence suggested that the current older population is healthier and has  
15 higher physical function than the earlier older generation (7,8). Life expectancy (LE), an important  
16 indicator for measuring the growth of the ageing population (9), is also increasing worldwide  
17 primarily due to declining mortality rates among older adults (10). Healthy Life Expectancy (HALE)  
18 is defined as LE by the absence of chronic disease (11,12). In Norway, HALE at age 60 years  
19 increased with 1.6 years during 2000 -2015 (13). During the same period, LE in Norway increased  
20 by 2.2 years. Thus, the increase in LE was mainly an increase in HALE (73%). At the same time,  
21 Disability-Free LE (DFLE) which is defined as years without problems with activities of daily living  
22 (ADL), has increased, which indicates that older adults today live longer without disability  
23 compared with two decades ago (8,13). The key information is whether the increase in overall LE is  
24 increasing faster than the decline of disability rate (14).

25 Recently, in line with the report from WHO, a Norwegian study reported increasing DFLE  
26 during the last two decades, and that most of the increase in LE among older adults in this period  
27 was disability free (8). Thus, in Norway these results suggest that DFLE is increasing faster than  
28 overall LE. Nevertheless, it is expected that countries with high LE, including Norway, will need to  
29 provide increased formal care in private homes, including nursing and other professional health care  
30 services (15–17). Current old age care policies in Norway aim at having older people living at home  
31 for as long as possible, and an increasing number of people receive advanced health care at home. It  
32 is an aim among policy makers to decrease the number of individuals in institutionalized care and

1 raise one's capacity to live at home (17). Research needs to be transformative and study the more  
2 advanced age groups to find more valid population data related to health conditions, functional  
3 capacities, care needs and care service use. Although DFLE decreases over time the steady increase  
4 in LE may indicate that the older age groups living in the community may need more home help or  
5 home nursing care services in the current generation compared to earlier generation. To enhance  
6 understanding of home care use among older adults, the first research question is how home care use  
7 in the last decades has been changed in Norway by looking at self-reporting of home care use in the  
8 Trøndelag Health surveys 2 to 4.

9 In Norway, formal home care services include home help and home nursing (18), which are  
10 generally provided by the municipality (19). Although it is confirmed that LE at older age in Norway  
11 is increasing (8,20), there is still a lack of information on time trends of expected years receiving  
12 formal home based care services in Norwegian older population. Therefore, the aim of the current  
13 study is to examine the trend in expected years receiving formal home help and/or home nursing  
14 services among Norwegian older adult aged 70 or older during 1995-2017 and make projections for  
15 number of persons receiving care in the coming decades.

16

## 17 **METHODS**

18

### 19 ***Study population***

20 The study population included a combination of two data sources of Norwegian adults aged  
21 70 years or older: (1) National registry data on mortality and population size by sex, education, and  
22 year (N=1,57 million); and (2) Trøndelag Health Study surveys 2-4 (HUNT2-4); available sample  
23 with self-reported data on at least one of the main outcome variables (home help services use/home  
24 nursing services use) (N=25,536). The study population is from the former Nord-Trøndelag county,  
25 which is fairly representative of Norway except it lacks a large city and few immigrants (21–23).  
26 The municipality has an average per capita income and the prevalence of people with higher  
27 education and current smokers was a slightly lower than the average in Norway (23,24).

### 28 **Data collection and measures**

29 ***Mortality (official registry data):*** National data on mortality were provided by *microdata.no* with  
30 the years close to the initial years for the HUNT surveys (1995, 2006 and 2016 – latest year  
31 available). Microdata is a collaboration service from the Norwegian Centre for Research Data (NSD)  
32 and Statistics Norway (SSB). Mortality was registered for people 70 years and older who were alive

1 1<sup>st</sup> of January followed over 1 year and categorized by sex and education. The mortality data  
2 included 34,057 deaths among 497,679 individuals (mid-year population) in 1995, 31,703 deaths  
3 among 491,878 individuals in 2006, and 30,822 deaths among 576,537 individuals in 2016. The  
4 national education database (NUDB) assessed education on 1<sup>st</sup> January and categorized as basic (9  
5 years or less, ISCED 2011 level 1–2) or higher (10+ years, ISCED 2011 level 3–8). Due to low  
6 numbers in the higher educational levels, the study defined two levels of education.

7  
8 **HUNT survey data:** A total of 50,828 participants aged 70 years and older were invited to  
9 participate in the HUNT surveys 2-4 (16,376 in HUNT2, 15,078 in HUNT3 and 19,374 in HUNT4)  
10 (21,22). Among these, 10,939 participants completed the questionnaire in HUNT2 (1995–1997),  
11 8,412 in HUNT3 (2006–2008), and 11,081 in HUNT4 (2017–2019) at study attendance. The  
12 available sample with self-reported data on disability and formal home help services use was 25,306,  
13 and home nursing services use was 24,478, and non-missing for either one was 25,536. The  
14 attendance (the number of people completed the data collection divided by the number of people  
15 invited to participate) was 57% in HUNT2, 46% in HUNT3 and 48% in HUNT4. The current study  
16 compared different birth cohorts at the same age at three different times, which allows participation  
17 of the same individual at different ages. Among the study participants, 15% were included more than  
18 once and 1% were included three times. The HUNT data was collected in the former Nord-  
19 Trøndelag County which is considered to be a representative population of the Norwegian  
20 (21,22,25).

21 ***Home help services (in Norwegian: praktisk bistand, formerly known as hjemmehjelp)***

22 Home help services were assessed with the question “Do you have home help services?” with  
23 two choices (private and community) to choose from (yes/no in HUNT2). In HUNT3 and 4, the  
24 question did not separate on whether services were provided by private providers or by the  
25 municipality, and the respondent was asked about services use in the last year: “Have you had home  
26 help services in the last 12 months?” (yes/no).

27  
28 ***Home nursing services (in Norwegian: helsetjenester i hjemmet, formerly known as  
29 hjemmesykepleie)***

30 Home nursing services were assessed with one question in HUNT2: “Do you receive home  
31 nursing care services?” (yes/no). In HUNT3 and HUNT4 the wording was slightly changed to reflect

1 the services used during the last year: “Have you received home nursing care in the last 12 months?”  
2 (yes/no).

#### 3 4 ***Education***

5 Education was self-reported, and dichotomized as primary ( $\leq 9$  years) or secondary/tertiary  
6 (10+ years) to match with the registry data. Missing values for education were 3%, 3% and 1%, for  
7 HUNT2, HUNT3 and HUNT4, respectively.

#### 8 9 ***Activities of daily living (ADL)***

10 ADL assessments are widely used to examine independency and disability level among older  
11 adults (6,26–28). ADL is often divided into two categories, Personal ADL (PADL) and Instrumental  
12 ADL (IADL) (29). PADL refers to the basic activities older adults need to do in daily living, while  
13 IADL is typically more complex and includes outdoor activities. Both PADL and IADL disability  
14 increase with age and it is a major predictor of hospitalization and institutionalization among older  
15 adults (30,31). ADL in the HUNT survey was measured with a self-reported questionnaire starting  
16 with the following question “Can you, without the help of others, do the following daily tasks?”.  
17 PADL items included 1) move around indoors on the same floor, 2) go to the toilet, 3) wash  
18 yourself, 4) take bath or shower, 5) dress and undress yourself, 6) go to bed and get up, and 7) eat.  
19 IADL items included 1) do heavier housework, 2) pay bills, 3) take the medicines, 4) go out, 5) do  
20 the shopping, and 6) take the bus. ADL questions were asked with three response categories (1 =  
21 yes; 2 = with some help; 3 = no) in HUNT2, and two response categories (1 = yes; 2 = no) in  
22 HUNT3 and HUNT4. Each ADL item was scored as 0 if participants answered “yes” to complete  
23 task alone and scored as 1 if answers were “no” or “with some help”. The summary scores of all 7  
24 items of PADL, and 6 items of IADL were generated to further dichotomize disability group. No  
25 disability in PADL and IADL was defined separately if participants reported to have no disability  
26 (PADL or IADL summary score = 0), and disability was defined if participant reported any difficulty  
27 in the PADL and IADL items (PADL or IADL summary score  $> 0$ ). Living arrangement was  
28 dichotomized as single or cohabitant.

#### 29 30 **Statistical methods**

31 First, three sets of standardized prevalence estimates were estimated; i) prevalence of  
32 receiving home help services, ii) prevalence of receiving home nursing services, iii) prevalence of

1 having any ADL-disability. The differences in the crude prevalence of home care uses and  
2 characteristics between HUNT surveys were examined with Chi-square test. The latter prevalence  
3 was only used for projected future care service needs, and compared to the projected reported use.

4 For smoothing purposes, the prevalence was estimated by age, sex, and education, and  
5 predicted from a general linear model with Poisson distribution and identity link, including the  
6 predictor variables age (aggregated in 5-year age intervals), sex and education (primary versus  
7 secondary or higher), and a dummy variable for each of the three surveys in the HUNT data. All  
8 interactions (three-way and two-way) between these predictor variables were included to ensure full  
9 flexibility in the modelling and allowing trends to differ by age, sex, education, and time. To get  
10 population estimates representative for Norway, the prevalence estimates were standardized using  
11 the full Norwegian population by year (1995, 2006 and 2016), 5-year age groups, sex, and education  
12 (primary, higher) as post stratification weights in the regression model. Then, life expectancy (LE),  
13 and expected years spent with home-based services in Norway were estimated by the Sullivan  
14 method, combining the standardized services use prevalence with the mortality data (32).

15 Confidence intervals for LE and for expected years spent with home-based services were  
16 calculated using the procedure developed by Chiang (32,33). Finally, prevalence at HUNT2-4 and  
17 projections of number of Norwegians receiving home help, home nursing services, or having ADL-  
18 problems for the years 2020, 2025, 2035 and 2050, were performed using the age, sex and education  
19 standardized prevalences at HUNT4 as basis, and multiplying these prevalences by population  
20 projections by age and sex from the main alternative from Statistics Norway.

## 21 22 **RESULTS**

23 Mean age of the 70+ population in the three HUNT surveys were similar (76.8, 77.2 and 76.6  
24 years in HUNT2, 3 and 4 respectively). The educational level increased from HUNT2 to HUNT4;  
25 the prevalence of secondary/tertiary education was 21.0% in HUNT2, 36.2% in HUNT3 and 57.4%  
26 in HUNT4. From HUNT2 to HUNT4, the percentage of people living alone decreased from 38.6%  
27 to 30.9%, PADL-disability decreased from 8.4% to 3.0% and IADL-disability decreased from 32.9%  
28 to 15.7%. The standardized prevalence (standardized according to sex, age, and education in  
29 Norway) of both home care services use (home help and home nursing) was higher in older age and  
30 the highest prevalence was in the oldest age group (85+ years) (Figure 1).

31  
32 *Home help services use*



1 Mean age of those receiving home help services was higher than for those not receiving such  
2 services; 80.1 versus 75.8 years in HUNT2 and 82.5 versus 76.2 years in HUNT4. Crude prevalence  
3 of home help services use decreased from HUNT2 to HUNT4; from 22.6% to 6.2% (chi-squared test  
4 of difference in prevalence  $p < 0.001$ ) (Table 1). From HUNT2 to HUNT4, the percentage of home  
5 help services use changed from 19.3% to 4.7% in men, and from 25.2% to 7.5% in women (both  
6  $p < 0.001$ ). This declining time trend occurred in both educational groups. Home help services use  
7 were more prevalent among those living alone than for those living with others; 33.6% versus 15.1%  
8 ( $p < 0.001$ ) in HUNT2 and 12.8% versus 3.2% ( $p < 0.001$ ) in HUNT4. Among those reporting PADL  
9 disability in HUNT2, 58.3% received home help services, while among those without PADL  
10 disability the prevalence was 19.4%. In HUNT4 ( $p < 0.001$ ), the corresponding numbers were 34.3%  
11 and 5.3% ( $p < 0.001$ ). Similar declines in home help services use over time and between disability  
12 groups were observed for IADL. Age and sex adjusted prevalence of home help services use  
13 (standardized to the Norwegian population by age, sex and education) also declined significantly  
14 over time (test for linear trend HUNT2-4:  $p < 0.001$ ).

15

#### 16 *Home nursing services use*

17 Receivers of home nursing services were older than those not receiving such services; 80.8  
18 versus 76.4 years in HUNT2, and 81.8 versus 76.3 years in HUNT4. Crude prevalence of home  
19 nursing services use was more stable over time, but had a slight decline from HUNT2 (6.4%) to  
20 HUNT4 (5.8%) ( $p = 0.004$ ) (Table 2). Home nursing services use were more common in women than  
21 in men (HUNT2: 7.6% in women versus 4.9% in men ( $p < 0.001$ ); HUNT4: 6.9% versus 3.9%  
22 ( $p < 0.001$ )). Secondary/tertiary education was associated with lower use of home nursing services,  
23 while living alone was associated with higher use. ADL disability was strongly associated with  
24 home nursing services use; among those reporting PADL disability at HUNT2, 36.1% received  
25 home nursing services, while among those without PADL the services use was 3.8% ( $p < 0.001$ ).  
26 Corresponding numbers at HUNT4 were 36.5% and 4.5% ( $p < 0.001$ ). Among those reporting IADL  
27 disabilities at HUNT2, 16.0% had home nursing services, while among those without IADL  
28 disabilities, the prevalence was 1.7% ( $p < 0.001$ ). At HUNT4 the corresponding numbers were 22.7%  
29 and 2.2% ( $p < 0.001$ ). Age and sex adjusted prevalence of home nursing services use (standardized to  
30 the Norwegian population by age, sex and education) did not decline significantly over time (test for  
31 linear trend HUNT2-4:  $p = 0.69$ ).

32

1 *Expected years lived with home care services after age 70 during 1995-2017 in Norway*

2       During 1995-2017, LE in Norway at age 70 increased by 3.4 years in men (from 11.9 to 15.3  
3 years, test for difference:  $p<0.05$ ) and by 2.4 years in women (from 14.7 to 17.1 years,  $p<0.05$ )  
4 (Table 3). During this time, the expected years receiving home help services after age 70 in Norway  
5 decreased by 1.5 years in men (from 2.6 to 1.1 years,  $p<0.05$ ), and by 2.3 years in women (from 4.4  
6 to 2.1 years,  $p<0.05$ ). During the same time, expected years receiving home nursing services  
7 increased by 0.3 years in men (from 0.6 to 0.9 years,  $p<0.05$ ) and by 0.4 years in women (from 1.3  
8 to 1.7 years,  $p<0.05$ ).

9  
10 *Projections of home care services use, and home care services needs in Norway towards 2050*

11       Based on self-reported data of home care services use from HUNT4 and population  
12 projections from SSB, the estimated projection of older adults aged 70+ receiving home help  
13 services in Norway in 2020 was 47,823, while the estimate for receiving home nursing services was  
14 40,873. By 2050, these numbers are expected to rise to 120,778 and 102,700 respectively (Figure 2).  
15 The estimated number of older adults receiving both services is expected to rise from 15,840 in 2020  
16 to 40,190 in 2050. Receivers of either type of home care services will increase from 64,075 in 2020  
17 to 159,753 in 2050.

18       Also, in the shorter time frame the expected number of older adults aged 70+ receiving either  
19 home help or home nursing services will increase; from 2020 towards 2025 the increase is projected  
20 to be 14% for home help services, and towards 2035 the increase is projected to be 75%. The  
21 corresponding projections for home nursing services are 14% towards 2025 and 74% towards 2035.  
22 Corresponding numbers of receiving either home help or home nursing services are expected to rise  
23 74% towards 2035.

24       Based on ADL-data from HUNT4 and population projections from SSB, the estimated  
25 projection of older adults' home care services need, reflected in age, sex and education standardized  
26 prevalences of having any ADL problems (indicating disability), is expected to rise from 124,783 in  
27 2020 to 207,427 in 2035 and further to 287,773 in 2050 (Appendix, Figure A1). Thus, the projected  
28 need of services is nearly double that of projected use of services.

29

30 **DISCUSSION**

31

32 *Summary of findings*

1           During the last two decades, self-reported use of home help services decreased substantially  
2 among older adults, while home nursing services use was more stable with only a slight decrease.  
3 During 1995-2017, LE at age 70 years increased by more than three years in men and by two years  
4 in women. At the same time, expected years receiving home help services decreased, and in 2017,  
5 men and women could expect to live approximately one and two years with home help services,  
6 respectively. During the same time-period, expected years receiving home nursing services were  
7 stable; men could expect to live approximately one year with home nursing and women around a  
8 year and a half with such services. Towards 2050 the number of persons in need of home help or  
9 home nursing services are projected to increase by a factor of 2.5, from around 64,000 in 2020 to  
10 160,000 in 2050.

11           Our prevalence estimates of home nursing services use were similar to the prevalence in  
12 official registries for Nord-Trøndelag, which suggest our sample might be representative of the  
13 general population of Nord-Trøndelag; The prevalence of home nursing services use among older  
14 adults aged 80+ (age is restricted to this age group in the data base) from official Norwegian registry  
15 data in 2017 for the former Nord-Trøndelag County was 14.2% (34), which is similar to the  
16 prevalence of home nursing services use in the same age group in HUNT4 (2017-2019) in our study  
17 (13.2%).

18           LE at age 70 increased during the two decades covered in our study, while the time expected  
19 to live with home help services decreased and the time expected to live with home nursing services  
20 was stable. This implies that the more recent born cohorts of older adults started to receive home  
21 help and nursing services at a higher age compared with the earlier born cohorts, suggesting that the  
22 most recent cohorts had the functions to continue independent daily living longer than the earlier  
23 cohorts did. To our knowledge, the current study is the first to investigate time trends in years with  
24 home-based help services and home nursing services in Norway.

### 25 ***Previous findings and current care system & Norwegian health care system***

26           Through its public health and welfare policy, Norway provides generous health and social care  
27 to its citizens. As the population becomes older there is a growing need for long-term care and  
28 increased health care costs for individuals and society (35,36). The current health care model in  
29 Norway has been transformed from institutional care to home-based care to adapt to an increasing  
30 need for home-based health care (37). The home-based health care services has emerged in the past  
31 decades and aims to address the increased volume of urgent health care needs among the older  
32 population in Norway (2). According to the 2010 data on health care cost in Norway, 15% of the

1 total population who were 65 or older were responsible for almost half of the total health care cost  
2 which dominantly used for people under age 80 (36). Those who receive home help services also  
3 suffer from various chronic diseases, and physical and cognitive functional impairment (38,39). Both  
4 physical and cognitive impairment were strongly and positively associated with the amount of home  
5 help services provided to older adults in Norway (40). An observational study found that the  
6 majority of older adults receiving daily home help services in Norway were people with frailty in  
7 need of more flexible and pro-active ways to preserve current function and prevent hospitalization  
8 (37).

9 The decline of the home care services from 1995 to 2017 in the current study could be partly  
10 explained by the policy changes as well as expanded private care services in Nordic countries (1,37).  
11 Home care policies have been focused on retrenchment and prioritization on the coverage of long  
12 term care services in the last two decades (1,41) which is linked to the declining tendency of the  
13 home care services use in Nordic countries. The Swedish care system started to offer prioritized  
14 home care for those with the most demanding care needs in 1980s (which Norway followed in  
15 2010s), resulting dramatic drop of the age group care coverage rate (42,43). Targeting the most frail  
16 older adults for the home care services implies that access to home care is prioritized for those with  
17 highest needs which may further increase unmet need and decline of home care services use among  
18 older adults (44). The private care services section has also vastly expanded over the last two  
19 decades along the care service policy changes (2,45,46). Therefore, the current older generation are  
20 given more available options to choose the private care services than the previous older generation.  
21

### 22 ***Interpretation of the decreasing trend of home care services use***

23 One of our main findings was that during the past two decades the expected years of receiving  
24 home help services decreased among people aged 70 years and older, which suggests a healthier 70+  
25 population. The former hypothesis is backed up by recent studies reporting improved grip strength  
26 and cognition, much-used indicators of intrinsic capacity (47), in later born cohorts of older  
27 Norwegians (48,49). In line with this, another study using HUNT data, found increased DFLE, while  
28 years of disability were compressed (8). An alternative explanation is that the threshold for receiving  
29 home based services may have become higher as it was reported in the same period in Sweden (43).  
30 In general, the allocation of the home help services requires functional assessment to confirm  
31 reduced/impaired ability to maintain independent living (40,50). Therefore, the decreasing years  
32 receiving home help services in the current study can be due to several factors, such as better health

1 and physical function among the recent cohort of older adults, higher threshold for receiving home  
2 based services, or other effects of the changes in policy from institutional care to more home-based  
3 care. Hence, this study may indicate that the recent cohort of older adults maintain independent  
4 living until a more advanced age without a need of receiving home help services, but may also imply  
5 that needs are not met. Increased educational level during HUNT2-4 (secondary/tertiary education:  
6 21% in HUNT2 to 57% in HUNT4) may also have contributed on the declining trend of home help  
7 services use over time because it is found that older adults with higher education are less likely to have  
8 need of care than those with lower education (51).

9 Most home help and home nursing care services are skewed towards older age because of an  
10 increased burden of disease and disability with increasing age (52,53). Although the sex gap in LE is  
11 narrowing (8), our results suggest that women use home help services and home nursing services  
12 more often than men, which was also suggested by a previous study from Norway (40). This sex  
13 difference might be due to the longer LE and higher comorbidity among women in the older age  
14 groups (36). A recent study reflected our finding that women outlives men and due to higher number  
15 of women at higher ages, women have higher share of health care costs than men in Norway, and the  
16 difference was more pronounced for long-term care that included home nursing (60.5%) than for  
17 home help services (52.6%) (36). While periods of recent cohort participants spent with home help  
18 after the age 70 were shorter than that of the earlier two cohorts, the time spent with home nursing  
19 were very stable in all three cohorts. The results could also be explained by women's longer LE than  
20 men, which causes chronic non-fatal and disabling conditions to last longer in women. However,  
21 men are known more likely to experience 'life-threatening' conditions, which contributes to higher  
22 mortality among men (54). Our estimates indicate that the projected use of home care services will  
23 rapidly increase towards 2050. Projected need of services, however, using ADL disability estimates  
24 from HUNT4 is more than double the size of actual use of services.

25 A simple comparison of numbers between ADL disability and receiving care in our study  
26 may not fully reflect the care receiving process in municipality. However, those in need of home  
27 care services according to the ADL function who receive less home care services than needed may  
28 have replaced it with informal care from spouses, relatives, or other social networks which tend to be  
29 the case for those who live with others (55). Use of private care service could also be one of the  
30 reason contributed to the decreased home care service use.

### 31 *Strengths and Limitations*

1           There are several limitations of the current study worth mentioning. First, when the outcome  
2 of the current study is interpreted, it should be considered that the data was based on the use of home  
3 help services provided by both municipality and private health care service companies. Second, the  
4 self-reported data on home help services use were based on slightly different questions in three  
5 HUNT surveys, which might hamper a direct comparison between study surveys. In HUNT3-4, a  
6 time-period was specified (the last year) for services use, while in HUNT2, the questions asked  
7 about current services use. The longer time frame in the last two surveys could potentially increase  
8 the reported services use. Third, our data is lacking information on frequency, regularity and  
9 classification of home help services received. Fourth, attendance in HUNT2 (57%), was higher than  
10 in HUNT3 (46%) and in HUNT4 (48%), which might have resulted in HUNT2 being a more  
11 representative sample of older adults than HUNT3-HUNT4. Of note, however, HUNT3 and HUNT4  
12 had similar attendance and the prevalence rates for both care services were very similar to the rates  
13 calculated for the same region in the Norwegian Registry data. Overall, the non-participants had  
14 lower socio-economic status and a higher mortality than participants (21,22). Thus, possible  
15 selection bias should be taken into consideration. Fifth, the reports on home help services use did not  
16 take into account the informal care and help that participants may have received from their personal  
17 networks. Although informal care is an important part of health care, it is not counted as official data  
18 (45). Thus, it is possible that older adults receiving informal help because of physical or cognitive  
19 impairment, similar to those receiving formal care, are included among those not receiving the home  
20 help services. Therefore, the results on LE among the users of care services need to take into account  
21 that the informal care data was not available for the LE estimation. The current study did not look at  
22 the physical or social activity levels in conjunction with overall changes in LE and the use of home  
23 care services as this information was not consistently collected. However, healthy lifestyle including  
24 physical and social activity has a strong association with education (56,57) which our analysis  
25 adjusted for. Higher education was associated with both lower home help services use and lower  
26 home nursing services use in HUNT4 (also in age and sex adjusted analysis, results not shown). The  
27 projections of home services use in the future were based on age-sex-and-education-standardized  
28 prevalence estimates using the Norwegian population as the standard. Thus, the projections are then  
29 fixed at this educational distribution. However, most likely education level will continue to increase,  
30 but this increase was not built into our projections. Therefore, the projections might be somewhat  
31 overestimated, especially for home nursing services where education mattered most.

1 One of the strengths of the study is the large number of older adults included and the  
2 inclusion of multiple birth cohorts of the same age group over 24 years, enabling us to examine the  
3 trend of home-based formal care services use among older adults over time. Second, the use of  
4 formal care services data from one particular county, ensured that the data are based on consistent  
5 services allocation rules. A major strength is also the high correspondence with registry data on  
6 actual home based services use, which suggests representability.

## 8 CONCLUSIONS

9 The current study investigated time spent with and without home care services among older  
10 adults during 1995-2017, and while overall life expectancy increased, the expected years receiving  
11 home help decreased and home nursing slightly increased. The substantial increase in the projected  
12 number of older adults using home care services in the future is an alert for the current health care  
13 planners.

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Table 1. Home help services use, the Norwegian HUNT study 1995-2017. N=25,306

	HUNT2 (1995-1997)		HUNT3 (2006-2008)		HUNT4 (2017-2019)		P-value*
	Participants (N)	Home help receivers n (%)	Participants (N)	Home help receivers n (%)	Participants (N)	Home help receivers n (%)	
Total	9239	2089 (22.6)	6870	765 (11.1)	9197	569 (6.2)	<0.001
Women	5178	1305 (25.2)	3810	520 (13.7)	4864	365 (7.5)	<0.001
Men	4061	784 (19.3)	3060	245 (8.0)	4333	204 (4.7)	<0.001
Age group, years							
70-74	3619	388 (10.7)	2513	89 (3.5)	4030	83 (2.1)	<0.001
75-79	3140	597 (19.0)	2234	156 (7.0)	2806	107 (3.8)	<0.001
80-84	1687	621 (36.8)	1454	267 (18.4)	1523	152 (10.0)	<0.001
85 +	793	483 (60.9)	669	253 (37.8)	838	227 (27.1)	<0.001
Education							
Primary	7076	1666 (23.5)	4253	547 (12.9)	3914	309 (7.9)	<0.001
Secondary/tertiary	1895	359 (18.9)	2416	193 (8.0)	5273	258 (4.9)	<0.001
Living arrangement							
Single	3470	1167 (33.6)	2445	488 (20.0)	2824	360 (12.8)	<0.001
Cohabitant	5454	824 (15.1)	4392	268 (6.1)	6336	204 (3.2)	<0.001
PADL disability							
Yes	755	440 (58.3)	224	117 (52.2)	277	95 (34.3)	<0.001
No	8332	1612 (19.4)	6583	637 (9.7)	8893	472 (5.3)	<0.001
IADL Disability							
Yes	2909	1583 (54.4)	1433	584 (40.8)	1426	415 (29.1)	<0.001
No	5932	408 (6.9)	5339	166 (3.1)	7724	146 (1.9)	<0.001

N: Number of participants, PADL: Personal activities of daily living, IADL: Instrumental activities of daily living.

\* P-value based on chi-square test for home nursing (yes/no) by the three hunt study surveys.

Table 2. Home nursing services use, the Norwegian HUNT study 1995-2017. N=24,478.

	HUNT2 (1995-1997)		HUNT3 (2006-2008)		HUNT4 (2017-2019)		P-value*
	Participants (N)	Home nursing receivers n (%)	Participants (N)	Home nursing receivers n (%)	Participants (N)	Home nursing receivers n (%)	
Total	8802	560 (6.4)	6475	432 (6.7)	9201	504 (5.5)	0.004
Women	4853	368 (7.6)	3578	292 (8.2)	4862	334 (6.9)	0.078
Men	3949	192 (4.9)	2897	140 (4.8)	4339	170 (3.9)	0.068
Age group, years							
70-74	3517	82 (2.3)	2353	63 (2.7)	4027	85 (2.1)	0.350
75-79	2963	163 (5.5)	2088	87 (4.2)	2807	106 (3.8)	0.005
80-84	1589	163 (10.3)	1382	150 (10.9)	1526	124 (8.1)	0.031
85 +	733	152 (20.7)	652	132 (20.2)	841	189 (22.5)	0.532
Education							
Primary	6707	480 (7.2)	3979	316 (7.9)	3917	291 (7.4)	0.327
Secondary/tertiary	1854	64 (3.5)	2305	99 (4.3)	5274	211 (4.0)	0.376
Living arrangement							
Single	3263	340 (10.4)	2342	259 (11.1)	2827	295 (10.4)	0.700
Cohabitant	5258	191 (3.6)	4102	168 (4.1)	6336	204 (3.2)	0.062
PADL disability							
Yes	696	251 (36.1)	217	114 (52.5)	274	100 (36.5)	<0.001
No	7988	300 (3.8)	6204	312 (5.0)	8899	402 (4.5)	0.001
IADL Disability							
Yes	2761	442 (16.0)	1387	313 (22.6)	1426	323 (22.7)	<0.001
No	5707	95 (1.7)	5007	109 (2.2)	7726	172 (2.2)	0.054

N: Number of participants, PADL: Personal activities of daily living, IADL: Instrumental activities of daily living.

\* P-value based on chi-square test for home nursing (yes/no) by the three hunt study surveys.

Table 3. Life Expectancy and expected years of receiving formal home care services at age 70 in Norway (95% CI), the Norwegian HUNT study 1995-2017.

Year	LE at age 70 (95% CI)	Expected years of receiving home care services	
		Home help care services LE at age 70 (95% CI)	Home nursing services LE at age 70 (95% CI)
<b>Men</b>			
1995	11.9 (11.7-12.0)	2.6 (2.4-2.7)	0.6 (0.5-0.7)
2006	13.9 (13.7-14.0)	1.5 (1.3-1.7)	0.8 (0.7-0.9)
2017	15.3 (15.2-15.5)	1.1 (0.9-1.3)	0.9 (0.8-1.1)
<b>Women</b>			
1995	14.7 (14.6-14.9)	4.4 (4.2-4.6)	1.3 (1.1-1.4)
2006	16.0 (15.8-16.1)	2.7 (2.5-2.9)	1.5 (1.4-1.7)
2017	17.1 (16.9-17.3)	2.1 (1.9-2.3)	1.7 (1.5-1.9)

CI: confidence interval, LE: life expectancy.

Figure 1. Standardized prevalence estimates of home help and home nursing services use by sex in HUNT2 (1995-1997), HUNT3 (2006-2008) and HUNT4 (2017-2019). Standardized using the 70+ Norwegian population in 1995 for HUNT2, in 2006 for HUNT2 and 2016 for HUNT4, as standard populations. Standardized according to sex, age, and education.

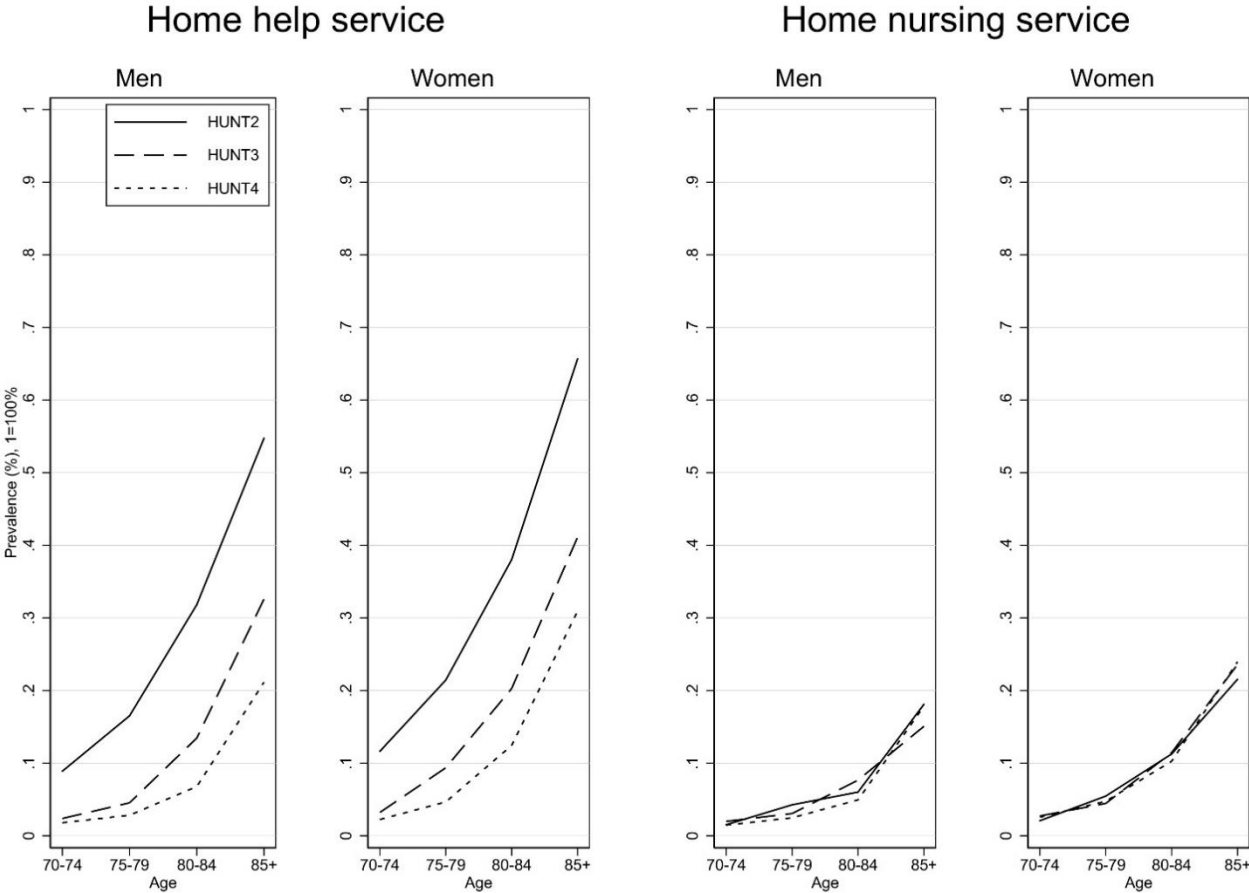
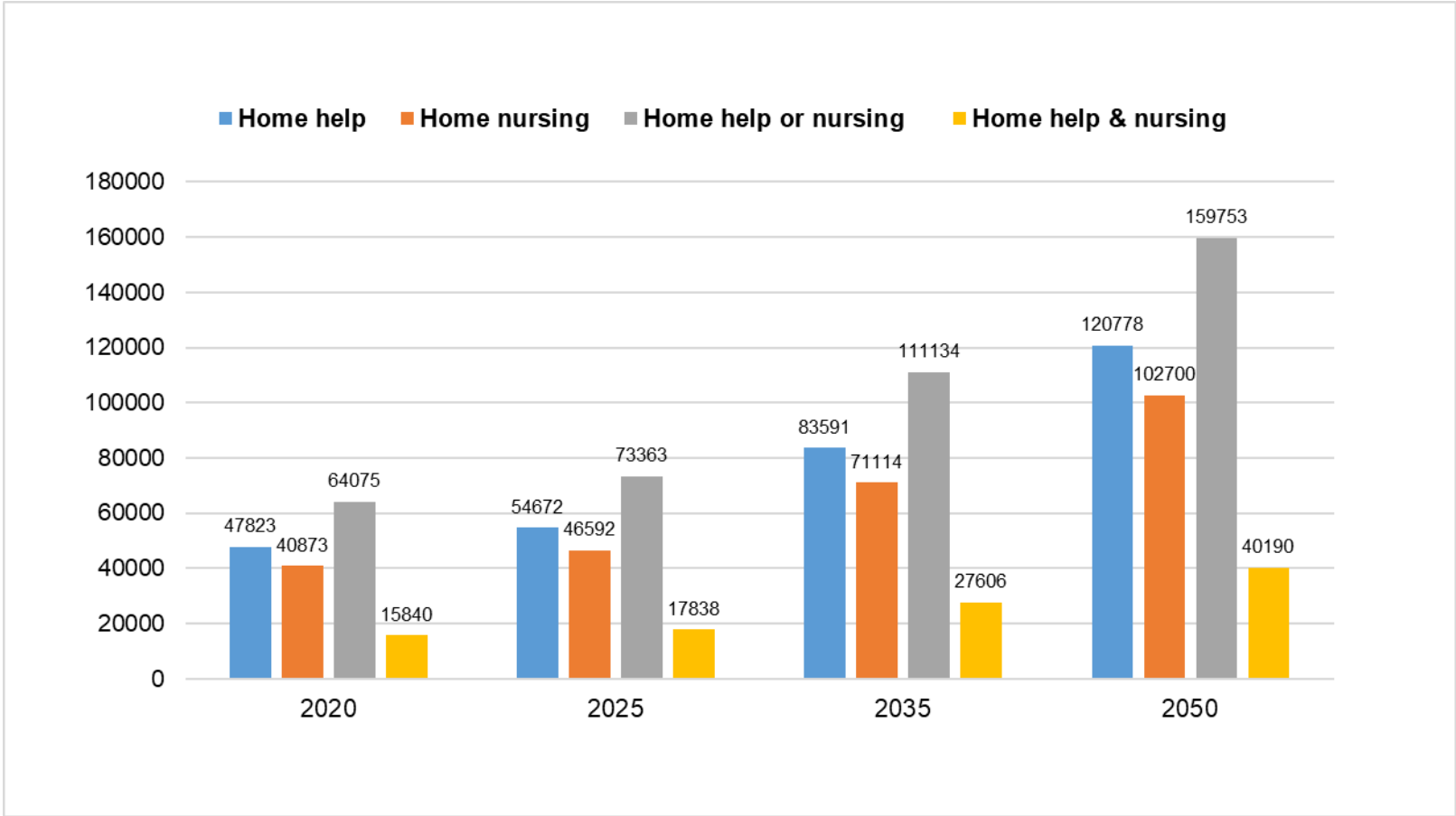


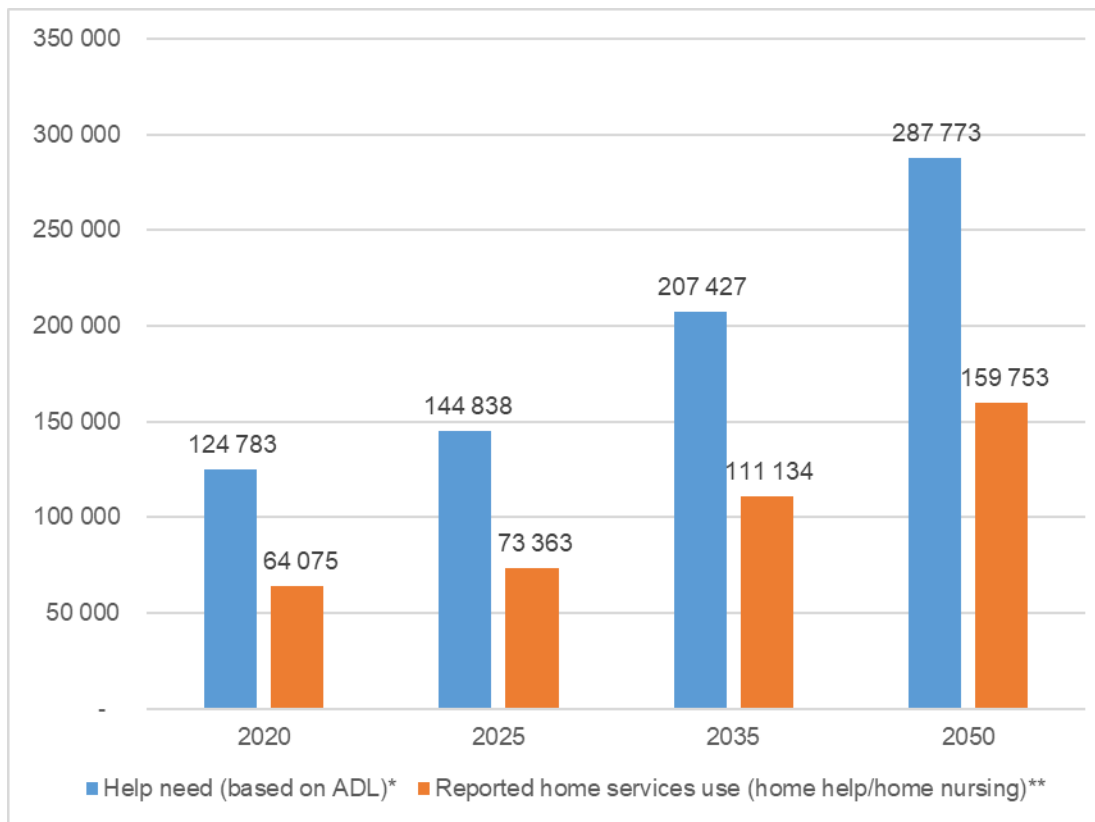
Figure 2. Projected number of home help and home nursing services users in Norway 2020-2050. Projections are based on self-reported data on home care services use from HUNT4 (2017-2019) standardized by age, sex and education (primary, secondary/tertiary) combined with population projections (main alternative) by age (70-74, 75-79, 80-84, 85+) and sex from Statistics Norway.





## Appendix

Figure A1. Home help and home nursing services in Norway 2020-2050: projected number of actual users (orange color) and projected number in need of home care services based on ADL (blue color). Projections are based on self-reported data on home care services use from HUNT4 (2017-2019) standardized by age, sex and education (primary, secondary/tertiary) combined with population projections (main alternative) by age (70-74, 75-79, 80-84, 85+) and sex from Statistics Norway.



\* Any ADL-problems reported in HUNT4 among home dwellers (prevalence numbers are reported in Table 1 in (8))

\*\* Reported home help services and/or home nursing services use in HUNT4. All prevalence estimates are standardized by age, sex and education using the Norwegian population in 2019 as standard population.

All numbers are for interviews performed at HUNT4 station, and thus excluding home visits and nursing homes.