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# Frailty among older patients receiving home care services

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ORIGINAL ARTICLE

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## **BACKGROUND**

It is a policy objective for older people in need of care to be able to live at home for as long as possible and receive healthcare services outside of institutions. The degree of frailty in this group and consequent risk of emergency hospitalisation and death have not been widely studied. The objective of this project was to study these questions over a period of two years in a medium-sized Norwegian municipality.

## **MATERIAL AND METHOD**

A sample of patients aged 65 years or older who received home care nursing services on a weekly basis were included. The patients underwent geriatric assessment in their own home every six months over two years. Their degree of frailty was measured using the Frailty Index. Deaths and emergency hospitalisations were recorded over two years.

## **RESULTS**

Of the 271 patients who were asked to participate, 210 were included. Altogether 160 patients (76 %) were classified as moderately or severely frail. During the observation period, 307 hospital admissions were recorded, amounting to a total of 1 235 hospitalisation days. When compared to severely frail patients, those with mild degrees of frailty were less frequently hospitalised (hazard ratio (HR) 0.33; 95 % confidence interval (CI) 0.19–0.60). During the two-year observation period, 63 (30 %) patients died. The mortality rate was highest in patients with severe frailty. In an adjusted Cox regression, increasing age was associated with a higher risk of death, but not with acute hospitalisation.

## **INTERPRETATION**

Older patients with home care nursing services have a high degree of frailty, and a high degree of frailty is associated with increased risk of hospitalisation and death.

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### **Main findings**

Three of every four older patients receiving home care nursing services in the municipality of Sandefjord can be classified as moderately or severely frail. A higher degree of frailty predicted more frequent hospitalisations and death.

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The current life expectancy in Norway is 83 years. The increase in life expectancy over the last 70 years is mainly due to medical advancements, and new treatment methods make us survive diseases that previously were fatal. Consequently, many people live with chronic diseases or sequelae after

previous illness. Among people older than 65 years, the majority have two or more chronic conditions [\(1\)](#). However, we age differently, and morbidity and life expectancy vary in persons with the same chronological age.

Frailty can be defined in various ways, but a geriatric assessment that includes assessments of level of functioning, chronic diseases, use of medication, mobility, cognitive function, nutritional status, emotional function, and social network is considered to be the gold standard [\(2\)](#). The degree of frailty also provides prognostic information on remaining life expectancy, the risk of complications after surgery, adverse drug effects, further functional decline, institutionalisation and death [\(3\)](#). Multimorbidity and polypharmacy are associated with the degree of frailty, but frailty is nevertheless considered to be an independent state.

In 2018, approximately 140 000 Norwegians aged 67 years or older received public healthcare services at home [\(4\)](#), and political signals indicate that home-based care will be prioritised over institution-based care [\(5\)](#). However, we have limited knowledge about morbidity, level of functioning and frailty in older people who receive healthcare services at home. Here, we present the degree of frailty and whether frailty predicts emergency hospitalisations and death over a period of two years among older people receiving home care nursing services.

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## Material and method

This is a prospective study that was carried out from May 2015 to June 2018 in the municipality of Sandefjord, which had 45 300 inhabitants in 2015 [\(6\)](#).

### Participants

Patients  $\geq 65$  years who received home care nursing services at least once a week, were assessed for inclusion. The head nurse in each home care district reviewed patient lists and identified patients who satisfied the inclusion or exclusion criteria. These patients were invited to participate in consecutive alphabetical order. The inclusion process was ended in June 2016, because of resource availability in the project. Patients were not included if the nurse responsible considered their remaining life expectancy to be less than two weeks, if the patient had confirmed dementia with Lewy bodies, or if the assistance provided by the service was due to use of addictive substances or a serious psychiatric disorder other than dementia. Patients with confirmed Lewy body dementia were not included, because it can be especially difficult to identify delirium in patients with this type of dementia, which was one of the research project's other objectives.

### Data collection

Every six months for two years, the included patients received a home visit by the project doctor (MK) or a project nurse (TLF or ES). During the home visit, type of housing (detached house, semi-detached/terraced house, apartment, sheltered housing), marital status (married, divorced, co-habiting, widowed), education and years of work experience, were registered. An overview of

regular medication, dosages and medications taken as needed was collected from the patient, or from the home care nursing service if the patient needed assistance with drug management. Regular use of five or more drugs was classified as polypharmacy. An overview of chronic diseases was collected both from the patient and their medical record, and Charlson's comorbidity index was estimated (7). The amount of home care given was retrieved from the home care nursing service's administrative records system (CosDoc), in the form of decisions on the number of weekly contacts and hours of home care.

At each home visit, the patient was tested with the Montreal Cognitive Assessment Scale (MoCA), a validated cognitive screening tool consisting of 12 questions covering executive function, attention, language, delayed recall, orientation and abstract thinking (8). Scores range from 30 (maximum) to 0 (minimum). In our analyses, the MoCA scores were categorised with the following threshold values: 22–30 = no cognitive impairment; 17–21 = mild cognitive impairment; 13–16 = moderate cognitive impairment;  $\leq 12$  = severe cognitive impairment. Activities of daily living (ADL) was assessed using Barthel's ADL index, a validated instrument with scores ranging from 0 to 20. Higher scores indicate higher degrees of independence (9). Whether the patients could drive a car, do shopping and manage their own finances was also registered. Bodyweight was measured using a digital scale. For patients who were bedridden or in a wheelchair, a chair scale was used by the home care service and registered within two weeks of the home visit. Height was measured in a standing position; if the patient was unable to stand, height was calculated on the basis of knee height (10).

Gait speed was identified by a four-metre walking test in the patient's home. The patients made two attempts, and the best gait speed, measured in metres per second (m/s), was used in the analyses. Patients who were unable to walk were assigned a gait speed of 0. In the analyses, gait speed was categorised by the following threshold values:  $\geq 1.00$  m/s = not reduced; 0.80–0.99 m/s = somewhat reduced; 0.60–0.79 m/s = moderately reduced,  $< 0.60$  m/s = significantly reduced.

Grip strength was investigated using an electronic dynamometer. The patients made three attempts for each hand. The highest measurement of the dominant hand was used in the analyses. The following threshold values for grip strength measured in kg were used:  $\geq 32$  (men)/  $\geq 20$  (women) = not reduced; 26.0–31.9 (men)/16.0–19.9 (women) = moderately reduced;  $< 26.0$  (men)/  $< 16.0$  (women) = significantly reduced.

Cognitive changes over the last ten years were identified through interviews with relatives and use of the validated Informant Questionnaire on Cognitive Decline in the Elderly – Short Form (IQCODE-SF) (11). Depression was identified using Cornell's index through an interview with the patient, their next of kin (as identified by the patient) and a final, overall clinical assessment (12). Based on all the information collected, an assessment was made of whether the patient met the ICD-10 criteria for dementia (13). This review was undertaken independently by two doctors (MK and GS). In case of discrepancy, patients were discussed until consensus was reached.

Level of frailty was assessed using the Frailty Index (FI), which is based on a geriatric assessment (14). In its original form, the index consists of 48 items linked to chronic diseases, health problems and loss of function. The degree of frailty is estimated as the number of domains where the patient has a problem, divided by the number of domains assessed. The index gives a score ranging from 0 to 1, where a higher value indicates more advanced frailty. The index has been shown to be valid if at least 30 of the 48 items have been assessed (15). In our material, 34 of 48 variables were collected. The threshold values for degrees of frailty are given in Table 1.

**Table 1**

Characteristics of the included patients  $\geq 65$  years receiving home care nursing services in the municipality of Sandefjord,  $n = 210$ . Number (%) unless otherwise specified.

Variable	Value
Age in years, mean (SD)	84.5 (8.3)
Sex	
Women	138 (65.7)
Type of housing	
Detached house	54 (25.7)
Semi-detached house/terraced house	25 (11.9)
Apartment	78 (37.1)
Sheltered housing	53 (25.2)
Marital status	
Lives alone	151 (71.9)
Lives with others	59 (28.1)
Number of years of education, mean (SD)	9.8 (3.4)
Number of years of work experience <sup>2</sup> , mean (SD)	30.4 (16.8)
Comorbidity score on Charlson's comorbidity index, mean (SD)	2.6 (2.0)
Number of regular medications, mean (SD)	7.3 (4.0)
Dementia <sup>3</sup>	
No dementia	38 (18.1)
Mild cognitive impairment	60 (28.6)
Dementia	112 (53.3)
Body mass index (kg/m <sup>2</sup> )	
< 19	11 (5.2)
19–21	27 (12.9)
21–23	32 (15.2)
$\geq 23$	140 (66.7)

Variable	Value
Degree of frailty (threshold values for the Frailty Index in brackets)	
None ( $\leq 0.19$ )	9 (4.3)
Mild (0.20–0.29)	41 (19.5)
Moderate (0.30–0.39)	70 (33.3)
Severe ( $\geq 0.40$ )	90 (42.9)

<sup>1</sup>Apartment associated with a welfare service centre for the elderly, with meals provided. These welfare centres have no permanent care or nursing staff, and residents who need care receive home care nursing services.

<sup>2</sup>Data on years of work experience were missing in 11 patients.

<sup>3</sup>Consensual assessment based on available information.

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Hospitalisations during the project period were registered continuously from electronic messages sent by the hospital to the municipality for all patients who receive municipal services. The information was harmonised with the hospital's administrative system. Registrations included the date of admission and whether the admission was planned or acute. Time of death was registered continuously through the municipal records system, harmonised with information from the National Population Register.

## Ethics

Regional Committee for Medical and Health Research Ethics approved the project (no. 2014/1972). Upon inclusion, the home care nursing service obtained oral consent, while written consent was obtained during the first home visit. If the patient had limited capacity to consent, written consent was obtained both from their next of kin and the patient in question.


## Statistics

Patient characteristics are presented as means and standard deviations (SD) for continuous variables and as frequencies and percentages for categorical variables. Outcome indicators in the analyses were hospitalisations and deaths. Cox regression analysis was used to test which pre-defined patient characteristics (collected upon inclusion) were associated with a risk of hospitalisation and death. The choice of patient characteristics was primarily based on previous literature and clinical judgement. Some characteristics that were assumed to be less important were not included in the model because of a relatively small number of events (readmissions and deaths). The assumption of proportional hazards was tested through the inclusion of an interaction factor between each explanatory variable and the logarithm of time. The model for hospitalisation risk was adjusted for dependency in the data caused by repeated events (hospitalisations) in the same patient through random effects. The statistics packages SAS version 9.4 and STATA version 15 were used for the statistical analyses.

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## Results

The patient flow is presented in Figure 1 and patient characteristics in Table 1. Of the 210 patients included, 138 (66 %) were women, and the mean age was 84.5 years (range 65–102 years). The patients received 4.7 hours (SD 4.9) of weekly home care on average, and the median number of weekly visits was 14 (first–third quartile 7–21).

 Figure 1 Patient flow.

**Figure 1** Patient flow.

The Frailty Index is presented in Figure 2. The mean frailty index score was 0.39 (SD 0.13), which indicates moderate to severe frailty. Altogether 160 patients (76 %) were classified as moderately or severely frail (Table 1).

 Figure 2 Number of patients ≥ 65 years receiving home care services in the municipality of Sandefjord who upon inclusion had...

**Figure 2** Number of patients ≥ 65 years receiving home care services in the municipality of Sandefjord who upon inclusion had a problem in the 34 domains that were included in the frailty index of the study (14),  $N = 210$ .

Over the two-year observation period, 140 patients were hospitalised at least once. These 140 patients accounted for 307 emergency hospitalisations and 1 235 emergency hospital days, with a mean duration of 4.0 days (SD 3.8). The association between patient characteristics upon inclusion and the risk of hospitalisation is shown in Table 2. When compared to patients with severe frailty or dementia, those with mild frailty or no dementia were hospitalised significantly less frequently in the adjusted model.

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**Table 2**


Risk factors for hospitalisation over a period of two years among included patients aged 65 and older receiving home care nursing services,  $n = 210$ .

	Unadjusted model Hazard ratio (95 % CI)	Adjusted model <sup>†</sup> Hazard ratio (95 % CI)
Frailty Index (reference: severe frailty)		
Moderate frailty	0.64 (0.45–0.92)	0,70 (0.47–1.03)
Mild frailty	0.30 (0.18–0.49)	0,33 (0.19–0.60)
No frailty	0.50 (0.22–1.18)	0,56 (0.23–1.40)
Age (years)	1.00 (0.98–1.02)	1.01 (0.99–1.03)
Sex (reference: male)	0.90 (0.64–1.27)	0.86 (0.59–1.25)
Charlson's comorbidity index	1.18 (1.10–1.27)	1.09 (0.98–1.22)
Malignant disease last five years	1.60 (1.02–2.50)	1.20 (0.70–2.04)


	<b>Unadjusted model Hazard ratio (95 % CI)</b>	<b>Adjusted model<sup>1</sup> Hazard ratio (95 % CI)</b>
Dementia (reference)		
Mild cognitive impairment	1.23 (0.80–1.90)	1.15 (0.78–1.69)
No dementia	0.93 (0.63–1.36)	1.63 (1.02–2.60)
Number of regular medications	1.07 (1.03–1.11)	1.02 (0.97–1.07)
Lives with others	0.94 (0.65–1.37)	0.91 (0.61–1.35)

<sup>1</sup>Adjusted for all variables in the model.

Figure 3 illustrates the association between the degree of frailty and the patient's housing, use of short-term placement and admission to long-term stay in institutions during the project period. Upon inclusion, 43 % of the severely frail patients were living in private homes, without any short-term placements during the last six months. After 24 months, this proportion had declined to 14 %. Altogether 63 patients (30 %) died during the two-year observation period. Of these, 42 (67 %) had been classified as severely frail upon inclusion (Figure 4). 36 patients (57 %) died in nursing homes (short- or long-term placement), 20 (32 %) died in hospital, and seven (11 %) died at home. The risk factors for death are shown in Table 3. Severe frailty (when compared to patients with mild or moderate frailty), more advanced age, more comorbidities, and cancer were independent and statistically significant risk factors for mortality.

 Figure 3 Number of patients, by degree of frailty, who were living in sheltered housing, short-term placement in the last...

**Figure 3** Number of patients, by degree of frailty, who were living in sheltered housing, short-term placement in the last six months, or permanently institutionalised at different times during the study period. The graph does not take the number of deaths into account. Number of deaths after 24 months: no frailty: 2; mild frailty: 4; moderate frailty: 15; and severe frailty: 42.

 Figure 4 Survival as a function of the degree of frailty among older patients receiving home care nursing service, N = 210.

**Figure 4** Survival as a function of the degree of frailty among older patients receiving home care nursing service, N = 210.

### Table 3

Risk factors for death over a period of two years among included patients aged 65 and older receiving home care nursing services,  $n = 210$ .

	Unadjusted models Hazard ratio (95 % CI)	Adjusted model <sup>1</sup> Hazard ratio (95 % CI)
Frailty Index (reference: severe frailty)		
Moderate frailty	0.37 (0.20–0.66)	0,38 (0.20–0.73)
Mild frailty	0.17 (0.06–0.47)	0,18 (0.06–0.55)
No frailty	0.40 (0.10–1.64)	0,39 (0.09–1.81)
Age (years)	1.04 (1.01–1.07)	1.06 (1.02–1.10)
Sex (reference: male)	0.85 (0.51–1.42)	0.82 (0.46–1.48)
Charlson's comorbidity index	1.26 (1.13–1.40)	1.19 (1.02–1.38)
Malignant disease last five years	2.72 (1.54–4.81)	2.06 (1.02–4.15)
Dementia (reference)		
Mild cognitive impairment	0.80 (0.45–1.42)	1,26 (0.68–2.33)
No dementia	0.54 (0.24–1.20)	1,17 (0.47–2.90)
Number of regular medications	1.01 (0.95–1.08)	0.96 (0.88–1.04)
Lives with others	1.40 (0.83–2.36)	1.24 (0.68–2.27)

<sup>1</sup>Adjusted for all variables in the model

The association between death and degree of frailty is presented in Figure 4.

## Discussion

Among 210 older patients with weekly home care nursing services, three of every four were classified as moderately or severely frail. Frailty, but not chronological age, along with absence of dementia, were risk factors for hospitalisation. Age, frailty, comorbidity, and cancer were all risk factors for death.

In 2014, 9 % of persons in the age group 67–79 years and 41 % of persons aged 80 years or older received home care nursing services in Norway (16). Few Norwegian studies have identified the degree of frailty in persons who receive healthcare services at home, and the association between the degree of frailty and the risk of acute hospitalisation and death has not been previously studied. A study of 83 recipients of daily home care nursing services in the city of Oslo found a high degree of frailty in the form of multimorbidity and functional impairment (17), and argued that these patients needed qualified observations and coordinated care. It is well known that the frequency of emergency hospitalisations rises with increasing chronological age (18). Our study shows that the degree of frailty is a strong risk factor for emergency hospitalisations and death, while age is not associated with emergency hospitalisations. This

concur with findings from other countries (19). Included patients with severe frailty had the highest risk of both hospitalisation and death. The severity of chronic diseases and having cancer were associated with an elevated risk of death, but not of hospitalisations. Absence of dementia was significantly associated with hospitalisations in the adjusted model. The reason may be that patients with dementia have an established treatment plan with a higher threshold for hospitalisation than is the case for patients without dementia.

Most patients with frailty have multimorbidity, but the majority of the patients with multimorbidity are not frail (20). Assessment of the level of functioning is an important element in an assessment of frailty, and this illustrates the importance of assessing not only the patient's chronic diseases, but also the effect these diseases have on activities in daily living. Frailty is multifactorial and dynamic, and it is crucial to identify reversible factors that affect the patient's health and level of functioning. By identifying and intervening against reversible factors, the degree of frailty can be reduced (21). Examples of potentially reversible factors include malnutrition, depression, painful conditions that can be cured or alleviated, reduced mobility and inactivity where facilitation and exercise can improve mobility and increase the level of activity, optimised treatment of chronic diseases, and critical review and discontinuation of drugs that are no longer indicated.

Our study shows that older patients who live at home and receive home care nursing services have a high prevalence of severe frailty and a high risk of hospitalisation and death. There is little indication that these hospitalisations are so-called 'unnecessary admissions', since the mean length of stay was four days. Quite the reverse, our findings underscore that these patients need coordinated services and a consistent approach. Patients with a severe degree of frailty have reduced life expectancy, and their general practitioner in collaboration with the patients, their relatives and the home care nursing service should think ahead and together plan how any acute exacerbation should be addressed in line with the patients' goals and priorities (22). An assessment of frailty is crucial both for avoiding overtreatment of patients with a severe degree of frailty and avoiding undertreatment of fit patients with a high chronological age (23). Patients with severe frailty and few reversible factors are at high risk of complications and will potentially not benefit from treatments that will only be effective in the longer term. This should be taken into account in discussions with patients about their preferences and goals.

A strength of the study is its broad inclusion and exclusion criteria, making it representative of older home dwelling patients receiving weekly home care nursing services. The patients were assessed using validated screening tools, information was collected from relatives in a standardised form, and information on the patients' health was based on input from the patients, their relatives and information from medical records. Only one patient withdrew consent for use of collected data.

The study's weakness is that all the included patients live in the same municipality. Compared to other municipalities, Sandefjord has a higher proportion of older people living at home and receiving home care nursing services, and fewer in institutions (24). On average, the included patients were

provided with 4.7 hours of home nursing care, while the national average for persons older than 67 years is 4.5 hours (25). The municipality also have a higher number of hospital admissions from municipal care to the specialist health service than the national average. This may limit the transferability of results to other municipalities. Furthermore, we did not undertake any independent diagnostics, but based the study on registered diagnoses and information from the patients and their relatives. Therefore, the patients' morbidity may be higher than registered. Another weakness is that the registration of the amount of home care provided was based on the time recorded in the administrative system, since the municipality does not use real-time registration.

## Conclusion

Older patients receiving home care nursing services have a high prevalence of moderate and severe frailty, they are frequently admitted to hospital and their mortality rate is high. The degree of frailty is associated with negative events, such as acute hospitalisation and death.

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*The article has been peer reviewed.*

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