

BMJ Open Association between the level of municipality healthcare services and outcome among acutely older patients in the emergency department: a Danish population-based cohort study

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ABSTRACT

Objectives This study aims to describe the association between use of municipality healthcare services before an emergency department (ED) contact and mortality, hospital reattendance and institutionalisation.

Design Population-based prospective cohort study.

Setting ED of a large university hospital.

Participants All medical patients ≥65 years of age from a single municipality with a first attendance to the ED during a 1-year period (November 2013 to November 2014).

Primary and secondary outcome measures Patients were categorised as independent of home care, dependent of home care or in residential care depending on municipality healthcare before ED contact. Patients were followed 360 days after discharge. Outcomes were postdischarge mortality, hospital reattendance and institutionalisation.

Results A total of 3775 patients were included (55% women), aged (median (IQR) 78 years (71–85)). At baseline, 48.9% were independent, 34.9% received home care and 16.2% were in residential care. Receiving home care or being in residential care was a strong predictor of mortality, hospital reattendance and institutionalisation. Among patients who were independent, 64.3% continued being independent up to 360 days after discharge. Even among patients ≥85 years, 35.4% lived independently in their own house 1 year after ED contact.

Conclusion Prehospital information on municipality healthcare is closely related to patient outcome in older ED patients. It might have the potential to be used in risk stratification and planning of needs of older acute medical patients attending the ED.

INTRODUCTION

Worldwide the proportion of older people (age 65 years or older) is increasing and it is expected that older patients will comprise an increasing proportion in the emergency departments (EDs).^{1,2}

An ED contact indicates a high-risk situation for older patients. There are several potential poor outcomes following discharge including

Strengths and limitations of this study

- This population-based cohort study from a Danish municipality was based on data from several Danish national registers.
- A major strength was the complete coverage of a municipality, the complete follow-up and high data quality.
- Home care was registered during delivery making data more realistic.
- The study was a single-centre study which may reduce the generalisability of the results.
- Categorisation of patients according to level of municipality healthcare may not give the true level of dependency.

mortality,^{3–14} hospital reattendance^{6 10 15–18} and institutionalisation.^{11 19 20} Prognostic factors for these outcomes are numerous including increasing age,^{3–8 11–14} number of drugs,¹⁰ comorbidity,^{4 7 12} male sex,^{7–9 11} previous hospitalisations,^{10 12} length of stay,⁴ functional disability^{5 7 9–11 14 19} and being a nursing home resident prior to admission.^{5 14}

Knowledge of prognostic factors is useful to identify patients at high risk of poor outcomes for whom targeted intervention and treatment may be indicated.

In daily clinical ED practice where the staff is handling a high number of patients, identification of special prognostic factors in the management and treatment planning of the older patients might stay unrecognised. Assessment of patients' social history including use of other healthcare services is a part of daily clinical work, but evidence for its prognostic usefulness is limited.

Frailty is a health state with increased vulnerability to stressors and identification of frailty has proved to be an important

prognostic factor.²¹ Use of healthcare services like home care is a part of the two most validated frailty screening tools because it is assumed that it grants relevant information and help guide treatment and care.^{22,23} However, the concept of frailty and geriatric emergency medicine are not well implemented in the ED and it is often restricted to be used by geriatricians.²⁴

As many older patients are often dependent on municipality healthcare services like home care,²⁵ it is possible that systematic knowledge of the patients' dependency of municipality healthcare services has a potential to add information, that is, easily accessible, in the assessment of risk and prognosis in the ED.

The aim of this study was to assess the association between dependency of municipality healthcare services prior to ED contact and the risk of mortality, rehospitalisation and institutionalisation in 360 days after discharge in patients ≥ 65 years attending the ED.

METHOD

Participants

We included all patients 65 years or older living in Odense municipality with a first acute medical contact to the ED of Odense University Hospital, Denmark, from 1 November 2013 to 31 October 2014. We excluded patients dead on arrival to the ED, patients without a Danish personal identification number and patients residing outside Odense Municipality at the time of index contact.

Data on the same patients have been used in a previous study.²⁶

Study design and setting

We conducted a population-based cohort study with follow-up 360 days after an acute medical hospital contact.

Odense University Hospital is a 1000-bed university teaching hospital with all specialties present. The ED provides 24 hours acute medical care and serves a mixed rural–urban primary catchment area of 288 200 persons including Odense municipality, which has a population of 168 731 adult citizens with 20.0% being 65 years or older.²⁷ It is the only ED in this area. Patients are referred from primary care or arrive by ambulance emergency call. The ED receives all acute patients except patients with prehospital identified cardiogenic disease, ongoing nephrogenic or oncological treatment. At arrival, all patients are assigned to a specialty track and an urgency category based on main complaint and vital signs.²⁸

The Danish healthcare system is tax funded and provides free healthcare for all residents. The primary care services are well established and free of charge for the patients. The municipalities are responsible for delivery of any kind of home care services to older and disabled people. Each municipality delivers home care consisting of general nursing care and care to support activities of daily living (ADL). The type and amount of home care are based on an individual plan laid down in collaboration with a special educated nurse and changes are adjusted continuously with 1-day notice. Staff does on-location registrations of time and task. The data are automatically transferred to a personal electronic citizen record. Furthermore, the municipality administrates residential care institutions like rehabilitation homes and nursing homes.

Data source

Data were assembled from the data sources seen in [table 1](#).

The Odense University Pharmacoepidemiological Database is a prescription database

Table 1 Description of data sources

Data source	Description
The Danish Civil Registration System (CRS)	Since 1968 the Danish CRS has assigned a unique 10-digit civil personal registry number to each Danish citizen at birth and to residents on immigration. The CRS covers data on births, deaths, migration, municipality and marital status. ³⁰ The unique civil registry number enables accurate linkage of information from different data sources on an individual level.
The Danish National Patient Register (NPR)	Since 1977 the Danish NPR has registered all hospital admissions and since 1995 also all ED visits. ⁵⁰ Data are assembled regarding the date of admission and discharge and admission department.
The electronic hospital record and the emergency department (ED)-logistic system	All hospital data from each patient are registered and stored in the electronic hospital record and the logistic tool used in the ED.
Odense University Pharmacoepidemiological Database (OPED)	OPED is a prescription database. It covers the region of Southern Denmark including the municipality of Odense. Information on dispensed prescriptions is reported on an individual basis from community pharmacies to OPED. Only drugs that are reimbursed are covered. ³³
The Municipality Citizen Record	All data on kind and amount of home care and resident type are registered in The Municipality Citizen Record on an individual level. When residents are in residential care, it is registered as such.

Data variables

If a patient had more medical acute ED contacts in the study period, only the first contact was included as the index contact. The primary date of contact defined the index date. Index contact date and urgency category at arrival were collected from the patient health record and the ED electronic logistic tool. Urgency category was defined from the initial triage.²⁹ In the present study, urgency categories were divided in two predefined urgency categories: level 1 and 2 as 'urgent' and level 3 and 4 as 'less urgent'.

Data on patients' status on receiving home care or being in residential care were retrieved from The Municipality Citizen Record. Patients were subdivided in three groups according to the level of dependency on municipality healthcare the last 30 days prior to the index date: 'Residential care' defined as one or more days at a nursing home or a rehabilitation home, 'Dependent on home care' defined as receiving any municipality home care and 'Independent' defined as not receiving any municipality home care the preceding 30 days. Patients could only be in one category and it was prioritised as: residential care, dependency of home care or independent of home.

Data on birth, migration, vital status, municipality of residence and marital status were retrieved from the Danish Civil Registration System.³⁰ We categorised patients as being alone if they were single, divorced, widower or widow.

Based on registration in the Danish National Patient Register, the length of stay was calculated from the date of index contact to the end of hospitalisation. Contacts were classified as ED visits if patients were not admitted to the hospital. All other contacts were classified as admissions and divided in two categories: <48 hours admission or ≥48 hours admission.

Comorbidity was described based on Charlson Comorbidity Index identified by hospital discharge diagnoses from the previous 10 years.^{31 32}

The number of medications with different Anatomical Therapeutic Chemical (ACT) codes (fourth level, chemical subgroup) reimbursed within 3 months prior to the index contact was used to calculate the number of medications at index contact.^{33 34}

Outcome variables

Outcome variables were mortality, hospital reattendance and institutionalisation. All outcome variables were assessed at 30 and 360 days following discharge. The time started from the day of discharge. The proportion of patients that had been in residential care one or more days in the 360 days period after discharge, the proportion of patients that had received any home care (dependent on municipality home care) one or more days in the 360 days period after discharge and the proportion of patients that did not receive any home care (independent on municipality home care) all 360 days after discharge were measured.

Data analysis and statistical methods

The distribution of patients in age categories, gender, Charlson Comorbidity Index, contact category (ED visit or admission), length of stay (in days) and urgency category according to the level of dependency within the 30 days prior to ED contact were presented as total and proportions or as medians with IQR. Only medians and (IQR) were calculated due to the skewness of the data distributions. χ^2 test was used to test the significance of differences between proportions in categorical data.

All-cause mortality proportions were calculated at 30 days and 360 days after discharge. Risk factors were evaluated by Cox regression analysis and presented as unadjusted and adjusted HRs with 95% CIs at 30 days and 360 days after discharge. Level of municipality healthcare the month before index contact, age (as a continuous variable), gender, Charlson Comorbidity Index, number of medications, being alone, length of stay and urgency category (as categorical variables) were used as independent variables.

Risk factors for hospital reattendance and for institutionalisation 30 days and 360 days after discharge were analysed using competing risks methodology with hospital reattendance and residential care analysed separately as the event of interest and death due to any cause as the competing event.

Level of municipality healthcare the month before index contact, age, gender, Charlson Comorbidity Index, number of medications, being alone, length of stay and urgency category were used as independent variables.

Cumulative competing risk curves for acute hospital reattendance and institutionalisation were calculated and presented.

The proportion of patients being independent, dependent on home care or living in residential care 30 days and 360 days after discharge stratified by level of municipality healthcare the month before was calculated.

Variance inflating factors were calculated to evaluate collinearity.

No data were missing on mortality, municipality healthcare or hospital reattendance. Data on being alone were missing in 43 patients and data on urgency category were missing in 53 patients. Sensitivity analyses were done with missing data replaced by 'being alone' or 'not being alone' for alone status and 'urgent' or 'less urgent' for urgency category.

Follow-up was complete for all patients.

All calculations were performed using Stata Release V.15.0 (StataCorp).

The reporting of this study conforms to the Strengthening the Reporting of Observational Studies in Epidemiology statement and the checklist was completed.³⁵

Patient and public involvement

Patients and/or public were not involved in the development, design, recruitment or conduct of the study.

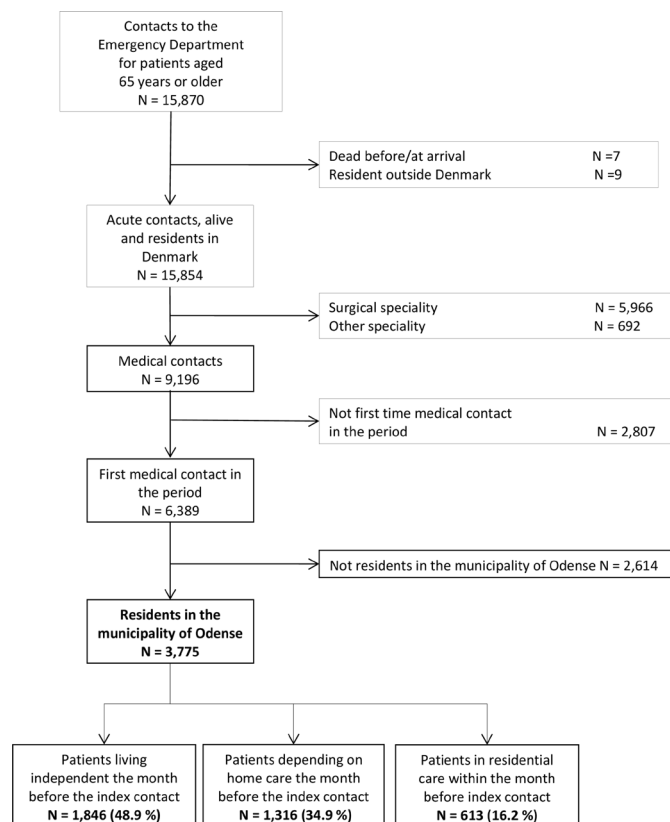


Figure 1 Flow chart of patients included in the study period.

RESULTS

Participants

Among the 6389 first-time medical contacts for older patients to the ED in the study period, 3775 patients were citizens in Odense municipality and included in the study (figure 1).

Median (IQR) age of the included patients was 78 years (71–85), 55% were female. Median Charlson Comorbidity Index was 1 (0–3), the median number of medications at index contact was 5 (3–8) and 38.8% were categorised as urgent at arrival (table 2).

Within the month before index contact, 48.9% of the 3775 patients were independent, 34.9% were dependent on home care (median days 18 days (3–30)) with 37.5% of these receiving home care all days and 16.2% were in residential care one or more days (median days 30 (30–30)) with 81.1% in residential care all 30 days (figure 1).

Table 2 describes the characteristics of the 3775 patients displayed by level of municipality healthcare the month before index ED contact. Patients who were independent before the ED contact were younger (median age 74 (69–79)), the majority was not alone (59.6%), had less comorbidity (median Charlson Comorbidity Index 1 (0–2)) and took fewer medications (median 4 (2–7)) than patients dependent on home care and patients in residential care. In the groups of patients receiving home care and patients in residential care the month before the index contact, no significant differences were seen in age, comorbidity or the number of medications taking on a regular basis.

The urgency level at arrival to the ED did not vary between the three groups, but patients in residential care were more impaired in their conscious level (data not displayed). Significantly less of the independent patients were admitted and the admissions were shorter (table 2) ($p < 0.001$).

Outcome

Mortality

In-hospital mortality was 4.0% in independent patients, 9.4% in dependent patients and 9.5% in patients in residential care (table 2) ($p < 0.001$).

Among patients discharged alive a total of 4.9% died within 30 days after discharge and 20% within 360 days. In our study, 13.6% of those independent of municipality home care in the month before the index contact—and discharged alive from hospital—were dead within 1 year after discharge. Whereas 35% and 43% of those dependent on home care or in residential care the month before index contact—and discharged alive—were dead within 1 year after discharge, respectively ($p < 0.001$).

Hospital reattendance and institutionalisation

Of the 3519 patients discharged alive 44.6% had reattended the hospital within 360 days.

We found that 12% of patients receiving home care before ED contact were or had been in residential care within 30 days after discharge. Only 3% of patients who were independent were or had been in residential care within 30 days after discharge.

Independent

Stratifying for age categories, figure 2 displays the proportion of patients discharged alive who died, stayed in residential care (any day), were dependent on home care (any day) or were independent (all days) in the 360 days period after discharge in relation to level of municipality healthcare the 30 days before ED contact.

In patients ≥ 85 years of age who were independent before ED contact more than 35% were still independent all 360 after discharge and about 70% still lived in their own home with or without home care.

Prognostic factors

In the multiple variable analysis, we found that receiving home care doubled the risk of mortality within 360 days (HR 2.07, 95% CI 1.68 to 2.56) and residential care tripled the risk (HR 3.03, 95% CI 2.39 to 3.85). Male sex, age, comorbidity and index admission lasting over 48 hours were also independent predictors of mortality (table 3).

Likewise, receiving home care increased the risk of reattendance to the ED. Within 30 days after discharge (sub-HR (SHR) 1.46, 95% CI 1.22 to 1.64) and within 360 days after discharge (SHR 1.16, 95% CI 1.01 to 1.32). Residential care before index contact seemed to be a protective factor for hospital reattendance within 360 days after discharge (SHR 0.84, 95% CI 0.70 to 1.01) (table 4). Cumulative competing risk curve of acute hospital reattendance displayed by level of municipality healthcare

Table 2 Baseline characteristics of the whole study population stratified according to level of dependency of home care within the month prior to index contact

	Study population: Patients ≥65 year old with an acute medical emergency department (ED) contact and residents in the municipality of Odense	Patients living independent the month before index contact	Patients dependent on home care the month before the index contact	Patients in residential care any time within the month before index contact	Pearson χ^2 test
Age	3775	1846	1316	613	P<0.001
In years, median (IQR)	78 (71–85)	74 (69–79)	83 (76–88)	85 (78–90)	
Age groups					
65–74 years	36.5% (n=1378)	54.4% (n=1004)	20.3% (n=267)	17.5% (n=107)	
75–84 years	36.2% (n=1368)	35.2% (n=649)	39.5% (n=520)	32.5% (n=199)	
≥85 years	27.3% (n=1029)	10.5% (n=193)	40.2% (n=529)	50.1% (n=307)	
Gender	3775	1846	1316	613	P<0.001
Female	55.2% (n=2083)	47.2% (n=871)	63.0% (n=829)	62.5% (n=383)	
Male	44.8% (n=1692)	52.8% (n=975)	37.0% (n=487)	37.5% (n=230)	
Being alone	3715	1832	1286	597	P<0.001
No	42.1% (n=1565)	59.6% (n=1092)	29.4% (n=378)	15.9% (n=95)	
Yes	57.9% (n=2150)	40.4% (n=740)	70.6% (n=908)	84.1% (n=502)	
Charlson Comorbidity Index	3775	1846	1396	613	P<0.001
Median (IQR)	1 (0–3)	1 (0–2)	2 (1–4)	2 (1–4)	
0	28.6% (n=1081)	40.1% (n=741)	19.6% (n=258)	13.4% (n=82)	
1–2	41.7% (n=1575)	40.2% (n=742)	40.5% (n=533)	48.9% (n=300)	
≥3	29.6% (n=1119)	19.7% (n=363)	39.9% (n=525)	37.7% (n=231)	
No of medications	3775	1846	1316	613	P<0.001
Median (IQR)	5 (3–8)	4 (2–7)	6 (4–9)	6 (4–9)	
Urgency category	3678	1785	1289	604	P=0.564
Urgent	38.8% (n=1428)	39.6% (n=707)	37.7% (n=486)	38.9% (n=235)	
Less urgent	61.2% (n=2250)	60.4% (n=1078)	62.3% (n=803)	61.1% (n=369)	
Index contact	3775	1846	1316	613	P<0.001
ED visit	32.4% (n=1224)	38.2% (n=706)	25.9% (n=341)	28.9% (n=177)	
Hospital admission	67.6% (n=2551)	61.8% (n=1140)	74.1% (n=975)	71.1% (n=436)	
Length of admission	2551	1140	975	436	P<0.001
<48 hours	20.1% (n=513)	23.8% (n=271)	15.7% (n=153)	20.4% (n=89)	
≥48 hours	79.9% (n=2.038)	76.2% (n=869)	84.3% (n=822)	79.6% (n=347)	
Median days (IQR)	5 (2–9)	4 (2–7)	6 (3–10)	5 (2–9)	
In-hospital mortality	3775	1846	1316	613	
Died during hospitalisation	6.8% (n=256)	4.0% (n=74)	9.4% (n=124)	9.5% (n=58)	P<0.001

Data are presented as number of patients (n), proportions (%) and median (IQR).

before initial ED contact are displayed in online supplementary A.

For independent patients and dependent patients, the adjusted SHR for residential care 360 days after discharge were three times higher for patients receiving home care (SHR 3.26, 95% CI 2.34 to 4.54) (table 5). Cumulative competing risk curve of residential care placement after discharge from the ED displayed by level of municipality healthcare 30 days before contact to the ED is displayed in online supplementary B.

Sensitivity analysis for missing data did not show any significant differences for HR or SHR.

DISCUSSION

We found that the level of municipality healthcare dependency is a powerful predictor of postdischarge mortality, hospital reattendance and institutionalisation for older medical ED patients. If you are independent of municipality healthcare the month before ED contact, there is

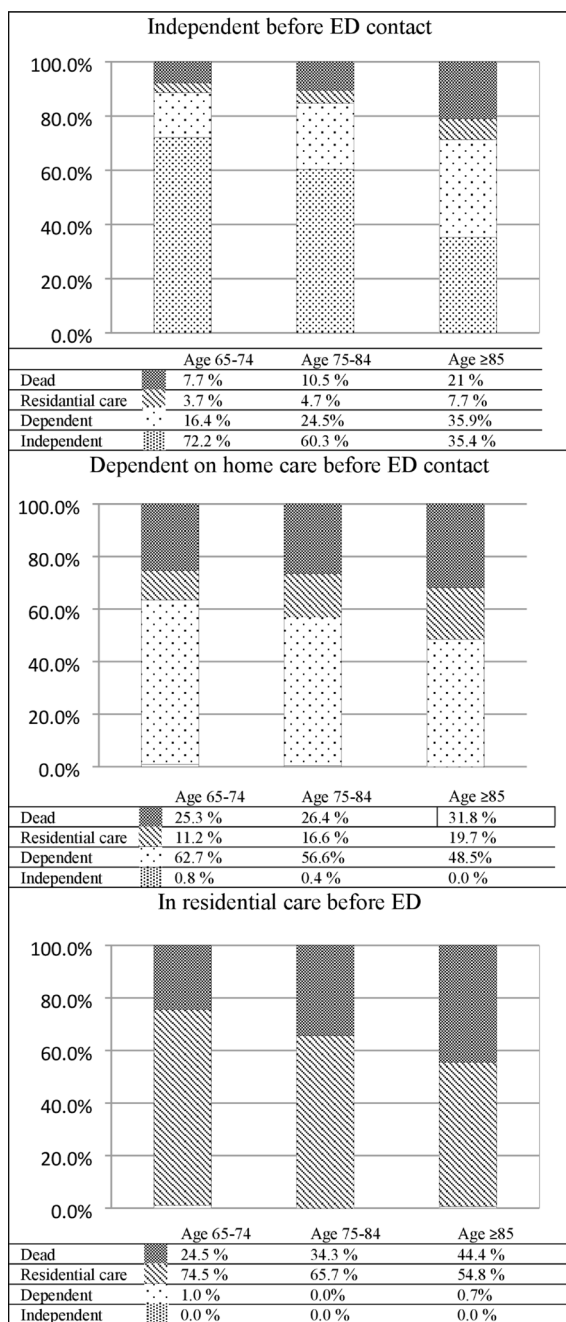


Figure 2 Stratifying for age categories, the proportion of patients discharged alive who died, stayed in residential care, received home care or lived independent in the 360 days period after discharge in relation to level of municipality healthcare the 30 days before index ED contact. ED, emergency department.

a good chance to be alive and living independent—or at least in your own home—1 year after discharge, even among the oldest patients.

Taking a social history is a part of patient assessment, but the evidence for the prognostic usefulness has been limited. In our study, we showed that information about level of dependency from municipality healthcare is a strong prognostic factor. This emphasises how important it is to continue asking patients about their need for help.³⁶ Additionally, in the presence of cognitive impairment,

history taking may be difficult and time consuming. Applying the information directly from the municipality healthcare record to the hospital record would help overcome some of the difficulties assessing the social history.

We found an overall mortality of 20%, 360 days after discharge. One-year mortality reported in other studies varies from 7% to 30%.^{5 6 8 11} They differed from our setting by including in-hospital mortality or only hospital admissions^{5 8} and different median ages.^{5 11} Male sex, age and comorbidity were also reported in other studies as independent predictors of mortality.^{5 6 8 11}

Like other studies, we found residential care to be a predictor of mortality.^{5 14} There is conflicting evidence of the predictive value of residential care as a risk for hospital reattendance. One study found residential care to decrease the risk of readmission within 30 days.³⁷ Others found an increased risk.^{6 38 39} Not all of the reported findings were statistically significant and none of the studies used competing risk methodology. We found residential care to be associated with an increased risk of reattendance within 30 days, and a non-statistic decrease of reattendance within 360 using a competing risk method.

Dependency of home care as a predictor of poor outcome has not been intensively investigated. Increased risk of hospital reattendance has been reported.^{17 39} Home care dependency reflects the lack of capability to withhold ADL due to restraints in psychical, cognitive, mental and social capacity. Several studies have shown an increased risk of mortality, hospital reattendance and institutionalisation among older patients with functional and cognitive impairment.^{5 7 9 11 19 40–42} Studies vary in follow-up time, the way of measuring functional disability and measurement time.

One of the known major frailty models is the accumulation of deficits model.⁴³ It counts the number of deficits found/seen in a patient, for example, functional disability, comorbidity and cognitive impairment. It has been validated to successfully predict poor outcome in numerous studies.^{44–46} A more clinical and ED useful version has been developed.²³ The Clinical Frailty Scale (CFS) has also been validated in the ED to predict poor outcome.^{47 48} The CFS is largely based on the required help with ADL. For example, on the 1–9 point frailty scale, a mildly frail patient (point 5) is in need of help with medications, domestic tasks and shopping, whereas a severely frail patient is completely dependent in all areas of ADL. In our study, we solely distinguished between whether a person received municipality home care, were in residential care or were independent of municipality home care. More detailed information on what activities of ADL patients were assisted with and what kind of nursing care and domestic help they received would also be possible to extract in future studies. Additionally, it would also be important to include care and help delivered by family or friends. We were not able to include this in our present study.

Knowledge of powerful risk factors, as receiving home care, may be used in the design of specialist services for

Table 3 Prognostic factors of mortality in older patients with acute emergency department (ED) contact

	0–30 days				0–360 days				
	% , total (n)	%, (n)	Crude HR (95% CI)	P value	Adjusted HR (95% CI)*	P value	Crude HR (95% CI)	Adjusted HR (95% CI)*	P value
Gender									
Female	55.4 (1949)	5.0 (98)	1 (ref)		1		1	1	
Male	44.6 (1570)	4.7 (74)	0.93 (0.69 to 1.26)	0.659	1.19 (0.85 to 1.66)	0.322	0.97 (0.84 to 1.12)	1.20 (1.02 to 1.41)	0.666
Age									
0			1.06 (1.04 to 1.08)	<0.001	1.03 (1.01 to 1.05)	0.004	1.06 (1.05 to 1.07)	1.04 (1.03 to 1.05)	<0.001
Charlson Comorbidity Index									
0	28.8 (1015)	3.6 (36)	1		1		1	1	
1–2	42.2 (1484)	4.3 (64)	1.22 (0.81 to 1.84)	0.334	1.02 (0.65 to 1.57)	0.947	1.70 (1.38 to 2.09)	1.37 (1.10 to 1.71)	<0.001
≥3	29.0 (1020)	7.1 (72)	2.02 (1.35 to 3.01)	0.001	1.44 (0.92 to 2.26)	0.108	2.60 (2.11 to 3.20)	1.82 (1.46 to 2.28)	<0.001
Living status									
Not alone	42.4 (1474)	3.6 (53)	1		1		1	1	
Alone	57.6 (2002)	5.5 (111)	1.56 (1.12 to 2.16)	0.008	0.97 (0.66 to 1.41)	0.865	1.40 (1.20 to 1.63)	0.86 (0.72 to 1.03)	<0.001
Urgency									
Less urgent	62.3 (2161)	4.9 (105)	1		1		1	1	
Urgent	37.7 (1305)	4.9 (64)	1.01 (0.74 to 1.38)	0.927	1.10 (0.80 to 1.51)	0.563	0.99 (0.85 to 1.15)	1.04 (0.89 to 1.21)	0.910
No of medications									
<5	36.2 (1275)	4.2 (53)	1		1		1	1	
≥5	63.8 (2244)	5.3 (119)	1.28 (0.92 to 1.77)	0.137	0.97 (0.68 to 1.37)	0.847	1.40 (1.19 to 1.64)	1.05 (0.89 to 1.25)	<0.001
Length of stay									
ED visit	33.6 (1184)	2.3 (27)	1		1		1	1	
<48 hours	13.0 (456)	3.5 (16)	1.55 (0.83 to 2.92)	0.165	1.56 (0.84 to 2.91)	0.164	0.97 (0.72 to 1.31)	0.95 (0.70 to 1.29)	0.834
≥48 hours	53.4 (1879)	6.9 (129)	3.09 (2.04 to 4.68)	<0.001	2.51 (1.63 to 3.84)	<0.001	2.18 (1.83 to 2.61)	1.82 (1.52 to 2.19)	<0.001
Municipality healthcare									
Independent	50.3 (1772)	2.2 (39)	1		1		1	1	
Dependent	33.9 (1192)	6.1 (73)	2.84 (1.93 to 4.20)	<0.001	2.06 (1.30 to 3.26)	0.002	3.14 (2.62 to 3.76)	2.07 (1.68 to 2.56)	<0.001
In residential care	15.8 (555)	10.8 (60)	5.13 (3.43 to 8.16)	<0.001	3.94 (2.41 to 6.45)	<0.001	4.54 (3.71 to 5.53)	3.03 (2.39 to 3.85)	<0.001

Proportions, HRs, and p-values < 0.05 presented as bold values.

*Cox proportional hazard model adjusted for gender, age as continuous variable, Charlson Comorbidity Index (0, 1–2, ≥3), number of medications (<5, ≥5), length of stay, living alone, urgency level (urgent, less urgent) and municipality healthcare the month before index contact as categorical variable.

Table 4 Prognostic factors of hospital reattendance in older patients discharge alive after an acute emergency department (ED) contact

	0-30 days				0-360 days				
	%, total (n)	%, (n)	Crude SHR (95% CI)	P value	Adjusted SHR (95% CI)*	P value	Crude SHR (95% CI)	Adjusted SHR (95% CI)*	P value
Gender									
Female	55.4 (1994)	15.8 (307)	1 (ref)	0.142	0.95 (0.79 to 1.15)	0.591	1	1.00 (0.88 to 1.14)	0.985
Male	44.6 (1570)	14.0 (219)	0.88 (0.74 to 1.04)	0.029	1.00 (0.99 to 1.01)	1.000	0.94 (0.84 to 1.06)	1.00 (1.00 to 1.01)	0.602
Age									
Charlson Comorbidity Index									
0	28.8 (1015)	12.7 (129)	1	0.325	0.97 (0.77 to 1.22)	0.800	1	1.12 (0.96 to 1.30)	0.166
1-2	42.2 (1484)	14.2 (210)	1.12 (0.90 to 1.39)	0.001	1.20 (0.93 to 1.53)	0.155	1.17 (1.01 to 1.35)	1.15 (0.97 to 1.38)	0.112
≥3	29.0 (1020)	18.3 (187)	1.47 (1.18 to 1.84)	0.048	1.02 (0.83 to 1.26)	0.855	1.23 (1.09 to 1.39)	1.23 (1.07 to 1.42)	0.004
Living status									
Not alone	42.4 (1474)	13.7 (202)	1	0.048	1.02 (0.83 to 1.26)	0.855	1	1.23 (1.09 to 1.39)	0.004
Alone	57.6 (2002)	16.1 (322)	1.19 (1.00 to 1.42)	0.001	1.23 (1.01 to 1.49)	0.039	1.13 (1.00 to 1.28)	1.06 (0.93 to 1.21)	0.351
Urgency									
Less urgent	62.3 (2161)	15.1 (326)	1	0.708	0.99 (0.82 to 1.18)	0.873	1	1.02 (0.90 to 1.16)	0.351
Urgent	37.7 (1305)	14.7 (192)	0.97 (0.81 to 1.15)	0.001	1.23 (1.01 to 1.49)	0.039	1.02 (0.90 to 1.15)	1.02 (0.90 to 1.16)	0.351
No of medications									
<5	36.2 (1275)	12.3 (157)	1	0.001	1.23 (1.01 to 1.49)	0.039	1	1.06 (0.93 to 1.21)	0.351
≥5	63.8 (2244)	16.4 (369)	1.36 (1.13 to 1.64)	0.001	1.23 (1.01 to 1.49)	0.039	1.13 (1.00 to 1.28)	1.06 (0.93 to 1.21)	0.351
Length of stay									
ED visit	33.6 (1184)	14.0 (166)	1	0.603	1.06 (0.80 to 1.41)	0.688	1	1.15 (0.95 to 1.38)	0.152
<48 hours	13.0 (456)	15.1 (69)	1.08 (0.81 to 1.42)	0.335	0.97 (0.80 to 1.18)	0.765	1.04 (0.89 to 1.22)	0.88 (0.77 to 1.00)	0.058
≥48 hours	53.4 (1879)	15.5 (291)	1.10 (0.91 to 1.33)	0.011	1.33 (0.98 to 1.81)	0.063	0.89 (0.80 to 0.99)	0.88 (0.77 to 1.00)	0.058
Municipality healthcare									
Independent	50.3 (1772)	11.5 (204)	1	<0.001	1.67 (1.34 to 2.10)	<0.001	1	1.28 (1.09 to 1.50)	0.002
Dependent	33.9 (1192)	19.7 (235)	1.78 (1.47 to 2.14)	0.011	1.33 (0.98 to 1.81)	0.063	1.33 (1.17 to 1.51)	0.88 (0.71 to 1.09)	0.242
In residential care	15.8 (555)	15.7 (87)	1.08 (1.08 to 1.77)	0.011	1.33 (0.98 to 1.81)	0.063	0.95 (0.80 to 1.14)	0.88 (0.71 to 1.09)	0.242

Proportions, SHRs, and p-values < 0.05 presented as bold values.

*Competing-risks regression model adjusted for gender, age as continuous variable, Charlson Comorbidity Index (0, 1-2, ≥3), number of medications (<5, ≥5), length of stay, living alone, urgency level (urgent, less urgent), and municipality healthcare the month before index contact as categorical variable.

SHR, sub-HR.

Table 5 Prognostic factors of residential care in older patients discharged alive after an acute emergency department (ED) contact

	0–30 days				0–360 days						
	% , total (n)	N, (%)	Crude SHR (95% CI)	P value	Adjusted SHR (95% CI)*	P value	% , (n)	Crude SHR (95% CI)	P value	Adjusted SHR (95% CI)*	P value
Gender											
Female	53.8 (1596)	6.9 (110)	1 (ref)		1		10.1 (161)	1		1	
Male	46.2 (1368)	6.2 (85)	0.90 (0.68 to 1.19)	0.460	1.30 (0.95 to 1.78)	0.099	8.6 (117)	0.84 (0.66 to 1.06)	0.144	1.28 (0.98 to 1.67)	0.067
Age											
			1.09 (1.07 to 1.10)	<0.001	1.05 (1.03 to 1.07)	<0.001		1.06 (1.05 to 1.07)	<0.001	1.03 (1.01 to 1.04)	<0.001
Charlson Comorbidity Index											
0	31.7 (939)	5.6 (53)	1		1		8.5 (80)	1		1	
1–2	40.9 (1211)	7.1 (86)	1.26 (0.90 to 1.77)	0.175	1.03 (0.74 to 1.45)	0.849	10.3 (125)	1.22 (0.92 to 1.62)	0.161	1.03 (0.77 to 1.39)	0.841
≥3	27.4 (814)	6.9 (56)	1.22 (0.84 to 1.77)	0.287	0.91 (0.62 to 1.33)	0.626	9.0 (73)	1.05 (0.77 to 1.44)	0.760	0.76 (0.53 to 1.08)	0.122
Living status											
Not alone	47.0 (1393)	4.3 (60)	1		1		5.7 (80)	1		1	
Alone	50.0 (1540)	8.5 (131)	2.00 (1.48 to 2.70)	<0.001	1.21 (0.85 to 1.73)	0.295	12.7 (196)	2.29 (1.77 to 2.97)	<0.001	1.50 (1.11 to 2.03)	0.009
Urgency											
Less urgent	61.0 (1809)	6.2 (112)	1		1		9.12 (165)	1		1	
Urgent	37.3 (1107)	7.2 (80)	1.17 (0.88 to 1.55)	0.269	1.21 (0.91 to 1.61)	0.184	9.8 (108)	1.08 (0.85 to 1.37)	0.548	1.12 (0.88 to 1.43)	0.358
No of medications											
<5	37.7 (1116)	6.9 (77)	1		1		9.3 (104)	1		1	
≥5	62.3 (1848)	6.4 (118)	0.92 (0.70 to 1.22)	0.576	0.71 (0.53 to 0.97)	0.030	9.4 (174)	1.01 (0.79 to 1.28)	0.945	0.81 (0.62 to 1.05)	0.116
Length of stay											
ED-visit	34.1 (1012)	1.1 (11)	1		1		5.6 (57)	1		1	
<48 hours	12.9 (382)	0.3 (1)	0.24 (0.03 to 1.86)	0.172	0.23 (0.03 to 1.74)	0.153	8.1 (31)	1.44 (0.94 to 2.21)	0.096	1.43 (0.93 to 2.19)	0.104
≥48 hours	53.0 (1570)	11.7 (183)	11.07 (6.05 to 20.24)	<0.001	8.28 (4.49 to 15.24)	<0.001	12.1 (190)	2.25 (1.68 to 3.02)	<0.001	1.76 (1.30 to 2.39)	<0.001
Municipality healthcare											
Independent	50.3 (1772)	2.9 (51)	1		1		4.5 (79)	1		1	
Dependent	33.9 (1192)	12.1 (144)	4.31 (3.14 to 5.91)	<0.001	2.64 (1.82 to 3.82)	<0.001	16.7 (199)	3.98 (3.07 to 5.17)	<0.001	3.26 (2.34 to 4.54)	<0.001

Proportions, SHRs, and p-values < 0.05 presented as bold values.

*Competing risks regression model adjusted for gender, age as continuous variable, Charlson Comorbidity Index (0, 1–2, ≥3), number of medications (<5, ≥5), length of stay, living alone, urgency level (urgent, less urgent) and municipality healthcare the month before index contact as categorical variable.

SHR, sub-HR.

older people at risk. But, it is also important to focus on the patients who do not suffer a poor outcome as mortality, reattendance or institutionalisation. We showed that living independent before an ED contact was a stronger predictor of postdischarge independent living than age. Of course, it might be that these patients actually received some kind of special service, like geriatric attendance and therefore might had a better prognosis, but no significant difference was seen in the allocation to medical specialty among the patients age ≥ 85 years of age, living independent at ED contact and still living independent after 360 days (35.4%) and the rest of the patients.

Another important aspect to consider is age and treatment. In some situations, there is a predominant reluctance towards treatment of the very old patients and ageism still exists among ED—and other—doctors.⁴⁹ As increasing age is often associated with multimorbidity, functional and cognitive impairment, it is correct that age is often associated with poor outcome. However, we found that even among the oldest medical ED patients, their prognosis is very good if they have been able to manage without home care at the arrival to the ED. It, therefore, seems important to include information on level of municipality healthcare to identify those with good chances of survival and maintaining independent living.

Limitations and strengths

The strengths of this study were the large sample size, and the accurate linkage between healthcare population-based registries allowing complete follow-up. To minimise bias, we included all consecutive medical hospital contacts, the proportion of missing data was very low, sensitivity analysis was done and follow-up was complete. We were able to collect data on all hospital reattendance in all Danish hospital and it was possible to follow each individual patient throughout the study period. Registration of time and type of municipality home care delivered was done during the planned visits, giving data a large conformity with the actual delivered home care and not just what was intended to be delivered.

Our study had some limitations. First, it is a Danish single-centre study and should be interpreted as such, even though the described system for hospital attendance and home care is quite uniform across the country. Second, categorisation of patients not receiving home care as 'independent' could be misleading. They might actually be in need of home care or have a healthy spouse taking care of them. Third, the Charlson Comorbidity Index at ED contact was calculated from information on previously discharge diagnosis, implying that for a given comorbidity to be recognised it had to require hospitalisation with coding for the comorbidity leading to risk of under-reporting. However, it has been shown that the validity of using Danish National health registers to calculate Charlson Comorbidity Index is good.³² Finally, several of the covariate estimates changed direction during the modelling process which suggests collinearity issues or

possible effect modification in the multiple variables and the result has to be interpreted with this in mind. The mean variance inflation factor was 2.88. All of the individual variance inflation factors were below 10, suggesting limited collinearity.

CONCLUSION

We found that the degree of dependency of municipality healthcare the last month before ED contact was a strong prognostic predictor of mortality, reattendance and institutionalisation. We also found that even among the oldest patients not receiving home care, there is a good chance that they will still be alive and living independent of home care 1 year after discharge. The ED, with its high patient turnover, limited time, and focus on urgent problems, may not be an appropriate place to implement time-consuming assessments of functional impairment and frailty. However, information on home care use and residential care before ED contact is simple and easy add-on information to the patients social history and might have the potential to be used in risk stratification and planning of needs of older acute medical patients attending the ED.

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