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High need of geriatric awareness in the Emergency Department – A Danish population-based cohort study

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ABSTRACT

Objectives: The objective was to describe the prevalence of geriatric target areas among acute older medical patients in the Emergency Department (ED) and the association between geriatric target areas and admission, length of admission, in-hospital mortality, 30 days post discharge mortality, 30 days hospital re-attendance, and 360 days loss of independency.

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 at the ED during a one year period (November 2013 to November 2014).

Primary and secondary outcome measures: Based on information from healthcare registers we defined prevalence of geriatric target areas as existence of impairment, recently increased impairment, polypharmacy, or comorbidity. Outcomes measured were admission, length of admission, post-discharge mortality, hospital re-attendance, and home care dependency 0-360 days following ED contact.

Results: Totally, 3,775 patients (55% women) were included, age 78 [71-85] years (median [IQR]). Follow-up was complete. Prevalence of 0-4 geriatric target areas were 14.9%, 27.3%, 25.2%, 22.3%, and 10.3%, respectively. Number of target areas was significantly associated to hospital admission, length of admission, 30 day mortality, and hospital re-attendance after discharge. Among patients with no target areas 70% lived independent all 360 days after discharge, whereas all patients with ≥3 target areas had some dependency or were dead within 360 days following discharge.

Conclusion: Among older medical ED patients 50% had two or more geriatric target areas which were associated with poor outcome. This highlights the need of geriatric awareness and competences in the ED.

Keywords: Older patients, Geriatric patients, Emergency department, Geriatric emergency medicine, Mortality, Re-hospitalisation.

Strengths and limitations of this study

- This population-based cohort study from a Danish municipality was based on data from several Danish national registers with high quality data
- A major strength was the complete coverage of a large municipality, the complete follow-up, and high data quality
- Home care was registered during delivery giving data a large conformity with reality
- The study was a single centre study which may reduce the generalisability of the results
- Several other geriatric target areas, than the ones used in the present study, exists

INTRODUCTION

In the future we can expect an increase in older patients in the Emergency Department (ED) due to the demographic changes.[1, 2] Increased mortality, institutionalisation, hospital re-attendance, functional impairment, and loss of independency are some of the potential severe outcomes associated with hospitalisation for some of the older patients.[3-8]

The geriatric patient is an older patient, usually 65 years or older, but the definition is not defined by age. Instead, the patients are defined by their characteristics or target areas, which are multi-morbidity with a mixture of age related changes, acute and chronic diseases, and due to this complexity, often derived physical and cognitive impairment combined with polypharmacy and social problems.[9] Geriatric patients often present with non-specific complaints (NSC) like general weakness, immobilisation, confusion, and fall, of common diseases. Among patients presenting with NSC it is difficult to find the right diagnoses and they are in risk of under-triage, admission, and longer admissions.[10-13]

Comprehensive Geriatric Assessment (CGA) is a multidimensional evidence-based assessment that has the potential to improve the prognosis for geriatric patients in hospital settings[14] including the acute setting.[15] It is a balance to identify patients who are neither to well (completely functional independent without medical comorbidities) nor too sick (terminal illness) to benefit from CGA. Also, there is no clear definition of which areas to assess, but major target areas are functional and cognitive capacity, polypharmacy, and medical comorbidities.[16] The prevalence of these geriatric target areas among older patients in the ED is however not known.

Therefore, the objective of this study was to describe the prevalence of geriatric target areas among older patients attending the ED and the prognosis associated with the prevalence of these target areas.

METHOD

Study design and Setting

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

Odense University Hospital in Denmark is a 1,000-bed university teaching hospital with all specialities presented. It is the only ED in this area and it provides 24-hour acute medical care. The ED serves a mixed rural-urban population and has a primary catchment area of 288,200 persons including Odense municipality. Odense municipality has a population of 168,731 adult citizens with 20.0 % being 65 years or older.[17] Patients arrive by ambulance emergency call or are referred from primary care. All acute patients are received through the ED except patients with prehospital identified cardiogenic disease, ongoing nephrogenic-or oncological treatment. The ED uses a four level Adaptive Process Triage (ADAPT) where triage category is assigned based on main complaint and vital signs.[18] The main complaint is registered before any other diagnostic proceedings are done. A total of 40 main complaint categories are used (supplement 1). From the ED patients are either admitted to the hospital or discharged home.

In the Danish healthcare system primary care services are well established and free of charge for all residents. The municipalities deliver all kind of home care services to older and disabled people. Home care consists of general nursing care and care to support activities of daily living. Home care type and amount are based on an individual plan generated in collaboration with a special educated nurse. Staffs do on-location registrations of time and task, and changes are adjusted continuously with one day's notice. Data are automatically transferred to a personal electronic citizen record. The municipality also administer residential care like nursing homes and short time rehabilitation homes.

Participants

All consecutive patients 65 years or older living in Odense municipality with a first time acute medical contact to the ED at Odense University Hospital during the period 1st of November 2013 to 31st of October 2014 were included. Patients dead upon arrival to the ED were excluded.

Data source

The Danish Civil Registration system

The Danish Civil Registration System (CRS) has since 1968 assigned a unique 10-digit civil personal registry number to each Danish citizen at birth and to residents upon immigration. The CRS covers data on deaths, births, migration, municipality of residence, and marital status.[19] The

unique civil personal registry number enables accurate linkage of information from different data sources on an individual level.

The Danish National Patient Register

Since 1995 the Danish National Patient Register has registered all hospital admissions and all ED contacts.[20] The registry contains data regarding date of admission and discharge, discharge diagnosis, and admission department.

The electronic hospital record and the ED logistic system

All patient hospital data are registered and stored at an individual level in the electronic hospital record and the ED logistic tool.

Odense University Pharmacoepidemiological Database

Odense University Pharmacoepidemiological Database (OPED) is a prescription database. It covers the region of Southern Denmark including the municipality of Odense. Information on redeemed prescriptions is reported on an individual basis from community pharmacies. Only drugs that are reimbursed are covered.[21]

The Municipality Citizen-Record

All data on kind and amount of home care and resident type is registered in the Municipality Citizen-Record on an individual day to day level. When residents are in residential care, it is registered as such, with no registration of amount and kind of help delivered.

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.

Geriatric target areas

We defined basic geriatric target areas as impairment, recently increased impairment, polypharmacy, and comorbidity based on Geriatric textbooks, areas assessed in CGA[16], and various descriptions of the geriatric discipline.

Impairment was defined as receiving home care one or more days the last 30 days prior to ED contact or one or more days in residential care.

Recently increased impairment was defined as increased use of home care (minutes) or more days in residential care the last 30 days prior to ED contact compared to the 30 days.

Polypharmacy was defined as intake of five or more medications at ED contact. The number of medications with different ACT-codes (4th level, chemical subgroup) redeemed within 90 days prior to the ED contact were used to calculate the number of medications at ED contact.[21, 22]

Finally, comorbidity was defined as Charlson comorbidity index ≥ 2. Charlson comorbidity index was identified by hospital discharge diagnoses from the previous 10 years.[23, 24]

All baseline variables and outcome variables were calculated and displayed for the whole study population and for five sub-populations depending on the number of defined geriatric target areas.

Baseline characteristics

Baseline characteristics at ED contact were extracted from patient records and population-based registers and included age, gender, marital status, initial triage urgency, vital signs, and main presenting complaint at arrival to the ED.

Patients' marital status was categorised as being with someone if they were married or had a registered partnership and being alone if they were single, divorced, widower, or widow. Urgency category was defined from the initial triage[25] and was dived in two predefined urgency categories: triage level 1 and 2 as "urgent" and triage level 3 and 4 as "less urgent". The 40 main complaints were grouped in two categories "specific complaint" and "non-specific complaint". As Nemec *et al,*[10] we defined a specific complaint as a complaint that provides key information that allows the generation of a working diagnosis and/or treatment protocol e.g. "chest pain", "fever", and "neurological disorder". Of the 40 predefined main complaints the following were defined as non-specific "uncooperative patient", "delirium", "falling", "unspecific illness", "dizziness", and "impaired consciousness" (supplement 1).

Outcome

We assessed the following variables as outcomes: Patient's destination (discharge from the ED or admitted to the hospital), length of admission, in-hospital mortality, 30 days post-discharge

mortality, and hospital re-attendance. Only acute hospital re-attendance like unplanned admission to the hospital or unplanned ED contact was considered in the analyses. Dependency of home care (receiving home care or in residential care) and living independent (community dwelling and not receiving any home care at any day in the presiding period) were also assessed as outcome 360 days after discharge.

Data analysis and statistical methods

Data are presented as total and proportions or as medians with interquartile range [IQR]. Only medians and [IQR] were calculated due to the skewness of the data distributions. Chi-square test was used to test the significance of differences between categorical data. Non parametric test for trend across ordered groups[26] was used to test the significance in trend in ordered quantitative non normal distributed variables.

For conditions considering hospitalisation (discharge from the ED or admitted to the hospital, length of hospital admission (≤ 48 hours or > 48 hours), and in-hospital mortality) we used multivariate logistic regression with numbers of identified geriatric target areas as the independent variable adjusted for predefined variables (age (continues variable), gender, and triage urgency level (categorical variables)).

Following discharge, risk factors for mortality were evaluated by Cox-regression analysis and presented as unadjusted and adjusted hazard ratios (HRs) with 95% confidential intervals (CIs) for the time periods 0-30 days after discharge. Patients were followed to date of death, emigration, or end of follow-up, whichever came first. In the regression analysis we defined numbers of identified geriatric target areas as the independent variable adjusted for predefined variables (age (continues variable), gender, and triage urgency level (categorical variables)).

Risk factors for a new acute hospital re-attendance day 0-30 after discharge were analysed using competing risks methodology with hospital re-attendance as the event of interest and death due to any cause as the competing event. In the competing risk analysis we defined numbers of identified geriatric target areas as the independent variable adjusted for predefined variables (age (continues variable), gender, and triage urgency level (categorical variables)).

Missing data were treated as such. No data were missing on mortality, municipality healthcare, the number of medications, comorbidity, or hospital re-attendance. Data on being alone were missing in

43 patients and data on urgency category were missing in 97 patients. Data on main complaint were missing in 257 patients.

Sensitivity analyses in regression analysis were done with missing data replaced by “urgent” or ”less urgent” for urgency category.

All calculations were performed using Stata Release 15.0 (StataCorp, College Station, TX, USA).

Ethics Committee Approval

The study was approved by the Danish Data Protection Agency (J No 14/19990) and the National Committee on Health Research Ethics (Project-ID S-20140031). The reporting of this study conforms to the STROBE statement.[27]

Patient and Public Involvement

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

RESULTS

Participants

Among the 6,389 first time medical contacts for older patients to the ED in the study period, a total of 3,775 patients were citizens in Odense municipality and included in the study (Figure 1).

Baseline characteristics

Median [IQR] age of all the included patients was 78 years [71-85] and 55 % were female. Median Charlson comorbidity was 1 [0-3], the median number of medications at ED contact was 5 [3-8], and 38.8 % were categorised as urgent at arrival (Table 1). Of the 3,775 patients 14.9 % had no geriatric target areas, 27.3 % had one geriatric target area, 25.2 % had two geriatric target areas, 22.3 % had three geriatric target areas, and 10.3 % had all four geriatric target areas. The most frequent geriatric target area was polypharmacy (64.3 % of the patients), followed by impairment (51.1 %), comorbidity (49.5 %), and recently increased impairment (20.8 %).

Table 1: Baseline characteristics of the total study population stratified according to number of predefined geriatric target areas (impairment, recently increased impairment, polypharmacy, and comorbidity). Presented as number of patients (n), proportions (%), and median [IQR].

	All patients (n=3,775)	**0 geriatric target areas** (n=563)	**1 geriatric target area** (n=1,032)	**2 geriatric target areas** (n=950)	**3 geriatric target areas** (n=840)	**4 geriatric target areas** (n=390)	significance level
Age, median [IQR]	**78** [71-85]	**73** [68-79]	**76** [70-82]	**80** [72-86]	**82.5** [76-88]	**82** [76-87]	**p<0.001** (¤)
Gender, % (n)							
Female	**55.2** (2,083)	**45.1** (254)	**53.0** (547)	**56.8** (540)	**62.5** (525)	**55.6** (217)	**p<0.001** (#)
Male	**44.8** (1,692)	**54.9** (309)	**47.0** (485)	**43.2** (410)	**37.5** (315)	**44.4** (173)	
Marital status, % (n)							
Not alone	**42.1** (1,565)	**59.4** (333)	**49.0** (501)	**39.9** (372)	**26.2** (214)	**38.1** (145)	**p<0.001** (#)
Alone	**57.9** (2,150)	**40.6** (228)	**51.0** (522)	**60.1** (560)	**73.8** (604)	**61.9** (236)	
Urgency category, % (n)							
Less urgent	**61.2** (2,250)	**63.1** (342)	**59.4** (596)	**60.6** (559)	**62.6** (517)	**61.5** (236)	p=0.558 (#)
Urgent	**38.8** (1,428)	**36.9** (200)	**40.6** (407)	**39.4** (364)	**37.4** (309)	**38.6** (148)	
Heart rate, (beats per minute), median [IQR]	**83** [71-97]	**81** [69-97]	**82** [71-95]	**83** [70.5-96]	**85** [74-98]	**84** [73-96]	**p=0.002** (¤)
Systolic blood pressure, (mm Hg), median [IQR]	**141** [122-158]	**147** [130-166]	**143.5** [125-161]	**141** [122-156]	**138** [118-156]	**132** [118-151]	**p<0.001** (¤)
Respiratory rate, (breaths per minute, median [IQR]	**16** [16-20]	**16** [16-18]	**16** [16-20]	**18** [16-20]	**18** [16-20]	**18** [16-22]	**p<0.001** (¤)
Saturation, (%), median [IQR]	**97** [95-98]	**97** [96-99]	**97** [95-99]	**97** [95-98]	**96** [94-98]	**96** [94-98]	**p<0.001** (¤)
Body temperature, (Celsius), median [IQR]	**36.6** [36.1-37.1]	**36.6** [36.1-37.1]	**36.6** [36.1-37.0]	**36.6** [36.2-37.2]	**36.6** [36.2-37.1]	**36.65** [36.2-37.2]	**p=0.023** (¤)
Glasgow Coma Scale, median [IQR]	**15** [15-15]	**15** [15-15]	**15** [15-15]	**15** [15-15]	**15** [15-15]	**15** [15-15]	**p<0.001** (¤)
Length of stay (days) * median [IQR] min-max	**5** [2-9] 1-127	**3** [1-7] 1-127	**4** [2-8] 1-80	**5** [2-9] 1-84	**5** [2-9] 1-53	**6** [3-10] 1-62	**p<0.001** (“)

Chi-square test

¤ Non-parametric test for trend across ordered groups

“ Kruskal-Wallis equality-of-populations rank test

* Only calculated for patients admitted to the hospital. Patient discharged home from the ED had stayed 0-24 hours in the ED

With increasing number of geriatric target areas patients were older, more were female, and more were alone. In parallel, there was a trend that patients with a high number of geriatric target areas had a higher respiratory rate, higher body temperature, higher heart rate, lower arterial oxygen saturation, lower systolic blood pressure, and lower Glasgow Coma Scale, but no difference were observed in the median of Glasgow Coma Scale and body temperature. There was no change in triage urgency category in relation to the number of geriatric target areas (Table 1).

At arrival to the ED 11 % of patients were registered with non-specific complaints. No differences were seen in the distribution of specific and non-specific complaints across different numbers of geriatric target areas. Details are presented in supplement 1.

Outcome

Follow up was complete. No patients were lost to follow up

An increasing amount of geriatric target areas were significantly associated to increasing odds for admission to the hospital, hospital stay > 48 hours, and in-hospital mortality (Table 2). Compared to patients with no geriatric target areas patients with four geriatric target areas had an odds ratio (OR) of 2.49 (95 % CI: (1.83-3.38)) for admission to the hospital, an OR of 1.80 (95 % CI: (1.19-2.27)) for admission lasting over 48 hours, and an OR of 6.11 (95 % CI: (3.01-12.40)) for dying during hospitalisation (Table 2).

Table 2: Geriatric target areas (impairment, recently increased impairment, polypharmacy, and comorbidity) as risk factor for patient's destination, length of admission (only patient admitted), and in-hospital mortality illustrated by crude and adjusted odds ratio (OR)

	Admitted to hospital			Admission > 48 hours #			Dead in-hospital		
	% (n)	Crude OR (95 % CI)	Adjusted OR (95 % CI) §	% (n)	Crude OR (95 % CI)	Adjusted OR (95 % CI) §	% (n)	Crude OR (95 % CI)	Adjusted OR (95 % CI)§
Geriatric target areas									
0 (n=563)	**57.0** (321)	1 (ref)	1	**73.8** (237)	1	1	**3.4** (19)	1	1
1 (n=1,032)	**63.5** (655)	**1.31** (1.06-1.62)	**1.24** (1.00-1.54)	**76.5** (501)	**1.15** (0.85-1.57)	**1.15** (0.83-1.58)	**4.8** (49)	**1.43** (0.83-2.45)	**2.09** (1.03-4.21)
2 (n=950)	**68.2** (648)	**1.62** (1.30-2.01)	**1.46** (1.17-1.83)	**80.9** (524)	**1.50** (1.09-2.06)	**1.44** (1.03-2.01)	**6.3** (60)	**1.93** (1.14-2.45)	**2.39** (1.18-4.82)
3 (n=840)	**73.8** (620)	**2.12** (1.69-2.67)	**1.90** (1.50-2.42)	**83.1** (515)	**1.74** (1.26-2.41)	**1.59** (1.13-2.25)	**9.4** (79)	**2.97** (1.78-3.27)	**3.97** (2.00-7.89)
4 (n=390)	**78.7** (307)	**2.79** (2.08-3.74)	**2.49** (1.83-3.38)	**85.0** (261)	**2.01** (1.35-3.00)	**1.80** (1.19-2.72)	**12.6** (49)	**4.11** (2.38-7.11)	**6.11** (3.01-12.40)

§ Logistic regression adjusted for age (continues variable), gender, and triage urgency (categorical variables). Odds ratios for gender, age, and urgency are displayed in supplement 2.
# only patients admitted are included in this analysis

In the multivariate analysis increasing number of geriatric target areas increased the hazard ratio for 30 days post-discharge mortality up to 4 times for patients with four target areas compared to patients with no target areas (Table 3). In the adjusted multivariate competing risk analysis for a new acute hospital re-attendance increasing numbers of geriatric target areas increased the risk of 30 days hospital re-attendance with 2.40 (95 % CI: (1.70-3.38)) for patients with four geriatric target areas compared to patients with no geriatric target areas (Table 3).

Table 3: Prognostic factors of 30 days mortality and 30 days acute hospital re-attendance in older patients after discharge from an acute Emergency Department contact. We defined basic geriatric target areas as impairment, recently increased impairment, polypharmacy, and comorbidity.

	Mortality 0-30 days			Acute hospital re-attendance 0-30 days		
	% (n)	Crude HR* (95 % CI)	Adjusted HR (95 % CI)§	% (n)	Crude SHR# (95 % CI)	Adjusted SHR (95 % CI)¤
Geriatric target areas						
0 (n=544)	**2.2** (12)	1 (ref)	1	**10.3** (56)	1	1
1 (n=983)	**2.5** (25)	**1.16** (0.58-2.30)	**1.13** (0.56-2.31)	**12.5** (123)	**1.23** (0.90-1.69)	**1.22** (0.88-1.68)
2 (n=890)	**5.4** (48)	**2.49** (1.32-4.68)	**2.09** (1.08-4.07)	**15.3** (136)	**1.52** (1.11-2.07)	**1.48** (1.07-2.03)
3 (n=761)	**6.7** (51)	**3.10** (1.65-5.82)	**2.41** (1.24-4.71)	**19.3** (147)	**1.95** (1.44-2.65)	**1.91** (1.39-2.63)
4 (n=341)	**10.6** (36)	**5.02** (2.61-9.64)	**3.85** (1.93-7.68)	**23.8** (81)	**2.45** (1.74-3.43)	**2.40** (1.70-3.38)

* HR = Hazard ratio
§ Cox proportional hazard model adjusted for age as continuous variable and number of geriatric target areas, gender, and triage urgency as categorical variable.
# SHR = Sub-hazard ratio
¤ Competing-risks regression model adjusted for age (continuous variable) and number of geriatric target areas, gender, and triage urgency as categorical variable
(HR and SHR for gender, age, and urgency are displayed in supplement 3)

Sensitivity analysis for missing data did not show any significant differences for odds ratio, hazard ratio, or sub-hazard ratio.

Mortality from index contact to 30 days after discharge was 11.3 % (n=428) for all patients, and for patients with 0-4 geriatric target areas 5.5 % (n=31), 7.2 % (n=74), 11.4 % (n=108), 15.5 % (n=130), and 21.8 % (n=85) respectively.

Figure 2 presents patient status within the first 30 and 360 days after discharge. Among patients with no geriatric target areas at arrival to the ED 70 % of patients lived independent all 360 days after discharge, 53 % of patients with one geriatric target area, 26 % of patients with two geriatric target areas, and none of the

patients with three or four geriatric target areas lived independently 360 days after discharge (Figure 2). Among all patients discharged alive (n=3,519) the mortality proportion 360 days after discharge were 20.6 %. A total of 38.7 % of the patients with four geriatric target areas at arrival to the ED were dead 360 days after discharge (Figure 2).

DISCUSSION

Our study showed that more than 50 % of all patients 65 years or older attending the ED with an acute medical complaint had two or more geriatric target areas. Furthermore, the amount of target areas was closely related to prognosis. By assigning four basic geriatric target areas to patients we were able to identify patients at high risk of admission, long hospital stay, in-hospital mortality, post-discharge mortality, acute hospital re-attendance, and loss of independency.

These findings correspond well with other studies assessing functional dependency, comorbidity, and polypharmacy as predictors of severe outcomes like in-hospital mortality, long hospital stay, post-discharge mortality, and hospital re-attendance.[4, 28-31]

The aim of this study was not to produce a scoring tool showing when older ED patients should receive specialist assessment like CGA, but to describe the size of the problem and a possible future approach that might be useful to identify geriatric patients in the ED. We used easy accessible data already available at ED contact to identify the geriatric target areas. This might be effective in the time restricted setting since no direct assessment is needed to identify these areas, and information is insured even if patients are cognitively impaired.

As the proportion of older patients in the ED rises with the demographic changes the importance of geriatric assessment and geriatric emergency medicine increases. Different ways of implementing geriatric emergency medicine exist. Generation of special geriatric EDs, like paediatric EDs and psychiatric EDs[32-34] or increasing the geriatric knowledge among ED physicians[35-37] are two possibilities. However, a great effort, at least in Denmark, has been done to unite the reception of acute patients at one place, to ensure the same level of treatment regardless of time and place.[38] Education of ED physicians increase their knowledge but the effect has been shown to be limited.[39, 40] A third model of geriatric emergency is the presence of geriatricians in the ED and a two-step procedure to identify geriatric patients at risk of poor outcome and subsequently applying full geriatric assessment.[41, 42] If we apply a purely age related visitation to geriatric assessment the patients in most need of geriatric healthcare skills might not be identified. Instead, a "need related" visitation seems more accurate.[43] How to identify the patients in need of geriatric assessment remains unclear. Using frailty scales, geriatric syndromes, or non-specific presentation as risk-stratification tools might be a possibility.[44, 45] Several frailty rating scales exists and screening appears to predict the risk of some but not all adverse outcome,[46, 47] but the definition of the frail patient is ambiguously and the lack of intervention studies questions the effectiveness of screening.[48, 49] Furthermore, some of these scales are time consuming, not designed for patients in different clinical stats, and requires well-trained clinicians or information not easy available, all compromising the feasibility and accuracy of these scales.[48, 50, 51]

The prevalence of NSC varies between studies from 5.5- 21 %[10, 52, 53] and is more common in frail older patients.[54] In our study, the prevalence of older patients presenting with NSC were 11%. This might be due to differences in the study populations. Vanpee *et al.*[52] only included patients 75 years or older and Nemec *et al.*[10] only included patients in the medium triage category. We included all patients ≥ 65 years. We were not able to find a difference in the prevalence according to numbers of geriatric target areas but among patients with functional impairment a higher prevalence of NSC were found (data not shown). This might be because functional impairment and presentation with NSC are somehow related.[55] Studies reporting the prognosis of patients presenting to the ED with NSC are conflicting.[10, 53, 56] We were not able to show an increased risk of neither in-hospital nor 30 days mortality in patients with NSC compared to patients with more specific complains (data nor shown).

Trends seen in the systolic blood pressure, respiratory rate, heart rate, and arterial oxygen saturation across increasing number of target areas corresponds with what is known regarding vital sign in older age.[57] However, abnormal or normal vital signs in older patients should always be interpreted with caution since age related impaired physical regulation, common illness, and medications taking by older often affects the range of vital signs.[57] Even though we found a trend, the observed differences among groups did not yield clinical meaningful differences.

With our study we can emphasise the importance of awareness on geriatric competencies in the ED. Geriatricians in the ED and initiatives like the acute frailty network[58] increases the knowledge of the special needs and care of a growing population, but also more formal training and knowledge seems important to be imposed to all ED clinicians.[44, 59]

Limitations and strengths

The strengths of this study were the longitudinal cohort design, the large sample size, and the accurate cross-sectional linkage between prehospital healthcare data, hospital data, and healthcare population-based registries. To minimise bias, we included all consecutive medical ED contacts, the proportion of missing data was very low, and follow-up was complete. Home care was always and only registered if it was delivered, giving data a large conformity with reality.

Our study also had some limitations. Firstly, it is a Danish single centre study and should be interpreted as such. Secondly, Charlson comorbidity index was calculated from information on 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. Also, Charlson comorbidity do not include common comorbidities seen in older patients like osteoporosis, hypertension, and atrial fibrillation and defining comorbidity as Charlson comorbidity index ≥ 2 might also lead to under-reporting. However, it has been shown that the validity of using Danish National health registers to calculate Charlson comorbidity index is

good and that it is a good predictor of mortality and functional impairment even among nursing home patients.[24, 60, 61] Thirdly, categorisation of patients not receiving home care as not functional impaired might be misleading. They might have a heathy spouse taking care of them. Fourthly, OPED only covers reimbursed medications and not drugs that are dispensed over the counter. This might lead to risk of under-reporting of number of medications taken. Finally, several of the covariate estimates changed direction during the modelling process which suggests collinearity issues or possible effect modification in the multivariate analysis and the results has to be interpreted with this in mind.

CONCLUSION

Among the older medical ED population the prevalence of patients with geriatric target areas is high and associated with severe hospital and post-discharge outcomes. Since previous studies have shown that specialised geriatric assessment improves the prognosis for frail older patients this highlights the need of geriatric awareness and competences in the ED. The literature supports the presence of geriatricians in existing ED's and thereby implying the principles of geriatric medicine in the acute setting. However, more effort is needed to precisely identify geriatric patients and the effect of applying geriatric assessment of ED patients on both patients and service outcome.

Author Contributors

All authors participated in the design of the study. AT performed the statistical analyses in a dialogue with ATL, JR, and JUR. AT wrote the manuscript. All authors were involved in the interpretation of data and the critical revision of the manuscript. AT had the primary responsibility for the final content. All authors read and approved the final manuscript.

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Competing interest

The authors have declared that no conflict of interest exists.

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The funders had no involvement in the study design, in the collection, analysis and interpretation of the data, in the writing of the report, or in the decision to submit the paper for publication.

Data sharing statement:

Due to the Danish Law on personal data, we are not allowed to share data in a public dataset. Access to data from the Danish Health Data Authority requires approval from the Danish Data Protection Agency: https://www.datatilsynet.dk/english/the-danish-data-protection-agency/introduction-to-the-danish-data-protection-agency/

For access and sharing of data and materials please contact the corresponding author or the Research Service at the Department of Clinical Research, University of Southern Denmark, 5000 Odense C. Phone: +45 65504051 and we will help you with the process and following provide access to the dataset.

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LEGENDS

Figure 1: Flowchart of patients included in the study period.

Figure 2: The proportion of patients discharged alive who died, were dependent on home care, or were independent of home care in the 30 days and 360 days period after discharge in relation to number of geriatric target areas (impairment, recently increased impairment, polypharmacy, and comorbidity)

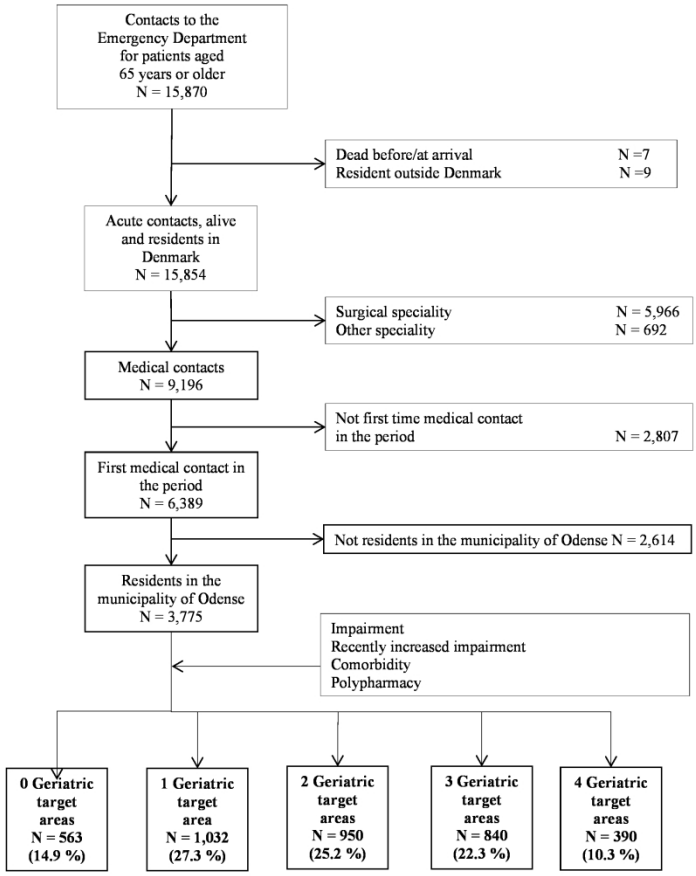

Figure 1: Flowchart of patients included in the study period.

209x297mm (300 x 300 DPI)

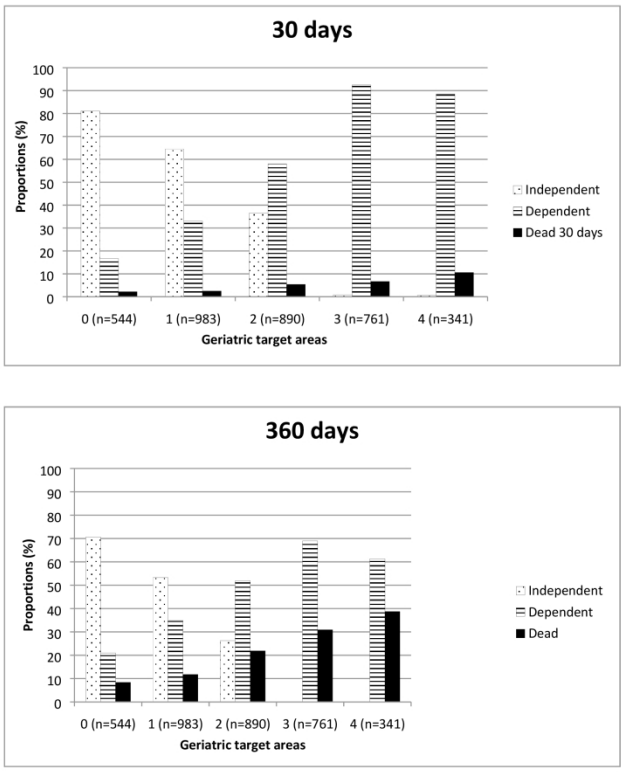

Figure 2: Stratifying for age-categories, the proportion of patients discharged alive who died, stayed in residential care, received home care, or lived independent in the 360 days period after discharge in relation to level of municipality healthcare the 30 days before index ED contact.

209x297mm (300 x 300 DPI)

Supplement 1

(A) Distribution of specific complaints and non-specific complaints according to number of geriatric target areas.
(B) Distribution of main complaint according to number of geriatric target areas and categorisation of main complaints in to specific complaints and non-specific complaints

A			**All patients** n=3,775	**0 geriatric target areas** n=563	**1 geriatric target area** n=1,032	**2 geriatric target areas** n=950	**3 geriatric target areas** n=840	**4 geriatric target areas** n=390
		Specific complaint	88.9 % (n=3,129)	88.8 % (n=459)	89.5 % (n=861)	89.0 % (n=783)	88.5 % (n=706)	88.6 % (n=320)
		Non-specific complaint	11.1 % (n=389)	11.2 % (n=58)	10.5 % (n=101)	11.0 % (n=97)	11.5 % (n=92)	11.4 % (n=41)
B								
Specific complain	Non-specific complaint	Main complaint:	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
X		Airway symptoms	643 (18.3)	61 (11.8)	140 (14.6)	177 (20.1)	185 (23.2)	80 (22.2)
X		Neurological disorder	398 (11.3)	66 (12.8)	144 (15.0)	89 (10.1)	74 (9.3)	25 (6.9)
X		Fever	370 (10.5)	54 (10.4)	87 (9.0)	87 (9.9)	96 (12.0)	46 (12.7)
X		Faint	284 (8.1)	61 (11.8)	93 (9.7)	62 (7.1)	46 (5.8)	22 (6.1)
X		Laboratory deviances	270 (7.7)	28 (5.4)	53 (5.5)	77 (8.8)	82 (10.3)	30 (8.31)
X		Chest pain	262 (7.5)	49 (9.5)	87 (9.0)	65 (7.4)	43 (5.4)	18 (5.0)
X		Abdominal pain	197 (5.6)	36 (7.0)	55 (5.7)	49 (5.6)	39 (4.9)	18 (5.0)
	X	Impaired consciousness	176 (5.0)	19 (3.7)	46 (4.8)	46 (5.2)	47 (5.9)	18 (5.0)
	X	Dizziness	120 (3.4)	32 (6.2)	30 (3.1)	29 (3.3)	20 (2.5)	9 (2.5)
X		Pain in back and loin	78 (2.2)	15 (2.9)	24 (2.5)	18 (2.1)	13 (1.6)	8 (2.2)
X		Gastrointestinal bleeding, upper	75 (2.1)	3 (0.6)	20 (2.1)	24 (2.7)	18 (2.3)	10 (2.8)
X		Pain in extremity	75 (2.1)	10 (1.9)	19 (2.0)	20 (2.3)	17 (2.1)	9 (2.5)
	X	Unspecific illness	72 (2.1)	6 (1.2)	20 (2.1)	15 (1.7)	21 (2.6)	10 (2.8)
X		Glucose deviances	62 (1.8)	2 (0.4)	14 (1.5)	19 (2.2)	16 (2.0)	11 (3.1)
X		Headache	46 (1.3)	12 (2.3)	20 (2.1)	8 (0.9)	5 (0.6)	1 (0.3)
X		Wounds	45 (1.3)	2 (0.4)	12 (1.3)	11 (1.3)	10 (1.3)	10 (2.8)
X		Convulsions	44 (1.3)	8 (1.6)	14 (1.5)	13 (1.5)	7 (0.9)	2 (0.6)
X		Palpitation	41 (1.2)	12 (2.3)	16 (1.7)	9 (1.0)	3 (0.4)	1 (0.3)
X		Poisoning	36 (1.0)	4 (0.8)	10 (1.0)	11 (1.3)	5 (0.6)	6 (1.7)
X		Allergy/anaphylaxis	53 (1.0)	12 (2.3)	10 (1.0)	6 (0.7)	5 (0.6)	2 (0.6)
X		High blood pressure	33 (0.9)	10 (1.9)	12 (1.3)	4 (0.5)	5 (0.6)	2 (0.6)
X		Pain and symptoms from urinary tract	32 (0.9)	5 (1.0)	4 (0.4)	8 (0.9)	11 (1.4)	4 (1.1)

X		Diarrhoea or/and vomiting	22 (0.6)	1 (0.2)	2 (0.2)	5 (0.6)	9 (1.1)	5 (1.4)
X		Cardiac dyspnoea	18 (0.5)	1 (0.2)	8 (0.8)	3 (0.3)	2 (0.3)	4 (1.1)
	X	Falling	15 (0.4)	1 (0.2)	4 (0.4)	6 (0.7)	2 (0.3)	2 (0.6)
X		Hip pain	13 (0.4)	1 (0.2)	1 (0.1)	6 (0.7)	4 (0.5)	1 (0.3)
X		Head trauma	9 (0.3)	1 (0.2)	3 (0.3)	1 (0.1)	2 (0.3)	2 (0.6)
X		Extremity trauma	8 (0.2)	0 (0.0)	2 (0.2)	2 (0.2)	2 (0.3)	2 (0.6)
X		Cardiac arrest	8 (0.2)	0 (0.0)	5 (0.5)	0 (0.0)	3 (0.4)	0 (0.0)
	X	Delirium	6 (0.2)	0 (0.0)	1 (0.1)	1 (0.1)	2 (0.3)	2 (0.6)
X		Peripheral oedema	6 (0.2)	1 (0.2)	1 (0.1)	2 (0.2)	2 (0.3)	0 (0.0)
X		Gastrointestinal bleeding, lower	4 (0.1)	1 (0.2)	1 (0.1)	1 (0.1)	1 (0.1)	0 (0.0)
X		Suicidality or self-harming	4 (0.1)	1 (0.2)	3 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)
X		Swallowing difficulties	4 (0.1)	1 (0.2)	0 (0.0)	2 (0.2)	1 (0.1)	0 (0.0)
X		Acute psychosis	2 (0.1)	1 (0.2)	0 (0.0)	1 (0.1)	0 (0.0)	0 (0.0)
X		Abstinence	2 (0.1)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)	0 (0.0)
X		Pain in scrotum	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.3)
X		Thorax trauma	2 (0.1)	0 (0.0)	0 (0.0)	2 (0.2)	0 (0.0)	0 (0.0)
	X	Uncooperative patient	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
X		Surgical abscess	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

Supplement 2

Gender, age, and triage urgency as risk factor for patient's destination, length of admission (only patient admitted), and in-hospital mortality showed by crude and adjusted odds ratio (OR)

	Admitted to hospital			Admission > 48 hours #			Dead in-hospital		
	% (n)	Crude OR (95 % CI)	Adjusted OR (95 % CI) §	% (n)	Crude OR (95 % CI)	Adjusted OR (95 % CI) §	% (n)	Crude OR (95 % CI)	Adjusted OR (95 % CI)§
Gender									
Female (n=2,083)	**67.2** (1,400)	1 (ref)	1	**80.3** (1,124)		1	**6.4** (134)	1	1
Male (n=1,692)	**68.0** (1,151)	**1.04** (0.90-1.19)	**1.17** (1.02-1.36)	**79.4** (914)	**0.95** (0.78-1.15)	**0.99** (0.81-1.22)	**7.2** (122)	**1.13** (0.88-1.46)	**1.45** (1.08-1.93)
Age		**1.03** (1.02-1.04)	**1.02** (1.02-1.04)		**1.02** (1.01-1.03)	**1.02** (1.00-1.03)		**1.04** (1.03-1.06)	**1.04** (1.02-1.06)
Urgency									
Less urgent (n=2,250)	**65.2** (1,468)	1	1	**82.4** (1,209)	1	1	**4.0** (89)	1	1
Urgent (n=1,428)	**71.3** (1,018)	**1.32** (1.72-2.05)	**1.35** (1.17-1.56)	**78.1** (795)	**0.76** (0.63-0.93)	**0.78** (0.64-0.95)	**8.6** (123)	**2.29** (1.73-3.03)	**2.39** (1.80-3.18)

§ Logistic regression adjusted for age (continues variable), gender, triage urgency, and number of geriatric target areas (all as categorical variables)

only patients admitted are included in this analysis

Supplement 3

Gender, age, and triage urgency as prognostic factors of 30 days mortality and 30 days acute hospital re-attendance in older patients after discharge from an acute Emergency Department contact

	Mortality 0-30 days			Acute hospital re-attendance 0-30 days		
	% (n)	Crude HR* (95 % CI)	Adjusted HR (95 % CI)§	% (n)	Crude SHR# (95 % CI)	Adjusted SHR (95 % CI)¤
Gender						
Female (n=1,949)	**5.0** (98)	1 (ref)	1	**16.1** (314)	1 (ref)	1
Male (n=1,570)	**4.7** (74)	**0.93** (0.69-1.27)	**1.18** (0.86-1.63)	**14.6** (229)	**0.90** (0.76-1.07)	**1.03** (0.89-1.19)
Age		**1.06** (1.04-1.08)	**1.05** (1.03-1.07)		**1.01** (1.00-1.02)	**0.99** (0.98-1.00)
Urgency						
Less urgent (n=2,161)	**4.9** (105)	1	1	**15.6** (338)	1	1
Urgent (n=1,305)	**4.9** (64)	**1.01** (0.73-1.39)	**1.06** (0.77-1.46)	**15.1** (197)	**0.96** (0.80-1.14)	**0.97** (0.83-1.12)

* HR = Hazard ratio
§ Cox proportional hazard model adjusted for age as continuous variable and number of geriatric target areas, gender, and triage urgency as categorical variable.
# SHR = Sub-hazard ratio
¤ Competing-risks regression model adjusted for age (continuous variable) and number of geriatric target areas, gender, and triage urgency as categorical variable

STROBE 2007 (v4) checklist of items to be included in reports of observational studies in epidemiology*

Checklist for cohort, case-control, and cross-sectional studies (combined)

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any pre-specified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4-5
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	5
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	The study was not matched
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*6-7*
Bias	9	Describe any efforts to address potential sources of bias	13-14
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	8
		(*b*) Describe any methods used to examine subgroups and interactions	7-8
		(*c*) Explain how missing data were addressed	8
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed	13-14 (complete

		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy	follow up)
		(*e*) Describe any sensitivity analyses	11
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	10
		(b) Give reasons for non-participation at each stage	Figure 1
		(c) Consider use of a flow diagram	Figure 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	10
		(b) Indicate number of participants with missing data for each variable of interest	9
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	10
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	10-11
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	-
		Cross-sectional study—Report numbers of outcome events or summary measures	-
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Table 2,3
		(*b*) Report category boundaries when continuous variables were categorized	10-11 and Table 2,3,
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	11
Discussion			
Key results	18	Summarise key results with reference to study objectives	11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13-14
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	12-13
Generalisability	21	Discuss the generalisability (external validity) of the study results	13-14
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	15

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.
Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Disability and morbidity among older patients in the Emergency Department – A Danish population based cohort study

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Disability and morbidity among older patients in the Emergency Department – A Danish population based cohort study

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ABSTRACT

Objectives: The objective was to describe the prevalence of geriatric conditions among older medical patients in the Emergency Department (ED) and the association with admission, mortality, re-attendance, and loss of independency.

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 one year period (November 2013 to November 2014).

Primary and secondary outcome measures: Based on information from healthcare registers we defined geriatric conditions as disability, recently increased disability, polypharmacy, and comorbidity. Outcomes were admission, length of admission, 30 days post-discharge mortality, 30 days hospital re-attendance, and home care dependency 0-360 days following ED contact.

Results: Totally, 3,775 patients (55% women) were included, age 78 [71-85] years (median [IQR]). No patients were lost to follow-up. The prevalence of 0-4 geriatric conditions was 14.9%, 27.3%, 25.2%, 22.3%, and 10.3%, respectively. The number of conditions was significantly associated with hospital admission, length of admission, 30 days post-discharge mortality, and 30 days hospital re-attendance. Among patients with no geriatric conditions 70% lived independent all 360 days after discharge, whereas all patients with ≥3 conditions had some dependency or were dead within 360 days following discharge.

Conclusion: Among older medical patients in the ED 50% had two or more geriatric conditions which were associated with poor health outcomes. This highlights the need for studies of the effect of geriatric awareness and competences in the ED.

Keywords: Cohort study, Older patients, Frailty, Emergency department, Mortality, Re-hospitalisation.

Strengths and limitations of this study

- This population-based cohort study from a Danish municipality was based on data from several Danish national registers with high quality data
- A major strength was the complete coverage of a large municipality, the complete follow-up, and high data quality
- Home care was registered during delivery giving data a large conformity with reality
- The study was a single centre study which may reduce the generalisability of the results
- Several other geriatric conditions, than the ones used in the present study, exist

INTRODUCTION

In the future we can expect an increase in the proportion of older medical patients in the Emergency Department (ED) due to the demographic changes.[1, 2] Increased mortality, institutionalisation, hospital re-attendance, functional impairment, and loss of independency are some of the potential severe outcomes associated with hospitalisation for some of these older patients.[3-8]

Comprehensive Geriatric Assessment (CGA) is a multidimensional evidence-based assessment that has the potential to improve the prognosis for geriatric patients in the hospital settings[9] including the acute settings.[10] It is a balance to identify patients who are neither too well (completely functional independent without medical comorbidities) nor too sick (terminal illness) to benefit from CGA.[11]

Geriatric patients are usually 65 years or older but are not solely defined by age. Instead, geriatric patients are better characterised by the presence of acute and chronic diseases combined with age related changes, polypharmacy, and social problems and due to these combinations often derived physical and cognitive impairment.[12] About 25 % of older patients in the ED have cognitive impairment as a result of delirium, dementia, or both,[13] polypharmacy is present in 37 %, and 39 % have functional decline before the ED contact.[14] Geriatric patients often present with non-specific complaints like general weakness, immobilisation, confusion, or fall. Among patients presenting with non-specific complaints it is difficult to identify the correct diagnose and these patients are at risk of wrong triage, admission, and longer hospital stay.[15-18] The presence of medical, physical, cognitive, and social problems make geriatric patients vulnerable (frail) and in an increased risk of poor health outcomes when encountering the ED.[12] During the past decade, frailty has been the focus of intense research in risk prediction and a large number of risk or frailty indices have been developed.[19] Depending on the population, setting, and the definition 5-30 % of the patients in the ED are characterised as frail.[20, 21] Most indices, including validated indices used in the ED,[22-25] uses geriatric areas like disability (cognitive and physical), polypharmacy, and comorbidity when evaluating frailty.[19] Furthermore, these areas are also major areas targeted in CGA.[11]

The cumulated prevalence of these geriatric target areas among older patients in the ED is not well known. Therefore, the objective of this study was to describe the prevalence of geriatric target areas among older medical patients attending the ED and the prognosis associated with these target areas.

METHOD

Study design and Setting

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

Odense University Hospital in Denmark is a 1,000-bed university teaching hospital with all specialties represented including geriatric medicine. The ED serves a mixed rural-urban population and has a primary catchment area of 288,200 persons including Odense municipality. It is the only ED in this area and it provides 24-hour acute medical care. Odense municipality has a population of 168,731 adult citizens with 20 % being 65 years or older.[26] Patients arrive by ambulance following an emergency call or are referred from primary care. All acute patients are received in the ED except patients with prehospital identified cardio-vascular disease, ongoing nephrological or oncological treatment. The ED uses a four level Adaptive Process Triage (ADAPT) where triage category is assigned based on main complaint and vital signs.[27] The main complaint is registered before any diagnostic proceedings are performed. A total of 40 main complaint categories are used (supplement 1). From the ED, patients are either admitted to in-hospital treatment or discharged home.

In the Danish healthcare system, primary care services are well established and free of charge for all residents. The municipalities deliver all kind of home care services to older or disabled people. Home care consists of general nursing care and care to support activities of daily living. Type and amount of home care are based on an individual plan generated in collaboration with a specialised nurse. Staffs do on-location registration of time and task, and changes are adjusted continuously with one day's notice. Data are automatically transferred to a personal electronic citizen record. The municipality also administers residential care like permeant and temporary nursing homes.

Participants

All consecutive patients 65 years or older living in Odense municipality with a first time acute medical contact to the ED at Odense University Hospital during the period 1st of November 2013 to 31st of October 2014 were included. Patients dead upon arrival to the ED were excluded.

Data source

The Danish Civil Registration system

The Danish Civil Registration System (CRS) has since 1968 assigned a unique 10-digit civil personal registry number to each Danish citizen at birth and to residents upon immigration. The CRS covers data on deaths, births, migration, municipality of residence, and marital status.[28] The unique civil personal registry number enables accurate linkage of information from different data sources on an individual level.

The Danish National Patient Register

Since 1995 the Danish National Patient Register has registered all hospital admissions and all ED contacts.[29] The registry contains data regarding date of admission and discharge, discharge diagnosis, and admission department.

The electronic hospital record and the ED logistic system

All patient related data are registered and stored at an individual level in the electronic hospital record and the ED logistic tool.

Odense University Pharmacoepidemiological Database

Odense University Pharmacoepidemiological Database is a prescription database. It covers the region of Southern Denmark including the municipality of Odense. Information on redeemed prescriptions are reported on an individual basis from community pharmacies. Only drugs that are reimbursed are covered.[30]

The Municipality Citizen-Record

All data on type and amount of home care and resident type are registered in the Municipality Citizen-Record on an individual day to day level. When residents are in residential care, it is registered as such, with no registration of type or amount of help delivered.

Data variables

If a patient had more acute medical ED contacts in the study period, only the first contact was included as the index contact.

Geriatric target areas

We defined geriatric target areas as disability, recently increased disability, polypharmacy, and comorbidity based on frailty indices,[22-25] Geriatric textbooks, areas assessed in CGA,[11] and various descriptions of the geriatric discipline.

Disability was defined as receiving home care one or more days the last 30 days prior to ED contact or one or more days spent in residential care.

Recently increased disability was defined as increased use of home care (minutes) or more days spent in residential care the last 30 days prior to ED contact compared to the previous 30 days.

Polypharmacy was defined as intake of five or more medications at ED contact. The number of medications with different ACT-codes (4th level, chemical subgroup) redeemed within 90 days prior to the ED contact were used to calculate the number of medications at ED contact.[30, 31]

Finally, comorbidity was defined as Charlson comorbidity index ≥ 2. Charlson comorbidity index was identified by hospital discharge diagnoses from the previous 10 years.[32, 33]

All baseline variables and outcome variables were calculated and displayed for the whole study population and for five sub-populations depending on the number of defined geriatric target areas (zero, one, two, three, four, or five).

Baseline characteristics

Baseline characteristics at ED contact included age, gender, marital status, initial triage urgency, vital signs, and main presenting complaint at arrival to the ED. Data were extracted from patient records and population-based registers.

Patients' marital status was categorised as "being with someone" if they were married or had a registered partnership and "being alone" if they were single, divorced, widower, or widow. Urgency category was defined from the initial triage[34] and was divided in two predefined urgency categories: triage level 1 and 2 as "urgent" and triage level 3 and 4 as "less urgent". The 40 main complaints were grouped in two categories "specific complaint" and "non-specific complaint". As Nemec *et al,*[17] we defined a specific complaint as a complaint that provides key information that allows the generation of a working diagnosis and/or treatment protocol e.g. "chest pain", "fever", or "neurological disorder". Following this, of the 40 predefined main complaints we defined the

following as non-specific complaints "uncooperative patient", "delirium", "falling", "unspecific illness", "dizziness", and "impaired consciousness" (supplement 1).

Outcome

We assessed the following variables as outcomes: Patient's destination (discharged from the ED or admitted to the hospital), length of admission, in-hospital mortality, 30 days post-discharge mortality and hospital re-attendance, and 360 days post-discharge dependency of home care (receiving home care or in residential care) and living independent (community dwelling and not receiving any home care at any day in the preceding period). Only acute hospital re-attendance (unplanned admission to the hospital or unplanned ED contact) was included in the analyses.

Data analysis and statistical methods

Data are presented as total and proportions or as medians with interquartile range [IQR]. Only medians and [IQR] were calculated due to the skewness of the data distributions. Chi-square test was used to test the significance of differences between categorical data. Nonparametric test for trend across ordered groups[35] was used to test the significance in trend in ordered quantitative non-normal distributed variables.

For conditions considering hospitalisation (discharge from the ED or admitted to the hospital, length of hospital admission (≤ 48 hours or > 48 hours), and in-hospital mortality) we used multivariate logistic regression with numbers of identified geriatric target areas as the independent variable adjusted for predefined variables (age (continuous variable), gender, marital status, and triage urgency level (categorical variables)). The dichotomisation of admission length into ≤ 48 hours and > 48 hours of admission was chosen due to the organisation of admissions in the ED of Odense University Hospital. When patients are expected to have a short admission (≤ 48 hours) they are admitted to a short time observation unite placed in relation to the ED. Patients with expected > 48 hours of admission are admitted to an in-hospital ward. If patients with expected short admission are in need of a longer admission, they are transferred to an in-hospital ward. This division into short-and long stay units is also seen in other hospitals.[36]

Following discharge, risk factors for mortality were evaluated by Cox-regression analysis and presented as unadjusted and adjusted hazard ratios (HRs) with 95 % confidential intervals (CIs) for the time period 0-30 days after discharge. Patients were followed to date of death, emigration, or

end of follow-up, whichever occurred first. In the regression analysis, we defined numbers of identified geriatric target areas as the independent variable adjusted for predefined variables (age (continuous variable), gender, marital status, and triage urgency level (categorical variables)).

Risk factors for a new acute hospital re-attendance 0-30 days after discharge were analysed using competing risks methodology with hospital re-attendance as the event of interest and death due to any cause as the competing event. In the competing risk analysis, we defined numbers of identified geriatric target areas as the independent variable adjusted for predefined variables (age (continuous variable), gender, marital status, and triage urgency level (categorical variables)).

Missing data were treated as such. No data were missing on mortality, municipality healthcare, number of medications, comorbidity, and hospital re-attendance. Data on marital status were missing in 43 patients and data on urgency category were missing in 97 patients. Data on main complaint were missing in 257 patients.

Sensitivity analyses in regression analysis were done with missing data on urgency replaced by "urgent" or "less urgent" for urgency category and with missing data on marital status replaced by "being alone" and "not alone".

All calculations were performed using Stata Release 15.0 (StataCorp, College Station, TX, USA).

Ethics Committee Approval

The study was approved by the Danish Data Protection Agency (J No 14/19990) and the National Committee on Health Research Ethics (Project-ID S-20140031). The reporting of this study conforms to the STROBE statement.[37]

Patient and Public Involvement

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

RESULTS

Participants

Among the 6,389 first time medical contacts for older patients to the ED in the study period, a total of 3,775 patients were citizens in Odense municipality and included in the study (Figure 1).

Baseline characteristics

Median [IQR] age of included patients was 78 [71-85] years and 55 % were female. Median Charlson comorbidity was 1 [0-3], the median number of medications at ED contact was 5 [3-8], and 38.8 % were categorised in the triage as urgent at arrival (Table 1). Of the 3,775 patients, 14.9 % had no geriatric target areas, 27.3 % had one geriatric target area, 25.2 % had two geriatric target areas, 22.3 % had three geriatric target areas, and 10.3 % had all four geriatric target areas. The most frequent geriatric target area was polypharmacy (64.3 % of the patients), followed by disability (51.1 %), comorbidity (49.5 %), and recently increased disability (20.8 %).

Table 1: Baseline characteristics of the total study population stratified according to number of predefined geriatric target areas (disability, recently increased disability, polypharmacy, and comorbidity). Presented as number of patients (n), proportions (%), and median [IQR].

	All patients (n=3,775)	**0 geriatric target areas** (n=563)	**1 geriatric target area** (n=1,032)	**2 geriatric target areas** (n=950)	**3 geriatric target areas** (n=840)	**4 geriatric target areas** (n=390)	significance level
Age, median [IQR]	**78** [71-85]	**73** [68-79]	**76** [70-82]	**80** [72-86]	**82.5** [76-88]	**82** [76-87]	**p<0.001** (¤)
Gender, % (n) Female	**55.2** (2,083)	**45.1** (254)	**53.0** (547)	**56.8** (540)	**62.5** (525)	**55.6** (217)	**p<0.001** (#)
Marital status, % (n) Alone	**57.9** (2,150)	**40.6** (228)	**51.0** (522)	**60.1** (560)	**73.8** (604)	**61.9** (236)	**p<0.001** (#)
Urgency category, % (n) Urgent	**38.8** (1,428)	**36.9** (200)	**40.6** (407)	**39.4** (364)	**37.4** (309)	**38.6** (148)	p=0.558 (#)
Heart rate, (beats per minute), median [IQR]	**83** [71-97]	**81** [69-97]	**82** [71-95]	**83** [70.5-96]	**85** [74-98]	**84** [73-96]	**p=0.002** (¤)
Systolic blood pressure, (mm Hg), median [IQR]	**141** [122-158]	**147** [130-166]	**143.5** [125-161]	**141** [122-156]	**138** [118-156]	**132** [118-151]	**p<0.001** (¤)
Respiratory rate, (breaths per minute, median [IQR]	**16** [16-20]	**16** [16-18]	**16** [16-20]	**18** [16-20]	**18** [16-20]	**18** [16-22]	**p<0.001** (¤)
Saturation, (%), median [IQR]	**97** [95-98]	**97** [96-99]	**97** [95-99]	**97** [95-98]	**96** [94-98]	**96** [94-98]	**p<0.001** (¤)
Body temperature, (Celsius), median [IQR]	**36.6** [36.1-37.1]	**36.6** [36.1-37.1]	**36.6** [36.1-37.0]	**36.6** [36.2-37.2]	**36.6** [36.2-37.1]	**36.6** [36.2-37.2]	**p=0.023** (¤)
Glasgow Coma Scale, median [IQR]	**15** [15-15]	**15** [15-15]	**15** [15-15]	**15** [15-15]	**15** [15-15]	**15** [15-15]	**p<0.001** (¤)
Length of stay (days) * median [IQR] min-max	**5** [2-9] 1-127	**3** [1-7] 1-127	**4** [2-8] 1-80	**5** [2-9] 1-84	**5** [2-9] 1-53	**6** [3-10] 1-62	**p<0.001** (“)

Chi-square test
¤ Non-parametric test for trend across ordered groups
“ Kruskal-Wallis equality-of-populations rank test
* Only calculated for patients admitted to in-hospital treatment. Patient discharged home from the ED had stayed 0-24 hours in the ED

With increasing number of geriatric target areas patients were older, more were female, and more were alone. In parallel, there was a trend that patients with a high number of geriatric target areas had a higher respiratory rate, higher body temperature, higher heart rate, lower arterial oxygen saturation, lower systolic blood pressure, and lower Glasgow Coma Scale, but no difference were observed in the median of Glasgow Coma Scale and body temperature. There was no difference in triage urgency category in relation to the number of geriatric target areas (Table 1).

At arrival to the ED, 11 % of patients were registered with non-specific complaints. No differences were seen in the distribution of specific and non-specific complaints across different numbers of geriatric target areas. Details are presented in supplement 1.

Outcome

An increasing amount of geriatric target areas were significantly associated with increasing odds for hospital admission, hospital stay > 48 hours, and in-hospital mortality (Table 2). Compared to patients with no geriatric target areas patients with four geriatric target areas had an odds ratio (OR) of 2.58 (95 % CI: (1.89-3.53)) for hospital admission, an OR of 1.77 (95 % CI: (1.17-2.69)) for admission lasting over 48 hours, and an OR of 5.83 (95 % CI: (2.85-11.90)) for dying during hospitalisation (Table 2).

Table 2: Geriatric target areas (disability, recently increased disability, polypharmacy, and comorbidity) as risk factor for patient's destination, length of admission (only patient admitted), and in-hospital mortality illustrated by crude and adjusted odds ratio (OR)

	Admitted to hospital			Admission > 48 hours #			Dead in-hospital		
	% (n)	Crude OR (95 % CI)	Adjusted OR (95 % CI) §	% (n)	Crude OR (95 % CI)	Adjusted OR (95 % CI) §	% (n)	Crude OR (95 % CI)	Adjusted OR (95 % CI)§
Geriatric target areas									
0 (n=563)	**57.0** (321)	1 (ref)	1	**73.8** (237)	1	1	**3.4** (19)	1	1
1 (n=1,032)	**63.5** (655)	**1.31** (1.06-1.62)	**1.22** (0.99-1.52)	**76.5** (501)	**1.15** (0.85-1.57)	**1.13** (0.82-1.56)	**4.8** (49)	**1.43** (0.83-2.45)	**1.94** (0.96-3.95)
2 (n=950)	**68.2** (648)	**1.62** (1.30-2.01)	**1.44** (1.15-1.81)	**80.9** (524)	**1.50** (1.09-2.06)	**1.40** (1.00-1.95)	**6.3** (60)	**1.93** (1.14-2.45)	**2.16** (1.06-4.39)
3 (n=840)	**73.8** (620)	**2.12** (1.69-2.67)	**1.88** (1.48-2.40)	**83.1** (515)	**1.74** (1.26-2.41)	**1.54** (1.09-2.19)	**9.4** (79)	**2.97** (1.78-3.27)	**3.86** (1.93-7.73)
4 (n=390)	**78.7** (307)	**2.79** (2.08-3.74)	**2.58** (1.89-3.53)	**85.0** (261)	**2.01** (1.35-3.00)	**1.77** (1.17-2.69)	**12.6** (49)	**4.11** (2.38-7.11)	**5.83** (2.85-11.90)

§ Logistic regression adjusted for age (continuous variable), gender, marital status, and triage urgency (categorical variables).
Odds ratios for gender, age, marital status, and triage urgency are displayed in supplement 2.
only patients admitted for in-hospital treatment are included in this analysis

In the multivariate analysis, increasing number of geriatric target areas increased the hazard ratio for 30 days post-discharge mortality almost 4 times for patients with four target areas compared to patients with no target areas (Table 3). Compared to patients with no target areas, the risk of 30 days hospital re-attendance increased progressively to 1.5, 1.9, and 2.4 in patients with two, three, and four target areas, respectively (Table 3).

Table 3: Geriatric target areas (disability, recently increased disability, polypharmacy, and comorbidity) as risk factors of 30 days mortality and 30 days acute hospital re-attendance in older patients after discharge from an acute Emergency Department contact.

	Mortality 0-30 days			Acute hospital re-attendance 0-30 days		
	% (n)	Crude HR* (95 % CI)	Adjusted HR (95 % CI)§	% (n)	Crude SHR# (95 % CI)	Adjusted SHR (95 % CI)¤
Geriatric target areas						
0 (n=544)	**2.2** (12)	1 (ref)	1	**10.3** (56)	1	1
1 (n=983)	**2.5** (25)	**1.16** (0.58-2.30)	**0.99** (0.48-2.05)	**12.5** (123)	**1.23** (0.90-1.69)	**1.22** (0.89-1.68)
2 (n=890)	**5.4** (48)	**2.49** (1.32-4.68)	**1.99** (1.02-3.90)	**15.3** (136)	**1.52** (1.11-2.07)	**1.48** (1.08-2.03)
3 (n=761)	**6.7** (51)	**3.10** (1.65-5.82)	**2.21** (1.12-4.35)	**19.3** (147)	**1.95** (1.44-2.65)	**1.93** (1.40-2.65)
4 (n=341)	**10.6** (36)	**5.02** (2.61-9.64)	**3.75** (1.87-7.52)	**23.8** (81)	**2.45** (1.74-3.43)	**2.43** (1.72-3.42)

* HR = Hazard ratio
§ Cox proportional hazard model adjusted for age (continuous variable) and number of geriatric target areas, gender, marital status, and triage urgency as categorical variable.
# SHR = Sub-hazard ratio
¤ Competing-risks regression model adjusted for age (continuous variable) and number of geriatric target areas, gender, marital status, and triage urgency as categorical variable
(HR and SHR for gender, age, marital status, and triage urgency are displayed in supplement 3)

Sensitivity analysis for missing data did not show any significant differences for odds ratio, hazard ratio, or sub-hazard ratio.

Figure 2 presents patient status (dead, dependent or independent of home care) within the first 30 days after discharge (Figure 2A) and 360 days after discharge (Figure 2B). Among patients with no geriatric target areas at arrival to the ED 70 % of the patients lived independent all 360 days after discharge, 53 % of patients with one geriatric target area, 26 % of patients with two geriatric target areas, and none of the patients with three or four geriatric target areas lived independently (Figure

2B). Among all patients discharged alive (n=3,519) the overall mortality during the entire 360 days follow-up period were 20.6 %. A total of 38.7 % of the patients with four geriatric target areas at arrival to the ED were dead 360 days after discharge (Figure 2B).

DISCUSSION

Our study showed that more than 50 % of all patients 65 years or older attending the ED with an acute medical complaint had two or more geriatric target areas. Furthermore, the amount of target areas was closely related to prognosis. By assigning four basic geriatric target areas to patients we were able to identify patients at high risk of admission, long hospital stay, in-hospital mortality, post-discharge mortality, acute hospital re-attendance, and loss of independency.

These findings correspond well with other studies assessing functional dependency, comorbidity, and polypharmacy as predictors of poor health outcomes like in-hospital mortality, long hospital stay, post-discharge mortality, and hospital re-attendance.[4, 38-41]

The aim of this study was not to develop a new tool in order to identify frail older patients in the ED or to show when older ED patients should receive specialist assessment like CGA. The aim was to assess and describe the potential size of the problem. Our results showed a substantial overlap between the 95 % confidence interval between the numbers of geriatric target areas, which also indicate that it would not be possible to use the number of geriatric target areas to identify the individual patient at risk of poor health outcome. As the proportion of older patients in the ED increases the importance of geriatric assessment and geriatric emergency medicine might increase. One way of implementing geriatric emergency medicine would be to develop special geriatric EDs, like paediatric EDs and psychiatric EDs.[42-44] However, a great effort, at least in Denmark, has been done to unite the attendance of acute medical patients at one place, to ensure the same level of treatment regardless of time and place.[45] Another way could be to increase the geriatric knowledge among ED physicians.[46-48] Education of ED physicians increase their knowledge but the effect has shown to be limited.[49, 50] A third model of implementing geriatric emergency is the presence of geriatricians in the ED. This allows a two-step procedure to identify geriatric patients at risk of poor outcome and subsequently applying full geriatric assessment.[51, 52] By applying an age related visitation only for patients to receive geriatric assessment the patients in most need of geriatric healthcare skills might not be identified. Instead, a "need related" visitation seems more accurate.[53] However, how to identify the patients in need of geriatric assessment remains unclear. Using frailty

scales as risk-stratification tools might be a possibility.[54, 55] Several frailty rating scales exists[19] and screening appears to predict the risk of mortality,[56] length of admission,[57] and risk of readmission[57] depending on the frailty scale used. The definition of the frail patient is ambiguously and unfortunately the lack of intervention studies questions the effectiveness of such frailty screening.[58, 59] We used easily accessible data already available at ED contact to identify the described geriatric target areas. This might be effective in the time restricted setting since no direct assessment is needed to identify these areas and information are insured even if patients are cognitively impaired. Like the electronic-frailty index developed to identify frail older patients in General practice[60] it might be possible to generate an electronic frailty index in the ED using an already developed frailty index like the Rockwood accumulation of deficits model.[23] To ease communication and transition between health care sectors an index should be applied uniformly across different health care systems. Further research is needed in order to develop such an instrument.

The prevalence of non-specific complaints varies between studies from 5.5- 21 %[17, 61, 62] and is more common in frail older patients.[63] In our study, the prevalence of older patients presenting with non-specific complaints were 11 %. This might be due to differences in the study populations. Vanpee *et al.*[61] only included patients 75 years or older and Nemec *et al.*[17] only included patients in the medium triage category. We included all patients ≥ 65 years of age. We were not able to detect any differences between the prevalence of non-specific complaints and the numbers of geriatric target areas but among patients with disability a higher prevalence of non-specific complaints were found (data not shown). This might be because functional impairment and presentation with non-specific complaints are somehow related.[64] Studies reporting the prognosis of patients presenting to the ED with non-specific complaints are conflicting.[17, 62, 65] We were not able to show an increased risk of neither in-hospital nor 30 days mortality in patients with non-specific complaints compared to patients with more specific complains (data not shown).

Trends seen in the measurements of systolic blood pressure, respiratory rate, heart rate, and arterial oxygen saturation across increasing number of target areas corresponds with already existing knowledge regarding vital signs in older age.[66] However, abnormal or normal vital signs in older patients should always be interpreted with caution since age related impaired physical regulation, common illness, and medications taking by older patients often affects the range of vital sign meassurements.[66] Even though we found a trend, the observed differences among groups did not yield clinical meaningful differences.

Limitations and strengths

The strengths of this study were the longitudinal cohort design, the large sample size, and the accurate cross-sectional linkage between prehospital healthcare data, hospital data, and healthcare population-based registries. To minimise bias, we included all consecutive medical ED contacts, the proportion of missing data were very low, and follow-up was complete. Home care was always and only registered if it was delivered, giving data a large conformity with reality.

Our study also had some limitations. Firstly, it is a Danish single centre study and should be interpreted as such. Secondly, Charlson comorbidity index was calculated from information on 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. Also, Charlson comorbidity do not include common comorbidities seen in older patients like osteoporosis, hypertension, and atrial fibrillation and defining comorbidity as Charlson comorbidity index ≥ 2 might also lead to under-reporting. However, it has been shown that the validity of using Danish National health registers to calculate Charlson comorbidity index is good and that it is a well-established predictor of mortality and functional impairment even among nursing home patients.[33, 67, 68] Thirdly, categorisation of patients not receiving home care as not disabled might be misleading. They might have a healthy spouse taking care of them. Fourthly, Odense University Pharmacoepidemiological Database only covers reimbursed medications and not drugs that are dispensed over the counter. This might lead to risk of under-reporting of number of medications taken. Finally, several of the covariate estimates changed direction during the modelling process which suggests collinearity issues or possible effect modification in the multivariate analysis and the results have to be interpreted with this in mind.

CONCLUSION

Among the older medical ED population the prevalence of patients with geriatric target areas is high and associated with poor hospital and post-discharge outcomes. The literature supports the presence of geriatricians in existing ED's thereby implying the principles of geriatric medicine in the acute setting. Our study emphasises the potential need of geriatric awareness but does not allow any conclusions regarding effect of geriatric interventions. More focus is needed on how to precisely identify the geriatric patients in the ED who might benefit from applying geriatric assessment and the effect of interventions on both patients-and service-outcome.

Author Contributors

All authors participated in the design of the study. AT performed the statistical analyses in a dialogue with ATL, JR, and JUR. AT wrote the manuscript. All authors were involved in the interpretation of data and the critical revision of the manuscript. AT had the primary responsibility for the final content. All authors read and approved the final manuscript.

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Competing interest

The authors have declared that no conflict of interest exists.

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The funders had no involvement in the study design, in the collection, analysis and interpretation of the data, in the writing of the report, or in the decision to submit the paper for publication.

Data sharing statement:

Due to the Danish Law on personal data, we are not allowed to share data in a public dataset. Access to data from the Danish Health Data Authority requires approval from the Danish Data Protection Agency: https://www.datatilsynet.dk/english/the-danish-data-protection-agency/introduction-to-the-danish-data-protection-agency/

For access and sharing of data and materials please contact the corresponding author or the Research Service at the Department of Clinical Research, University of Southern Denmark, 5000 Odense C. Phone: +45 65504051 and we will help you with the process and following provide access to the dataset.

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LEGENDS

Figure 1: Flowchart of patients included in the study period.

Figure 2: The proportion of patients discharged alive who died, were dependent on home care, or were independent of home care in relation to number of geriatric target areas (disability, recently increased disability, polypharmacy, and comorbidity) in the

A) 30 days period after discharge

B) 360 days period after discharge

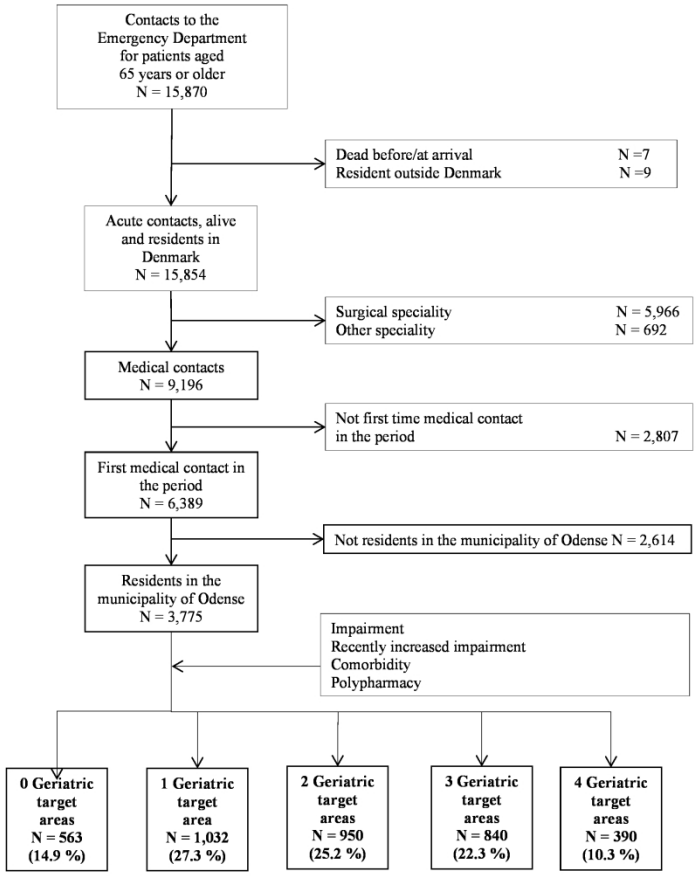
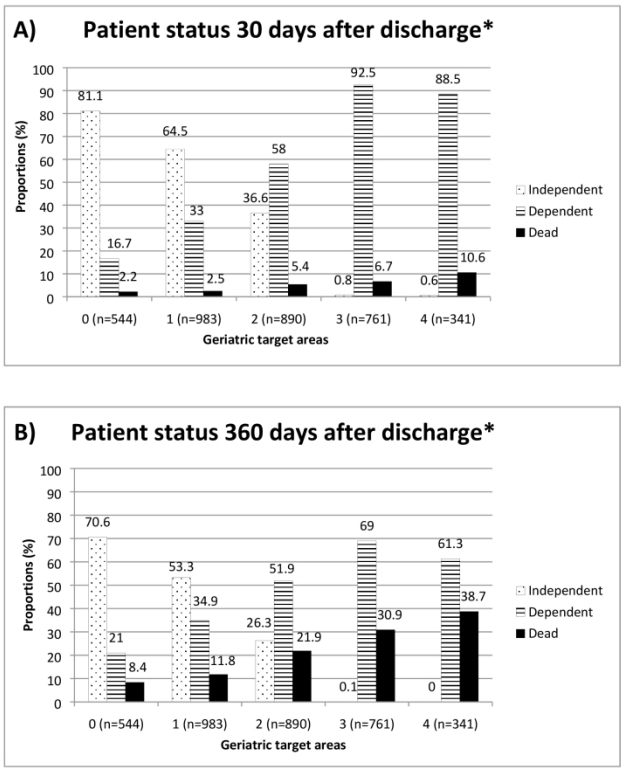


Figure 1: Flowchart of patients included in the study period.

209x297mm (300 x 300 DPI)



* Only patients discharged alive (n=3,519)

Figure 2: The proportion of patients discharged alive who died, were dependent on home care, or were independent of home care in relation to number of geriatric target areas (disability, recently increased disability, polypharmacy, and comorbidity) in the
A) 30 days period after discharge
B) 360 days period after discharge

209x297mm (300 x 300 DPI)

Supplement 1

(A) Distribution of specific complaints and non-specific complaints according to number of geriatric target areas.
(B) Distribution of main complaint according to number of geriatric target areas and categorisation of main complaints in to specific complaints and non-specific complaints

A			**All patients** n=3,775	**0 geriatric target areas** n=563	**1 geriatric target area** n=1,032	**2 geriatric target areas** n=950	**3 geriatric target areas** n=840	**4 geriatric target areas** n=390
		Specific complaint	88.9 % (n=3,129)	88.8 % (n=459)	89.5 % (n=861)	89.0 % (n=783)	88.5 % (n=706)	88.6 % (n=320)
		Non-specific complaint	11.1 % (n=389)	11.2 % (n=58)	10.5 % (n=101)	11.0 % (n=97)	11.5 % (n=92)	11.4 % (n=41)
B								
Specific complain	Non-specific complaint	Main complaint:	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
X		Airway symptoms	643 (18.3)	61 (11.8)	140 (14.6)	177 (20.1)	185 (23.2)	80 (22.2)
X		Neurological disorder	398 (11.3)	66 (12.8)	144 (15.0)	89 (10.1)	74 (9.3)	25 (6.9)
X		Fever	370 (10.5)	54 (10.4)	87 (9.0)	87 (9.9)	96 (12.0)	46 (12.7)
X		Faint	284 (8.1)	61 (11.8)	93 (9.7)	62 (7.1)	46 (5.8)	22 (6.1)
X		Laboratory deviances	270 (7.7)	28 (5.4)	53 (5.5)	77 (8.8)	82 (10.3)	30 (8.31)
X		Chest pain	262 (7.5)	49 (9.5)	87 (9.0)	65 (7.4)	43 (5.4)	18 (5.0)
X		Abdominal pain	197 (5.6)	36 (7.0)	55 (5.7)	49 (5.6)	39 (4.9)	18 (5.0)
	X	Impaired consciousness	176 (5.0)	19 (3.7)	46 (4.8)	46 (5.2)	47 (5.9)	18 (5.0)
	X	Dizziness	120 (3.4)	32 (6.2)	30 (3.1)	29 (3.3)	20 (2.5)	9 (2.5)
X		Pain in back and loin	78 (2.2)	15 (2.9)	24 (2.5)	18 (2.1)	13 (1.6)	8 (2.2)
X		Gastrointestinal bleeding, upper	75 (2.1)	3 (0.6)	20 (2.1)	24 (2.7)	18 (2.3)	10 (2.8)
X		Pain in extremity	75 (2.1)	10 (1.9)	19 (2.0)	20 (2.3)	17 (2.1)	9 (2.5)
	X	Unspecific illness	72 (2.1)	6 (1.2)	20 (2.1)	15 (1.7)	21 (2.6)	10 (2.8)
X		Glucose deviances	62 (1.8)	2 (0.4)	14 (1.5)	19 (2.2)	16 (2.0)	11 (3.1)
X		Headache	46 (1.3)	12 (2.3)	20 (2.1)	8 (0.9)	5 (0.6)	1 (0.3)
X		Wounds	45 (1.3)	2 (0.4)	12 (1.3)	11 (1.3)	10 (1.3)	10 (2.8)
X		Convulsions	44 (1.3)	8 (1.6)	14 (1.5)	13 (1.5)	7 (0.9)	2 (0.6)
X		Palpitation	41 (1.2)	12 (2.3)	16 (1.7)	9 (1.0)	3 (0.4)	1 (0.3)
X		Poisoning	36 (1.0)	4 (0.8)	10 (1.0)	11 (1.3)	5 (0.6)	6 (1.7)
X		Allergy/anaphylaxis	53 (1.0)	12 (2.3)	10 (1.0)	6 (0.7)	5 (0.6)	2 (0.6)
X		High blood pressure	33 (0.9)	10 (1.9)	12 (1.3)	4 (0.5)	5 (0.6)	2 (0.6)
X		Pain and symptoms from urinary tract	32 (0.9)	5 (1.0)	4 (0.4)	8 (0.9)	11 (1.4)	4 (1.1)

X		Diarrhoea or/and vomiting	22 (0.6)	1 (0.2)	2 (0.2)	5 (0.6)	9 (1.1)	5 (1.4)
X		Cardiac dyspnoea	18 (0.5)	1 (0.2)	8 (0.8)	3 (0.3)	2 (0.3)	4 (1.1)
	X	Falling	15 (0.4)	1 (0.2)	4 (0.4)	6 (0.7)	2 (0.3)	2 (0.6)
X		Hip pain	13 (0.4)	1 (0.2)	1 (0.1)	6 (0.7)	4 (0.5)	1 (0.3)
X		Head trauma	9 (0.3)	1 (0.2)	3 (0.3)	1 (0.1)	2 (0.3)	2 (0.6)
X		Extremity trauma	8 (0.2)	0 (0.0)	2 (0.2)	2 (0.2)	2 (0.3)	2 (0.6)
X		Cardiac arrest	8 (0.2)	0 (0.0)	5 (0.5)	0 (0.0)	3 (0.4)	0 (0.0)
	X	Delirium	6 (0.2)	0 (0.0)	1 (0.1)	1 (0.1)	2 (0.3)	2 (0.6)
X		Peripheral oedema	6 (0.2)	1 (0.2)	1 (0.1)	2 (0.2)	2 (0.3)	0 (0.0)
X		Gastrointestinal bleeding, lower	4 (0.1)	1 (0.2)	1 (0.1)	1 (0.1)	1 (0.1)	0 (0.0)
X		Suicidality or self-harming	4 (0.1)	1 (0.2)	3 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)
X		Swallowing difficulties	4 (0.1)	1 (0.2)	0 (0.0)	2 (0.2)	1 (0.1)	0 (0.0)
X		Acute psychosis	2 (0.1)	1 (0.2)	0 (0.0)	1 (0.1)	0 (0.0)	0 (0.0)
X		Abstinence	2 (0.1)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)	0 (0.0)
X		Pain in scrotum	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.3)
X		Thorax trauma	2 (0.1)	0 (0.0)	0 (0.0)	2 (0.2)	0 (0.0)	0 (0.0)
	X	Uncooperative patient	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
X		Surgical abscess	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

Supplement 2

Gender, age, marital status, and triage urgency as risk factor for patient's destination, length of admission (only patient admitted), and in-hospital mortality showed by crude and adjusted odds ratio (OR)

	Admitted to hospital			Admission > 48 hours #			Dead in-hospital		
	% (n)	Crude OR (95 % CI)	Adjusted OR (95 % CI) §	% (n)	Crude OR (95 % CI)	Adjusted OR (95 % CI) §	% (n)	Crude OR (95 % CI)	Adjusted OR (95 % CI)§
Gender									
Female (n=2,083)	**67.2** (1,400)	1 (ref)	1	**80.3** (1,124)		1	**6.4** (134)	1	1
Male (n=1,692)	**68.0** (1,151)	**1.04** (0.90-1.19)	**1.17** (1.01-1.36)	**79.4** (914)	**0.95** (0.78-1.15)	**1.05** (0.85-1.30)	**7.2** (122)	**1.13** (0.88-1.46)	**1.49** (1.08-2.04)
Age		**1.03** (1.02-1.04)	**1.03** (1.02-1.03)		**1.02** (1.01-1.03)	**1.02** (1.00-1.03)		**1.04** (1.03-1.06)	**1.04** (1.02-1.06)
Urgency									
Less urgent (n=2,250)	**65.2** (1,468)	1	1	**82.4** (1,209)	1	1	**4.0** (89)	1	1
Urgent (n=1,428)	**71.3** (1,018)	**1.32** (1.72-2.05)	**1.34** (1.16-1.55)	**78.1** (795)	**0.76** (0.63-0.93)	**0.79** (0.64-0.97)	**8.6** (123)	**2.29** (1.73-3.03)	**2.39** (1.78-3.22)
Marital status									
Not alone (n=1,565)	**65.6** (1,027)	1	1	**77.3** (794)	1	1	**5.8** (91)	1	1
Alone (n=2,150)	**68.7** (1,478)	**1.15** (1.00-1.32)	**1.01** (0.87-1.18)	**81.5** (1,205)	**1.30** (1.06-1.58)	**1.16** (0.93-1.45)	**6.9** (148)	**1.20** (0.91-1.57)	**0.95** (0.68-1.33)

§ Logistic regression adjusted for age (continuous variable), gender, marital, status, triage urgency, and number of geriatric target areas (categorical variables)

only patients admitted for in-hospital treatment are included in this analysis

Supplement 3

Gender, age, marital status, and triage urgency as prognostic factors of 30 days mortality and 30 days acute hospital re-attendance in older patients after discharge from an acute Emergency Department contact

	Mortality 0-30 days			Acute hospital re-attendance 0-30 days		
	% (n)	Crude HR* (95 % CI)	Adjusted HR (95 % CI)§	% (n)	Crude SHR# (95 % CI)	Adjusted SHR (95 % CI)¤
Gender						
Female (n=1,949)	**5.0** (98)	1 (ref)	1	**16.1** (314)	1	1
Male (n=1,570)	**4.7** (74)	**0.93** (0.69-1.27)	**1.28** (0.91-1.79)	**14.6** (229)	**0.90** (0.76-1.07)	**0.96** (0.80-1.16)
Age		**1.06** (1.04-1.08)	**1.05** (1.02-1.07)		**1.01** (1.00-1.02)	**1.00** (0.99-1.01)
Urgency						
Less urgent (n=2,161)	**4.9** (105)	1	1	**15.6** (338)	1	1
Urgent (n=1,305)	**4.9** (64)	**1.01** (0.73-1.39)	**1.10** (0.80-1.51)	**15.1** (197)	**0.96** (0.80-1.14)	**0.97** (0.81-1.15)
Marital status						
Not alone (n=1,474)	**3.6** (53)	1	1	**14.3** (211)	1	1
Alone (n=2,002)	**5.5** (111)	**1.53** (1.10-2.13)	**1.20** (0.83-1.73)	**16.5** (330)	**1.17** (0.98-1.39)	**1.04** (0.85-1.26)

* HR = Hazard ratio
§ Cox proportional hazard model adjusted for age (continuous variable) and number of geriatric target areas, gender, marital status, and triage urgency as categorical variable.
# SHR = Sub-hazard ratio
¤ Competing-risks regression model adjusted for age (continuous variable) and number of geriatric target areas, gender, marital status, and triage urgency as categorical variable

STROBE 2007 (v4) checklist of items to be included in reports of observational studies in epidemiology*

Checklist for cohort, case-control, and cross-sectional studies (combined)

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any pre-specified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	5
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	The study was not matched
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*6-8*
Bias	9	Describe any efforts to address potential sources of bias	9
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	8-9
		(*b*) Describe any methods used to examine subgroups and interactions	7-8
		(*c*) Explain how missing data were addressed	9
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed	17 (complete follow

		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy	up)
		(*e*) Describe any sensitivity analyses	9
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	10
		(b) Give reasons for non-participation at each stage	Figure 1
		(c) Consider use of a flow diagram	Figure 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	10
		(b) Indicate number of participants with missing data for each variable of interest	9
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	10
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	12
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	-
		Cross-sectional study—Report numbers of outcome events or summary measures	-
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Table 2,3
		(*b*) Report category boundaries when continuous variables were categorized	12-14 and Table 2,3,
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	12
Discussion			
Key results	18	Summarise key results with reference to study objectives	15
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	17
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	15-16
Generalisability	21	Discuss the generalisability (external validity) of the study results	17
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	18

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.
Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Disability and morbidity among older patients in the Emergency Department – A Danish population based cohort study

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Disability and morbidity among older patients in the Emergency Department – A Danish population based cohort study

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Supplements: 3

ABSTRACT

Objectives: The objective was to describe the prevalence of geriatric conditions among older medical patients in the Emergency Department (ED) and the association with admission, mortality, re-attendance, and loss of independency.

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 one year period (November 2013 to November 2014).

Primary and secondary outcome measures: Based on information from healthcare registers we defined geriatric conditions as disability, recently increased disability, polypharmacy, and comorbidity. Outcomes were admission, length of admission, 30 days post-discharge mortality, 30 days hospital re-attendance, and home care dependency 0-360 days following ED contact.

Results: Totally, 3,775 patients (55% women) were included, age 78 [71-85] years (median [IQR]). No patients were lost to follow-up. The prevalence of 0-4 geriatric conditions was 14.9%, 27.3%, 25.2%, 22.3%, and 10.3%, respectively. The number of conditions was significantly associated with hospital admission, length of admission, 30 days post-discharge mortality, and 30 days hospital re-attendance. Among patients with no geriatric conditions 70% lived independent all 360 days after discharge, whereas all patients with ≥3 conditions had some dependency or were dead within 360 days following discharge.

Conclusion: Among older medical patients in the ED 50% had two or more geriatric conditions which were associated with poor health outcomes. This highlights the need for studies of the effect of geriatric awareness and competences in the ED.

Keywords: Cohort study, Older patients, Frailty, Emergency department, Mortality, Re-hospitalisation.

Strengths and limitations of this study

- This population-based cohort study from a Danish municipality was based on data from several Danish national registers with high quality data
- A major strength was the complete coverage of a large municipality, the complete follow-up, and high data quality
- Home care was registered during delivery giving data a large conformity with reality
- The study was a single centre study which may reduce the generalisability of the results
- Several other geriatric conditions, than the ones used in the present study, exist

INTRODUCTION

In the future we can expect an increase in the proportion of older medical patients in the Emergency Department (ED) due to the demographic changes.[1, 2] Increased mortality, institutionalisation, hospital re-attendance, functional impairment, and loss of independency are some of the potential severe outcomes associated with hospitalisation for some of these older patients.[3-8]

Comprehensive Geriatric Assessment (CGA) is a multidimensional evidence-based assessment that has the potential to improve the prognosis for geriatric patients in the hospital settings[9] including the acute settings.[10] It is a balance to identify patients who are neither too well (completely functional independent without medical comorbidities) nor too sick (terminal illness) to benefit from CGA.[11]

Geriatric patients are usually 65 years or older but are not solely defined by age. Instead, geriatric patients are better characterised by the presence of acute and chronic diseases combined with age related changes, polypharmacy, and social problems and due to these combinations often derived physical and cognitive impairment.[12] About 25 % of older patients in the ED have cognitive impairment as a result of delirium, dementia, or both,[13] polypharmacy is present in 37 %, and 39 % have functional decline before the ED contact.[14] Geriatric patients often present with non-specific complaints like general weakness, immobilisation, confusion, or fall. Among patients presenting with non-specific complaints it is difficult to identify the correct diagnosis and these patients are at risk of wrong triage, admission, and longer hospital stay.[15-18] The presence of medical, physical, cognitive, and social problems make geriatric patients vulnerable (frail) and at increased risk of poor health outcomes when consulting the ED.[12] During the past decade, frailty has been the focus of intense research in risk prediction and a large number of risk or frailty indices have been developed.[19] Depending on the population, setting, and the definition 5-30 % of the patients in the ED are characterised as frail.[20, 21] Most indices, including validated indices used in the ED,[22-25] uses geriatric conditions like disability (cognitive and physical), polypharmacy, and comorbidity when evaluating frailty.[19] Furthermore, these conditions are also major conditions targeted in CGA.[11]

The cumulated prevalence of these geriatric conditions among older patients in the ED is not well known. Therefore, the objective of this study was to describe the prevalence of geriatric conditions among older medical patients attending the ED and the prognosis associated with these conditions.

METHOD

Study design and Setting

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

Odense University Hospital in Denmark is a 1,000-bed university teaching hospital with all specialties represented including geriatric medicine. The ED serves a mixed rural-urban population and has a primary catchment area of 288,200 persons including Odense municipality. It is the only ED in this area and it provides 24-hour acute medical care. Odense municipality has a population of 168,731 adult citizens with 20 % being 65 years or older.[26] Patients arrive by ambulance following an emergency call or are referred from primary care. All acute patients are received in the ED except patients with prehospital identified cardio-vascular disease, ongoing nephrological or oncological treatment. The ED uses a four level Adaptive Process Triage (ADAPT) where triage category is assigned based on main complaint and vital signs.[27] The main complaint is registered before any diagnostic proceedings are performed. A total of 40 main complaint categories are used (supplement 1). From the ED, patients are either admitted to in-hospital treatment or discharged home.

In the Danish healthcare system, primary care services are well established and free of charge for all residents. The municipalities deliver all kind of home care services to older or disabled people. Home care consists of general nursing care and care to support activities of daily living. Type and amount of home care are based on an individual plan generated in collaboration with a specialised nurse. Staffs do on-location registration of time and task, and changes are adjusted continuously with one day's notice. Data are automatically transferred to a personal electronic citizen record. The municipality also administers residential care like permanent and temporary nursing homes.

Participants

All consecutive patients 65 years or older living in Odense municipality with a first time acute medical contact to the ED at Odense University Hospital during the period 1st of November 2013 to 31st of October 2014 were included. Patients dead upon arrival to the ED were excluded.

Data source

The Danish Civil Registration system

The Danish Civil Registration System (CRS) has since 1968 assigned a unique 10-digit civil personal registry number to each Danish citizen at birth and to residents upon immigration. The CRS covers data on deaths, births, migration, municipality of residence, and marital status.[28] The unique civil personal registry number enables accurate linkage of information from different data sources on an individual level.

The Danish National Patient Register

Since 1995 the Danish National Patient Register has registered all hospital admissions and all ED contacts.[29] The registry contains data regarding date of admission and discharge, discharge diagnosis, and admission department.

The electronic hospital record and the ED logistic system

All patient related data are registered and stored at an individual level in the electronic hospital record and the ED logistic tool.

Odense University Pharmacoepidemiological Database

Odense University Pharmacoepidemiological Database is a prescription database. It covers the region of Southern Denmark including the municipality of Odense. Information on redeemed prescriptions are reported on an individual basis from community pharmacies. Only drugs that are reimbursed are covered.[30]

The Municipality Citizen-Record

All data on type and amount of home care and resident type are registered in the Municipality Citizen-Record on an individual day to day level. When residents are in residential care, it is registered as such, with no registration of type or amount of help delivered.

Data variables

If a patient had more than one acute medical ED contact in the study period, only the first contact was included as the index contact.

Geriatric conditions

We defined geriatric conditions as disability, recently increased disability, polypharmacy, and comorbidity based on frailty indices,[22-25] Geriatric textbooks, conditions assessed in CGA,[11] and various descriptions of the geriatric discipline.

Disability was defined as receiving home care one or more days the last 30 days prior to ED contact or one or more days spent in residential care.

Recently increased disability was defined as increased use of home care (minutes) or more days spent in residential care the last 30 days prior to ED contact compared to the previous 30 days.

Polypharmacy was defined as intake of five or more medications at ED contact. The number of medications with different ACT-codes (4th level, chemical subgroup) redeemed within 90 days prior to the ED contact were used to calculate the number of medications at ED contact.[30, 31]

Finally, comorbidity was defined as Charlson comorbidity index ≥ 2. Charlson comorbidity index was identified by hospital discharge diagnoses from the previous 10 years.[32, 33]

All baseline variables and outcome variables were calculated and displayed for the whole study population and for five sub-populations depending on the number of defined geriatric conditions (zero, one, two, three, four, or five).

Baseline characteristics

Baseline characteristics at ED contact included age, gender, marital status, initial triage urgency, vital signs, and main presenting complaint at arrival to the ED. Data were extracted from patient records and population-based registers.

Patients' marital status was categorised as "being with someone" if they were married or had a registered partnership and "being alone" if they were single, divorced, widower, or widow. Urgency category was defined from the initial triage[34] and was divided in two predefined urgency categories: triage level 1 and 2 as "urgent" and triage level 3 and 4 as "less urgent". The 40 main complaints were grouped in two categories "specific complaint" and "non-specific complaint". As Nemec *et al,*[17] we defined a specific complaint as a complaint that provides key information that allows the generation of a working diagnosis and/or treatment protocol e.g. "chest pain", "fever", or "neurological disorder". Following this, of the 40 predefined main complaints we defined the

following as non-specific complaints "uncooperative patient", "delirium", "falling", "unspecific illness", "dizziness", and "impaired consciousness" (supplement 1).

Outcome

We assessed the following variables as outcomes: Patient's destination (discharged from the ED or admitted to the hospital), length of admission, in-hospital mortality, 30 days post-discharge mortality and hospital re-attendance, and 360 days post-discharge dependency of home care (receiving home care or in residential care) and living independent (community dwelling and not receiving any home care at any day in the preceding period). Only acute hospital re-attendance (unplanned admission to the hospital or unplanned ED contact) was included in the analyses.

Data analysis and statistical methods

Data are presented as total and proportions or as medians with interquartile range [IQR]. Only medians and [IQR] were calculated due to the skewness of the data distributions. Chi-square test was used to test the significance of differences between categorical data. Nonparametric test for trend across ordered groups[35] was used to test the significance in trend in ordered quantitative non-normal distributed variables.

For conditions considering hospitalisation (discharge from the ED or admitted to the hospital, length of hospital admission (≤ 48 hours or > 48 hours), and in-hospital mortality) we used multivariate logistic regression with numbers of identified geriatric conditions as the independent variable adjusted for predefined variables (age (continuous variable), gender, marital status, and triage urgency level (categorical variables)). The dichotomisation of admission length into ≤ 48 hours and > 48 hours of admission was chosen due to the organisation of admissions in the ED of Odense University Hospital. When patients are expected to have a short admission (≤ 48 hours) they are admitted to a short time observation unite placed in relation to the ED. Patients with expected > 48 hours of admission are admitted to an in-hospital ward. If patients with expected short admission are in need of a longer admission, they are transferred to an in-hospital ward. This division into short-and long stay units is also seen in other hospitals.[36]

Following discharge, risk factors for mortality were evaluated by Cox-regression analysis and presented as unadjusted and adjusted hazard ratios (HRs) with 95 % confidential intervals (CIs) for the time period 0-30 days after discharge. Patients were followed to date of death, emigration, or

end of follow-up, whichever occurred first. In the regression analysis, we defined numbers of identified geriatric conditions as the independent variable adjusted for predefined variables (age (continuous variable), gender, marital status, and triage urgency level (categorical variables)).

Risk factors for a new acute hospital re-attendance 0-30 days after discharge were analysed using competing risks methodology with hospital re-attendance as the event of interest and death due to any cause as the competing event. In the competing risk analysis, we defined numbers of identified geriatric conditions as the independent variable adjusted for predefined variables (age (continuous variable), gender, marital status, and triage urgency level (categorical variables)).

Missing data were treated as such. No data were missing on mortality, municipality healthcare, number of medications, comorbidity, and hospital re-attendance. Data on marital status were missing in 43 patients and data on urgency category were missing in 97 patients. Data on main complaint were missing in 257 patients.

Sensitivity analyses in regression analysis were done with missing data on urgency replaced by "urgent" or "less urgent" for urgency category and with missing data on marital status replaced by "being alone" and "not alone".

All calculations were performed using Stata Release 15.0 (StataCorp, College Station, TX, USA).

Ethics Committee Approval

The study was approved by the Danish Data Protection Agency (J No 14/19990) and the National Committee on Health Research Ethics (Project-ID S-20140031). The reporting of this study conforms to the STROBE statement.[37]

Patient and Public Involvement

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

RESULTS

Participants

Among the 6,389 first time medical contacts for older patients to the ED in the study period, a total of 3,775 patients were citizens in Odense municipality and included in the study (Figure 1).

Baseline characteristics

Median [IQR] age of included patients was 78 [71-85] years and 55 % were female. Median Charlson comorbidity was 1 [0-3], the median number of medications at ED contact was 5 [3-8], and 38.8 % were categorised in the triage as urgent at arrival (Table 1). Of the 3,775 patients, 14.9 % had no geriatric conditions, 27.3 % had one geriatric condition, 25.2 % had two geriatric conditions, 22.3 % had three geriatric conditions, and 10.3 % had all four geriatric conditions. The most frequent geriatric condition was polypharmacy (64.3 % of the patients), followed by disability (51.1 %), comorbidity (49.5 %), and recently increased disability (20.8 %).

Table 1: Baseline characteristics of the total study population stratified according to number of predefined geriatric conditions (disability, recently increased disability, polypharmacy, and comorbidity). Presented as number of patients (n), proportions (%), and median [IQR].

	All patients (n=3,775)	**0 geriatric conditions** (n=563)	**1 geriatric condition** (n=1,032)	**2 geriatric conditions** (n=950)	**3 geriatric conditions** (n=840)	**4 geriatric conditions** (n=390)	significance level
Age, median [IQR]	**78** [71-85]	**73** [68-79]	**76** [70-82]	**80** [72-86]	**82.5** [76-88]	**82** [76-87]	**p<0.001** (¤)
Gender, % (n) Female	**55.2** (2,083)	**45.1** (254)	**53.0** (547)	**56.8** (540)	**62.5** (525)	**55.6** (217)	**p<0.001** (#)
Marital status, % (n) Alone	**57.9** (2,150)	**40.6** (228)	**51.0** (522)	**60.1** (560)	**73.8** (604)	**61.9** (236)	**p<0.001** (#)
Urgency category, % (n) Urgent	**38.8** (1,428)	**36.9** (200)	**40.6** (407)	**39.4** (364)	**37.4** (309)	**38.6** (148)	p=0.558 (#)
Heart rate, (beats per minute), median [IQR]	**83** [71-97]	**81** [69-97]	**82** [71-95]	**83** [70.5-96]	**85** [74-98]	**84** [73-96]	**p=0.002** (¤)
Systolic blood pressure, (mm Hg), median [IQR]	**141** [122-158]	**147** [130-166]	**143.5** [125-161]	**141** [122-156]	**138** [118-156]	**132** [118-151]	**p<0.001** (¤)
Respiratory rate, (breaths per minute, median [IQR]	**16** [16-20]	**16** [16-18]	**16** [16-20]	**18** [16-20]	**18** [16-20]	**18** [16-22]	**p<0.001** (¤)
Saturation, (%), median [IQR]	**97** [95-98]	**97** [96-99]	**97** [95-99]	**97** [95-98]	**96** [94-98]	**96** [94-98]	**p<0.001** (¤)
Body temperature, (Celsius), median [IQR]	**36.6** [36.1-37.1]	**36.6** [36.1-37.1]	**36.6** [36.1-37.0]	**36.6** [36.2-37.2]	**36.6** [36.2-37.1]	**36.6** [36.2-37.2]	**p=0.023** (¤)
Glasgow Coma Scale, median [IQR]	**15** [15-15]	**15** [15-15]	**15** [15-15]	**15** [15-15]	**15** [15-15]	**15** [15-15]	**p<0.001** (¤)
Length of stay (days) * median [IQR] min-max	**5** [2-9] 1-127	**3** [1-7] 1-127	**4** [2-8] 1-80	**5** [2-9] 1-84	**5** [2-9] 1-53	**6** [3-10] 1-62	**p<0.001** (“)

Chi-square test
¤ Non-parametric test for trend across ordered groups
“ Kruskal-Wallis equality-of-populations rank test
* Only calculated for patients admitted to in-hospital treatment. Patient discharged home from the ED had stayed 0-24 hours in the ED

With increasing number of geriatric conditions patients were older, more were female, and more were alone. In parallel, there was a trend that patients with a high number of geriatric conditions had a higher respiratory rate, higher body temperature, higher heart rate, lower arterial oxygen saturation, lower systolic blood pressure, and lower Glasgow Coma Scale, but no difference were observed in the median of Glasgow Coma Scale and body temperature. There was no difference in triage urgency category in relation to the number of geriatric conditions (Table 1).

At arrival to the ED, 11 % of patients were registered with non-specific complaints. No differences were seen in the distribution of specific and non-specific complaints across different numbers of geriatric conditions. Details are presented in supplement 1.

Outcome

An increasing amount of geriatric conditions were significantly associated with increasing odds for hospital admission, hospital stay > 48 hours, and in-hospital mortality (Table 2). Compared to patients without any geriatric conditions, those with four geriatric conditions had an odds ratio (OR) of 2.58 (95 % CI: (1.89-3.53)) for hospital admission, an OR of 1.77 (95 % CI: (1.17-2.69)) for admission lasting over 48 hours, and an OR of 5.83 (95 % CI: (2.85-11.90)) for dying during hospitalisation (Table 2).

Table 2: Geriatric conditions (disability, recently increased disability, polypharmacy, and comorbidity) as risk factor for patient's destination, length of admission (only patient admitted), and in-hospital mortality illustrated by crude and adjusted odds ratio (OR)

	Admitted to hospital			Admission > 48 hours #			Dead in-hospital		
	% (n)	Crude OR (95 % CI)	Adjusted OR (95 % CI) §	% (n)	Crude OR (95 % CI)	Adjusted OR (95 % CI) §	% (n)	Crude OR (95 % CI)	Adjusted OR (95 % CI)§
Geriatric conditions									
0 (n=563)	**57.0** (321)	1 (ref)	1	**73.8** (237)	1	1	**3.4** (19)	1	1
1 (n=1,032)	**63.5** (655)	**1.31** (1.06-1.62)	**1.22** (0.99-1.52)	**76.5** (501)	**1.15** (0.85-1.57)	**1.13** (0.82-1.56)	**4.8** (49)	**1.43** (0.83-2.45)	**1.94** (0.96-3.95)
2 (n=950)	**68.2** (648)	**1.62** (1.30-2.01)	**1.44** (1.15-1.81)	**80.9** (524)	**1.50** (1.09-2.06)	**1.40** (1.00-1.95)	**6.3** (60)	**1.93** (1.14-2.45)	**2.16** (1.06-4.39)
3 (n=840)	**73.8** (620)	**2.12** (1.69-2.67)	**1.88** (1.48-2.40)	**83.1** (515)	**1.74** (1.26-2.41)	**1.54** (1.09-2.19)	**9.4** (79)	**2.97** (1.78-3.27)	**3.86** (1.93-7.73)
4 (n=390)	**78.7** (307)	**2.79** (2.08-3.74)	**2.58** (1.89-3.53)	**85.0** (261)	**2.01** (1.35-3.00)	**1.77** (1.17-2.69)	**12.6** (49)	**4.11** (2.38-7.11)	**5.83** (2.85-11.90)

§ Logistic regression adjusted for age (continuous variable), gender, marital status, and triage urgency (categorical variables).
Odds ratios for gender, age, marital status, and triage urgency are displayed in supplement 2.
only patients admitted for in-hospital treatment are included in this analysis

In the multivariate analysis, increasing number of geriatric conditions increased the hazard ratio for 30 days post-discharge mortality almost 4 times for patients with four conditions compared to patients with no conditions (Table 3). Compared to patients with no conditions, the risk of 30 days hospital re-attendance increased progressively to 1.5, 1.9, and 2.4 in patients with two, three, and four conditions, respectively (Table 3).

Table 3: Geriatric conditions (disability, recently increased disability, polypharmacy, and comorbidity) as risk factors of 30 days mortality and 30 days acute hospital re-attendance in older patients after discharge from an acute Emergency Department contact.

	Mortality 0-30 days			Acute hospital re-attendance 0-30 days		
	% (n)	Crude HR* (95 % CI)	Adjusted HR (95 % CI)§	% (n)	Crude SHR# (95 % CI)	Adjusted SHR (95 % CI)¤
Geriatric conditions						
0 (n=544)	**2.2** (12)	1 (ref)	1	**10.3** (56)	1	1
1 (n=983)	**2.5** (25)	**1.16** (0.58-2.30)	**0.99** (0.48-2.05)	**12.5** (123)	**1.23** (0.90-1.69)	**1.22** (0.89-1.68)
2 (n=890)	**5.4** (48)	**2.49** (1.32-4.68)	**1.99** (1.02-3.90)	**15.3** (136)	**1.52** (1.11-2.07)	**1.48** (1.08-2.03)
3 (n=761)	**6.7** (51)	**3.10** (1.65-5.82)	**2.21** (1.12-4.35)	**19.3** (147)	**1.95** (1.44-2.65)	**1.93** (1.40-2.65)
4 (n=341)	**10.6** (36)	**5.02** (2.61-9.64)	**3.75** (1.87-7.52)	**23.8** (81)	**2.45** (1.74-3.43)	**2.43** (1.72-3.42)

* HR = Hazard ratio
§ Cox proportional hazard model adjusted for age (continuous variable) and number of geriatric conditions, gender, marital status, and triage urgency as categorical variable.
# SHR = Sub-hazard ratio
¤ Competing-risks regression model adjusted for age (continuous variable) and number of geriatric conditions, gender, marital status, and triage urgency as categorical variable
(HR and SHR for gender, age, marital status, and triage urgency are displayed in supplement 3)

Sensitivity analysis for missing data did not show any significant differences for odds ratio, hazard ratio, or sub-hazard ratio.

Figure 2 presents patient status (dead, dependent or independent of home care) within the first 30 days after discharge (Figure 2A) and 360 days after discharge (Figure 2B). Among patients with no geriatric conditions at arrival to the ED 70 % of the patients lived independent all 360 days after discharge, 53 % of patients with one geriatric condition, 26 % of patients with two geriatric conditions, and none of the patients with three or four geriatric conditions lived independently

(Figure 2B). Among all patients discharged alive (n=3,519) the overall mortality during the entire 360 days follow-up period were 20.6 %. A total of 38.7 % of the patients with four geriatric conditions at arrival to the ED were dead 360 days after discharge (Figure 2B).

DISCUSSION

Our study showed that more than 50 % of all patients 65 years or older attending the ED with an acute medical complaint had two or more geriatric conditions. Furthermore, the amount of conditions was closely related to prognosis. By assigning four basic geriatric conditions to patients we were able to identify patients at high risk of admission, long hospital stay, in-hospital mortality, post-discharge mortality, acute hospital re-attendance, and loss of independency.

These findings correspond well with other studies assessing functional dependency, comorbidity, and polypharmacy as predictors of poor health outcomes like in-hospital mortality, long hospital stay, post-discharge mortality, and hospital re-attendance.[4, 38-41]

The aim of this study was not to develop a new tool in order to identify frail older patients in the ED or to show when older ED patients should receive specialist assessment like CGA. The aim was to assess and describe the potential size of the problem. Our results showed a substantial overlap between the 95 % confidence interval between the numbers of geriatric conditions, which also indicate that it would not be possible to use the number of geriatric conditions to identify the individual patient at risk of poor health outcome. As the proportion of older patients in the ED increases the importance of geriatric assessment and geriatric emergency medicine might increase. One way of implementing geriatric emergency medicine would be to develop special geriatric EDs, like paediatric EDs and psychiatric EDs.[42-44] However, a great effort, at least in Denmark, has been done to unite the attendance of acute medical patients at one place, to ensure the same level of treatment regardless of time and place.[45] Another way could be to increase the geriatric knowledge among ED physicians.[46-48] Education of ED physicians increase their knowledge but the effect has shown to be limited.[49, 50] A third model of implementing geriatric emergency is the presence of geriatricians in the ED. This allows a two-step procedure to identify geriatric patients at risk of poor outcome and subsequently applying full geriatric assessment.[51, 52] By applying an age related visitation only for patients to receive geriatric assessment the patients in most need of geriatric healthcare skills might not be identified. Instead, a "need related" visitation seems more accurate.[53] However, how to identify the patients in need of geriatric assessment remains unclear. Using frailty

scales as risk-stratification tools might be a possibility.[54, 55] Several frailty rating scales exists[19] and screening appears to predict the risk of mortality,[56] length of admission,[57] and risk of readmission[57] depending on the frailty scale used. The definition of the frail patient is ambiguously and unfortunately the lack of intervention studies questions the effectiveness of such frailty screening.[58, 59] We used easily accessible data already available at ED contact to identify the described geriatric conditions. This might be effective in the time restricted setting since no direct assessment is needed to identify these conditions and information are insured even if patients are cognitively impaired. Like the electronic-frailty index developed to identify frail older patients in General practice[60] it might be possible to generate an electronic frailty index in the ED using an already developed frailty index like the Rockwood accumulation of deficits model.[23] To ease communication and transition between health care sectors an index should be applied uniformly across different health care systems. Further research is needed in order to develop such an instrument.

The prevalence of non-specific complaints varies between studies from 5.5- 21 %[17, 61, 62] and is more common in frail older patients.[63] In our study, the prevalence of older patients presenting with non-specific complaints were 11 %. This might be due to differences in the study populations. Vanpee *et al.*[61] only included patients 75 years or older and Nemec *et al.*[17] only included patients in the medium triage category. We included all patients ≥ 65 years of age. We were not able to detect any differences between the prevalence of non-specific complaints and the numbers of geriatric conditions but among patients with disability a higher prevalence of non-specific complaints were found (data not shown). This might be because functional impairment and presentation with non-specific complaints are somehow related.[64] Studies reporting the prognosis of patients presenting to the ED with non-specific complaints are conflicting.[17, 62, 65] We were not able to show an increased risk of neither in-hospital nor 30 days mortality in patients with non-specific complaints compared to patients with more specific complains (data not shown).

Trends seen in the measurements of systolic blood pressure, respiratory rate, heart rate, and arterial oxygen saturation across increasing number of conditions corresponds with already existing knowledge regarding vital signs in older age.[66] However, abnormal or normal vital signs in older patients should always be interpreted with caution since age related impaired physical regulation, common illness, and medications taking by older patients often affects the range of vital sign meassurements.[66] Even though we found a trend, the observed differences among groups did not yield clinical meaningful differences.

Limitations and strengths

The strengths of this study were the longitudinal cohort design, the large sample size, and the accurate cross-sectional linkage between prehospital healthcare data, hospital data, and healthcare population-based registries. To minimise bias, we included all consecutive medical ED contacts, the proportion of missing data were very low, and follow-up was complete. Home care was always and only registered if it was delivered, giving data a large conformity with reality.

Our study also had some limitations. Firstly, it is a Danish single centre study and should be interpreted as such. Secondly, Charlson comorbidity index was calculated from information on 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. Also, Charlson comorbidity do not include common comorbidities seen in older patients like osteoporosis, hypertension, and atrial fibrillation and defining comorbidity as Charlson comorbidity index ≥ 2 might also lead to under-reporting. However, it has been shown that the validity of using Danish National health registers to calculate Charlson comorbidity index is good and that it is a well-established predictor of mortality and functional impairment even among nursing home patients.[33, 67, 68] Thirdly, categorisation of patients not receiving home care as not disabled might be misleading. They might have a healthy spouse taking care of them. Fourthly, Odense University Pharmacoepidemiological Database only covers reimbursed medications and not drugs that are dispensed over the counter. This might lead to risk of under-reporting of number of medications taken. Finally, several of the covariate estimates changed direction during the modelling process which suggests collinearity issues or possible effect modification in the multivariate analysis and the results have to be interpreted with this in mind.

CONCLUSION

Among the older medical ED population the prevalence of patients with geriatric conditions is high and associated with poor hospital and post-discharge outcomes. The literature supports the presence of geriatricians in existing ED's thereby implying the principles of geriatric medicine in the acute setting. Our study emphasises the potential need of geriatric awareness but does not allow any conclusions regarding effect of geriatric interventions. More focus is needed on how to precisely identify the geriatric patients in the ED who might benefit from applying geriatric assessment and the effect of interventions on both patients-and service-outcome.

Author Contributors

All authors participated in the design of the study. AT performed the statistical analyses in a dialogue with ATL, JR, and JUR. AT wrote the manuscript. All authors were involved in the interpretation of data and the critical revision of the manuscript. AT had the primary responsibility for the final content. All authors read and approved the final manuscript.

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Competing interest

The authors have declared that no conflict of interest exists.

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Data sharing statement:

Due to the Danish Law on personal data, we are not allowed to share data in a public dataset. Access to data from the Danish Health Data Authority requires approval from the Danish Data Protection Agency: https://www.datatilsynet.dk/english/the-danish-data-protection-agency/introduction-to-the-danish-data-protection-agency/

For access and sharing of data and materials please contact the corresponding author or the Research Service at the Department of Clinical Research, University of Southern Denmark, 5000 Odense C. Phone: +45 65504051 and we will help you with the process and following provide access to the dataset.

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LEGENDS

Figure 1: Flowchart of patients included in the study period.

Figure 2: The proportion of patients discharged alive who died, were dependent on home care, or were independent of home care in relation to number of geriatric conditions (disability, recently increased disability, polypharmacy, and comorbidity) in the

A) 30 days period after discharge

B) 360 days period after discharge

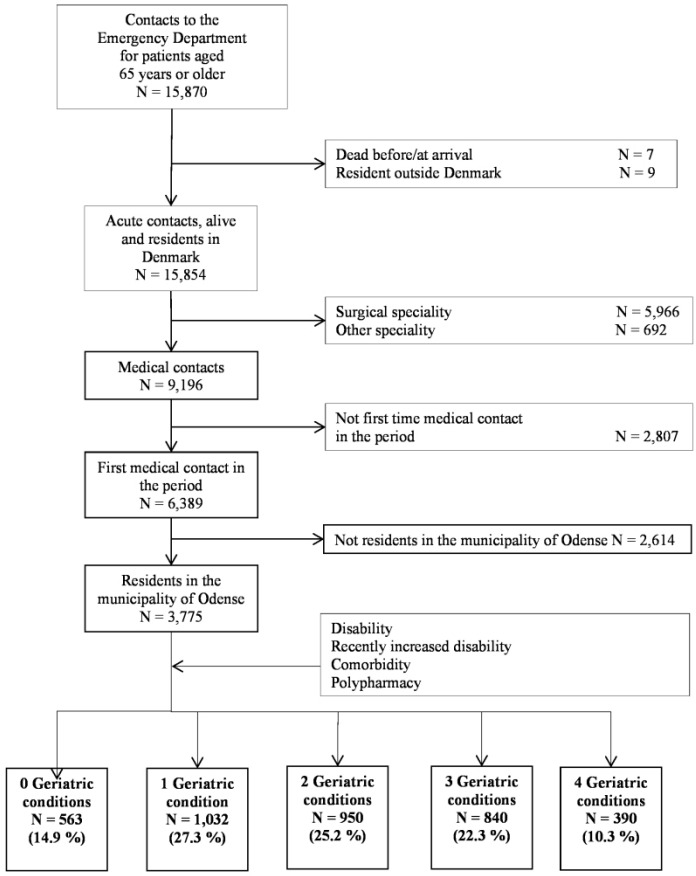
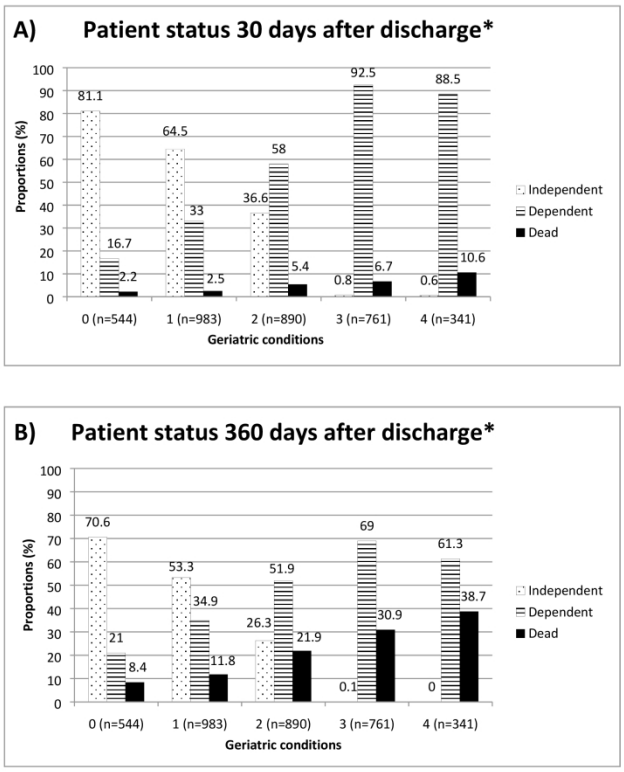


Figure 1: Flowchart of patients included in the study period.

209x297mm (300 x 300 DPI)



* Only patients discharged alive (n=3,519)

Figure 2: The proportion of patients discharged alive who died, were dependent on home care, or were independent of home care in relation to number of geriatric conditions (disability, recently increased disability, polypharmacy, and comorbidity) in the
A) 30 days period after discharge
B) 360 days period after discharge

209x297mm (300 x 300 DPI)

Supplement 1

(A) Distribution of specific complaints and non-specific complaints according to number of geriatric conditions.
(B) Distribution of main complaints according to number of geriatric conditions and categorisation of main complaints in to specific complaints and non-specific complaints

A			**All patients** n=3,775	**0 geriatric conditions** n=563	**1 geriatric condition** n=1,032	**2 geriatric conditions** n=950	**3 geriatric conditions** n=840	**4 geriatric conditions** n=390
		Specific complaint	88.9 % (n=3,129)	88.8 % (n=459)	89.5 % (n=861)	89.0 % (n=783)	88.5 % (n=706)	88.6 % (n=320)
		Non-specific complaint	11.1 % (n=389)	11.2 % (n=58)	10.5 % (n=101)	11.0 % (n=97)	11.5 % (n=92)	11.4 % (n=41)
B								
Specific complain	Non-specific complaint	Main complaint:	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
X		Airway symptoms	643 (18.3)	61 (11.8)	140 (14.6)	177 (20.1)	185 (23.2)	80 (22.2)
X		Neurological disorder	398 (11.3)	66 (12.8)	144 (15.0)	89 (10.1)	74 (9.3)	25 (6.9)
X		Fever	370 (10.5)	54 (10.4)	87 (9.0)	87 (9.9)	96 (12.0)	46 (12.7)
X		Faint	284 (8.1)	61 (11.8)	93 (9.7)	62 (7.1)	46 (5.8)	22 (6.1)
X		Laboratory deviances	270 (7.7)	28 (5.4)	53 (5.5)	77 (8.8)	82 (10.3)	30 (8.31)
X		Chest pain	262 (7.5)	49 (9.5)	87 (9.0)	65 (7.4)	43 (5.4)	18 (5.0)
X		Abdominal pain	197 (5.6)	36 (7.0)	55 (5.7)	49 (5.6)	39 (4.9)	18 (5.0)
	X	Impaired consciousness	176 (5.0)	19 (3.7)	46 (4.8)	46 (5.2)	47 (5.9)	18 (5.0)
	X	Dizziness	120 (3.4)	32 (6.2)	30 (3.1)	29 (3.3)	20 (2.5)	9 (2.5)
X		Pain in back and loin	78 (2.2)	15 (2.9)	24 (2.5)	18 (2.1)	13 (1.6)	8 (2.2)
X		Gastrointestinal bleeding, upper	75 (2.1)	3 (0.6)	20 (2.1)	24 (2.7)	18 (2.3)	10 (2.8)
X		Pain in extremity	75 (2.1)	10 (1.9)	19 (2.0)	20 (2.3)	17 (2.1)	9 (2.5)
	X	Unspecific illness	72 (2.1)	6 (1.2)	20 (2.1)	15 (1.7)	21 (2.6)	10 (2.8)
X		Glucose deviances	62 (1.8)	2 (0.4)	14 (1.5)	19 (2.2)	16 (2.0)	11 (3.1)
X		Headache	46 (1.3)	12 (2.3)	20 (2.1)	8 (0.9)	5 (0.6)	1 (0.3)
X		Wounds	45 (1.3)	2 (0.4)	12 (1.3)	11 (1.3)	10 (1.3)	10 (2.8)
X		Convulsions	44 (1.3)	8 (1.6)	14 (1.5)	13 (1.5)	7 (0.9)	2 (0.6)
X		Palpitation	41 (1.2)	12 (2.3)	16 (1.7)	9 (1.0)	3 (0.4)	1 (0.3)
X		Poisoning	36 (1.0)	4 (0.8)	10 (1.0)	11 (1.3)	5 (0.6)	6 (1.7)
X		Allergy/anaphylaxis	53 (1.0)	12 (2.3)	10 (1.0)	6 (0.7)	5 (0.6)	2 (0.6)
X		High blood pressure	33 (0.9)	10 (1.9)	12 (1.3)	4 (0.5)	5 (0.6)	2 (0.6)
X		Pain and symptoms from urinary tract	32 (0.9)	5 (1.0)	4 (0.4)	8 (0.9)	11 (1.4)	4 (1.1)

X		Diarrhoea or/and vomiting	22 (0.6)	1 (0.2)	2 (0.2)	5 (0.6)	9 (1.1)	5 (1.4)
X		Cardiac dyspnoea	18 (0.5)	1 (0.2)	8 (0.8)	3 (0.3)	2 (0.3)	4 (1.1)
	X	Falling	15 (0.4)	1 (0.2)	4 (0.4)	6 (0.7)	2 (0.3)	2 (0.6)
X		Hip pain	13 (0.4)	1 (0.2)	1 (0.1)	6 (0.7)	4 (0.5)	1 (0.3)
X		Head trauma	9 (0.3)	1 (0.2)	3 (0.3)	1 (0.1)	2 (0.3)	2 (0.6)
X		Extremity trauma	8 (0.2)	0 (0.0)	2 (0.2)	2 (0.2)	2 (0.3)	2 (0.6)
X		Cardiac arrest	8 (0.2)	0 (0.0)	5 (0.5)	0 (0.0)	3 (0.4)	0 (0.0)
	X	Delirium	6 (0.2)	0 (0.0)	1 (0.1)	1 (0.1)	2 (0.3)	2 (0.6)
X		Peripheral oedema	6 (0.2)	1 (0.2)	1 (0.1)	2 (0.2)	2 (0.3)	0 (0.0)
X		Gastrointestinal bleeding, lower	4 (0.1)	1 (0.2)	1 (0.1)	1 (0.1)	1 (0.1)	0 (0.0)
X		Suicidality or self-harming	4 (0.1)	1 (0.2)	3 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)
X		Swallowing difficulties	4 (0.1)	1 (0.2)	0 (0.0)	2 (0.2)	1 (0.1)	0 (0.0)
X		Acute psychosis	2 (0.1)	1 (0.2)	0 (0.0)	1 (0.1)	0 (0.0)	0 (0.0)
X		Abstinence	2 (0.1)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)	0 (0.0)
X		Pain in scrotum	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.3)
X		Thorax trauma	2 (0.1)	0 (0.0)	0 (0.0)	2 (0.2)	0 (0.0)	0 (0.0)
	X	Uncooperative patient	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
X		Surgical abscess	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

Supplement 2

Gender, age, marital status, and triage urgency as risk factor for patient's destination, length of admission (only patient admitted), and in-hospital mortality showed by crude and adjusted odds ratio (OR)

	Admitted to hospital			Admission > 48 hours #			Dead in-hospital		
	% (n)	Crude OR (95 % CI)	Adjusted OR (95 % CI) §	% (n)	Crude OR (95 % CI)	Adjusted OR (95 % CI) §	% (n)	Crude OR (95 % CI)	Adjusted OR (95 % CI) §
Gender									
Female (n=2,083)	**67.2** (1,400)	1 (ref)	1	**80.3** (1,124)	1	1	**6.4** (134)	1	1
Male (n=1,692)	**68.0** (1,151)	**1.04** (0.90-1.19)	**1.17** (1.01-1.36)	**79.4** (914)	**0.95** (0.78-1.15)	**1.05** (0.85-1.30)	**7.2** (122)	**1.13** (0.88-1.46)	**1.49** (1.08-2.04)
Age		**1.03** (1.02-1.04)	**1.03** (1.02-1.03)		**1.02** (1.01-1.03)	**1.02** (1.00-1.03)		**1.04** (1.03-1.06)	**1.04** (1.02-1.06)
Urgency									
Less urgent (n=2,250)	**65.2** (1,468)	1	1	**82.4** (1,209)	1	1	**4.0** (89)	1	1
Urgent (n=1,428)	**71.3** (1,018)	**1.32** (1.72-2.05)	**1.34** (1.16-1.55)	**78.1** (795)	**0.76** (0.63-0.93)	**0.79** (0.64-0.97)	**8.6** (123)	**2.29** (1.73-3.03)	**2.39** (1.78-3.22)
Marital status									
Not alone (n=1,565)	**65.6** (1,027)	1	1	**77.3** (794)	1	1	**5.8** (91)	1	1
Alone (n=2,150)	**68.7** (1,478)	**1.15** (1.00-1.32)	**1.01** (0.87-1.18)	**81.5** (1,205)	**1.30** (1.06-1.58)	**1.16** (0.93-1.45)	**6.9** (148)	**1.20** (0.91-1.57)	**0.95** (0.68-1.33)

§ Logistic regression adjusted for age (continuous variable), gender, marital status, triage urgency, and number of geriatric conditions (categorical variables)

only patients admitted for in-hospital treatment are included in this analysis

Supplement 3

Gender, age, marital status, and triage urgency as prognostic factors of 30 days mortality and 30 days acute hospital re-attendance in older patients after discharge from an acute Emergency Department contact

	Mortality 0-30 days			Acute hospital re-attendance 0-30 days		
	% (n)	Crude HR* (95 % CI)	Adjusted HR (95 % CI)§	% (n)	Crude SHR# (95 % CI)	Adjusted SHR (95 % CI)¤
Gender						
Female (n=1,949)	**5.0** (98)	1 (ref)	1	**16.1** (314)	1	1
Male (n=1,570)	**4.7** (74)	**0.93** (0.69-1.27)	**1.28** (0.91-1.79)	**14.6** (229)	**0.90** (0.76-1.07)	**0.96** (0.80-1.16)
Age		**1.06** (1.04-1.08)	**1.05** (1.02-1.07)		**1.01** (1.00-1.02)	**1.00** (0.99-1.01)
Urgency						
Less urgent (n=2,161)	**4.9** (105)	1	1	**15.6** (338)	1	1
Urgent (n=1,305)	**4.9** (64)	**1.01** (0.73-1.39)	**1.10** (0.80-1.51)	**15.1** (197)	**0.96** (0.80-1.14)	**0.97** (0.81-1.15)
Marital status						
Not alone (n=1,474)	**3.6** (53)	1	1	**14.3** (211)	1	1
Alone (n=2,002)	**5.5** (111)	**1.53** (1.10-2.13)	**1.20** (0.83-1.73)	**16.5** (330)	**1.17** (0.98-1.39)	**1.04** (0.85-1.26)

* HR = Hazard ratio
§ Cox proportional hazard model adjusted for age (continuous variable) and number of geriatric conditions, gender, marital status, and triage urgency as categorical variable.
# SHR = Sub-hazard ratio
¤ Competing-risks regression model adjusted for age (continuous variable) and number of geriatric conditions, gender, marital status, and triage urgency as categorical variable

STROBE 2007 (v4) checklist of items to be included in reports of observational studies in epidemiology*

Checklist for cohort, case-control, and cross-sectional studies (combined)

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any pre-specified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	5
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	The study was not matched
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*6-8*
Bias	9	Describe any efforts to address potential sources of bias	9
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	8-9
		(*b*) Describe any methods used to examine subgroups and interactions	7-8
		(*c*) Explain how missing data were addressed	9
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed	17 (complete follow

		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy	up)
		(*e*) Describe any sensitivity analyses	9
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	10
		(b) Give reasons for non-participation at each stage	Figure 1
		(c) Consider use of a flow diagram	Figure 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	10
		(b) Indicate number of participants with missing data for each variable of interest	9
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	10
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	12
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	-
		Cross-sectional study—Report numbers of outcome events or summary measures	-
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Table 2,3
		(*b*) Report category boundaries when continuous variables were categorized	12-14 and Table 2,3,
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	12
Discussion			
Key results	18	Summarise key results with reference to study objectives	15
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	17
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	15-16
Generalisability	21	Discuss the generalisability (external validity) of the study results	17
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	18

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.
Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.