

JOURNAL OF GERIATRIC EMERGENCY MEDICINE

Fall 2022 | Volume 3 | Issue 3

Article 6 | Original Research

JGEM | The Journal of Geriatric
Emergency Medicine

 Advocate Aurora Health[®]

 GEDC

Pre-hospital Conditions Affecting the Hospitalization Risk in Older Adults at the Emergency Department

Karin Erwander, MD, Kjell Ivarsson, MD PhD, Mona Landin Olsson, MD PhD, Björn Agvall, MD PhD

ABSTRACT

Introduction	The Emergency Department (ED) is a common route to hospitalization for critically ill and older adults. Older patients are admitted to hospital at a higher rate and have longer length of stay (LOS) when hospitalized. To be able to confront an increasing aging population, meet their medical needs and influence rising costs of health care, there is a need to focus on the older population. In Scandinavia, few studies are made that focus on the geriatric population at the ED. It is essential to early identify risk factors for hospitalization at the ED to improve the medical care for older adults and the influence of prehospital comorbidities.
Methods	This is a retrospective observational study of older adults visiting the ED in southwest Sweden. The aim of this study was to examine if routinely collected patient demographics and prehospital comorbidities were associated with ED disposition and in-patient process outcomes. The data collection was generated from the Regional Healthcare Information Platform. The variables extracted were age, gender, ED-visits, LOS at ED, admission rate, in-hospital LOS and comorbidities before visiting the ED.
Results	A total of 15 528 patients aged ≥ 65 years visited the ED during 2016, 8 098 (52%) were female and 7 430 (48%) were male, 6 631 (41%) were 65-74 years of age, 5 585 (36%) were 75-84 years of age and 3 612 (23%) were 85 years or older. LOS at the ED were over 4 hours for 45% of the population. Patients aged 85 or older had a Hazard ratio of 2.56 (CI 2.33-2.82) for admission and patients with HF had a Hazard ratio of 1.75 (CI 1.46-2.09).
Conclusion	Patients with old age, HF and comorbidities as prehospital conditions have a significant higher risk for admission to the hospital and a longer in-hospital stay regardless reason for the ED visit. The awareness of this could help physicians identify older patients with high risk for admission and early initiate an admission plan to be able to reduce LOS at the ED.

INTRODUCTION

The population of older adults is increasing worldwide and in Sweden, with its 10 million inhabitants, 20 % are 65 years of age or older¹. Older adults in Sweden accounts for 40 % of all visits to Emergency Department (ED) every year². The ED is a central service for critically ill patients and the majority of older patients in Sweden passes the ED before they are admitted to the hospital. Studies have shown that healthcare consumption increases with age and is even more significant during the last years of life³⁻⁶. Compared to younger patients, older patients use the ED at a higher rate and have longer length of stay (LOS) at the ED⁷⁻⁹. Visits to the ED for older adults are associated with higher risk of morbidity and mortality¹⁰. The risk of adverse events increases with LOS at the ED¹¹⁻¹³. It is important to consider what can be done to shorten LOS at the ED for the older adults to reduce mortality¹⁴. One way to reduce LOS at the ED could be to initiate a medical plan for the older patients at an early stage that culminate either to hospitalization or discharge home with a referral for follow-up plan in primary health care.

Older adults have more complex medical needs that consequently results in increased use of resources at the ED¹⁵⁻¹⁷. The prevalence of atypical, or non-specific, presentation as chief-complaint in the ED is common for older adults¹⁸. These patients are not always highly prioritized in the ED and have worse clinical outcome¹⁹. Chief-complaint is important to take into consideration when treating older adults at the ED but we also need to identify other risk factors to be able to improve their medical care at the ED.

Early identification of patients that needs admission could shorten LOS at the ED, improve the workflow at the ED, leave resources to critical ill patients and improve the medical care for older patients²⁰. As described in previous research it is important to take biological age in to consideration and not only chronological²¹. Multimorbidity is one important factor and studies have shown increased risk for ED-visits and hospitalization in this patient group^{4,22}. Circulatory and respiratory problems as well as injuries among older adults have been identified as the most common reason for ED-visits^{7,23}. Acute heart failure (HF) is one of the most common diagnoses that leads to unplanned hospital admission in the elderly population²⁴.

To be able to accommodate an aging population regarding their medical needs and accompanying rising of health care costs there is a need to focus on older adults with co-morbidities. In Scandinavia, few studies exist that focus on older adults at the ED. This study sought to compare previous international findings against a Swedish population. Additional research is important as it may point towards the need for additional resources to effectively manage older and complex patients who are at risk for hospitalization.

Aim

The aim of this study was to examine if certain prehospital conditions are associated with longer stay at the ED, hospitalization risk and longer in-hospital stay regardless of the reason for the ED visit.

METHODS

Setting and Design

This retrospective observational study was conducted with data of older adults ≥ 65 years of age visiting one of the ED in Region Halland (RH). The study period was between 1 January 2016 and 31 December 2016. RH is located on the southwest coast of Sweden. There are three hospitals in the region, where two of them have an ED open 24 hours a day.

Patients and Selection

During 2016 a total of 314784 individuals lived in RH. The proportion of individuals aged ≥ 65 years were 71688 (23%). Of these a total of 15528 (22%) individuals visited the ED at least one time during 2016 and were included in the study.

According to the WHO classification patients ≥ 65 years of age were classified as older adults and then categorized into three different age groups: 65-74 years, 75-84 years and ≥ 85 years²⁵.

Data Collection

The data collection was generated from the Regional Healthcare Information Platform (RHIP). The data variables extracted from RHIP were age, gender, ED-visits, ED-diagnoses, LOS at ED, admission rate, in-hospital LOS and comorbidities before visits to the ED. LOS at the ED were categorized as <4 hours or >4 hours²⁶. Comorbidities that each included patient had before their first ED-visit during 2016 were collected. All diagnoses were registered according to the International Classification of Disease-10 (ICD-10). The most common diagnoses were then categorized into the following groups: hypertension, ischemic heart disease (IHD), atrial fibrillation (AF), HF, cerebrovascular insult (CVI), diabetes mellitus (DM), chronic obstructive pulmonary disease (COPD), musculoskeletal pain, psychiatric disorders and tumors as described in Table 1. Patients with none of the above listed diagnosis were categorized as previously healthy.

Table 1: Diagnostic groups categorized according to the International Classification of Disease-10 (ICD-10).

Diagnostic group	ICD-10
Hypertension	I10-I15
IHD	I20-I25
AF	I48
HF	I50
CVI	I60-I69
DM	E10-E14
COPD	J43-J45
Musculoskeletal pain	M05-M06, M15-M19, M54, M48, M79
Psychiatric disorders	F00-F03, F10-F48, R54, G30
Tumor	C00-C97

Note: IHD = ischemic heart disease, AF = atrial fibrillation, HF = heart failure, CVI = cerebrovascular insult, DM = diabetes mellitus, COPD = chronic obstructive pulmonary disease.

The number of diagnosis groups (according to Table 1) was registered for each individual patient and, based on this, the patients were also categorized according to their health status if they were previously healthy, had diagnosis from 1-3 diagnostic groups or diagnosis from ≥ 4 diagnostic groups.

Outcome Measures

The primary outcome measures were number of ED-visits, admissions, and LOS at ED. The secondary outcome measure was demographic characteristics, previous health condition for the older adults that visits the ED and in-hospital LOS.

Statistical Analysis

Descriptive statistics were used to characterize patients' demographics. Continuous variables were described as means + standard deviation (SD) and analyzed using Student's t-test and One-way-ANOVA. Categorical variables were analyzed using Chi-2-Square tests and summarized using frequency and percentages. A multivariate regression analysis was performed to analyze if gender, age, and comorbidities were correlated to increase risk of admission and mortality. A risk evaluation of age, gender, and comorbidity with the number of hospital bed days is performed with logistic regression. A p-value < 0.05 was considered statistically significant. The analyses were executed with IBM SPSS Statistics 27, Armonk, New York, USA. There were no missing values in the data collection.

The Ethical Review Agency in Sweden granted ethical approval for the study (reference number 2016/20).

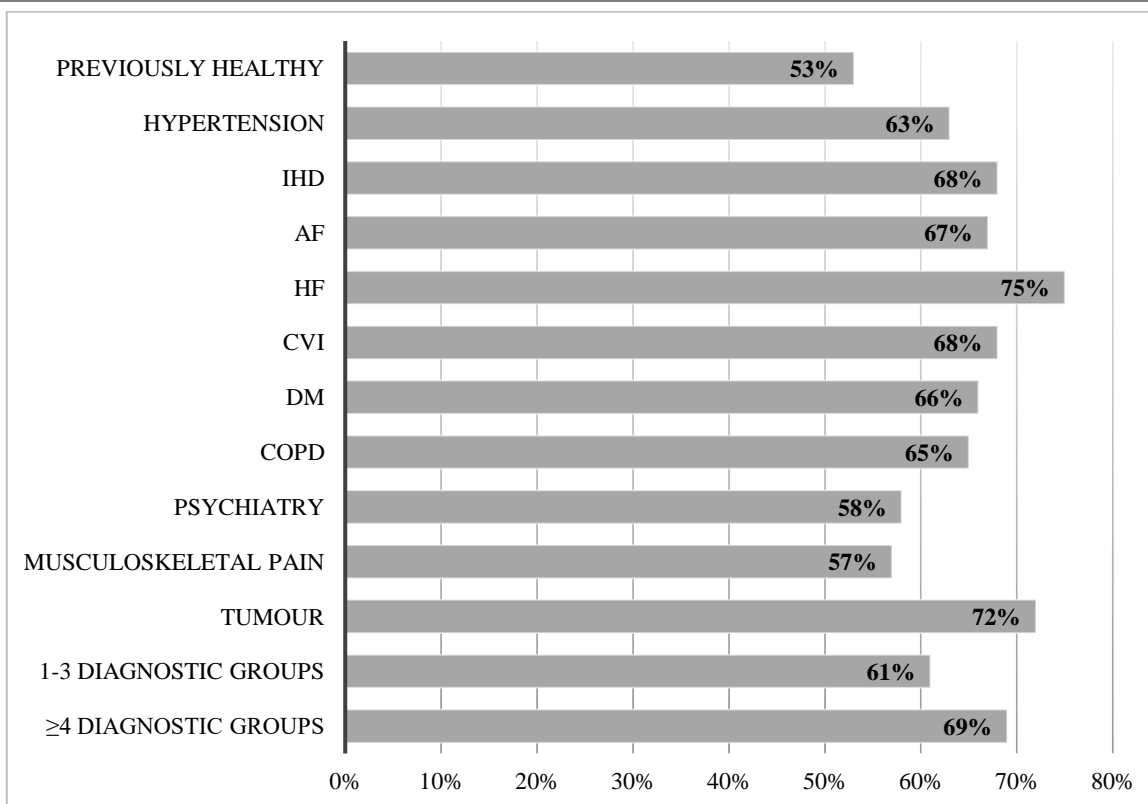
RESULTS

A total of 15528 patients aged ≥ 65 years visited the ED in RH during 2016, 8098 (52%) were female and 7430 (48%) were male, 6631 (41%) were 65-74 years of age, 5585 (36%) were 75-84 years of age and 3 612 (23%) were 85 years or older. A third of all patients were described as previously healthy prior to their first ED visit. Patients with 1-3 diagnostic groups were 9056 (58%) and 1 184 (8%) had four or more diagnosis. Cardiovascular diseases such as: hypertension, IHD, AF and HF were the dominating disease burden in this patient group and increased with age. Basic characteristics are given in Table 2.

Table 2: Demography of the study population that made visits to the ED during 2016.

	Total	65-74	75-84	>84	p-value
Total, n (%)	15528 (100)	6331 (41)	5585 (36)	3612 (23)	<0.001
<i>Gender</i>					
Women, n (%)	8098 (52)	3034 (48)	2867 (51)	2197 (61)	<0.001
Men, n (%)	7430 (48)	3297 (52)	2718 (49)	1415 (39)	<0.001
<i>Pre-hospital health status</i>					
Previously healthy, n (%)	5288 (34)	2714 (43)	1540 (28)	1034 (29)	<0.001
Hypertension, n (%)	5426 (35)	1755 (28)	2190 (39)	1481 (41)	<0.001
IHD, n (%)	1950 (13)	548 (9)	809 (15)	593 (16)	<0.001
AF, n (%)	2821 (18)	708 (11)	1167 (21)	946 (26)	<0.001
HF, n (%)	1225 (8)	221 (3)	464 (8)	540 (15)	<0.001
CVI, n (%)	858 (6)	218 (3)	383 (7)	257 (7)	<0.001
DM, n (%)	2106 (14)	801 (13)	894 (16)	411 (11)	<0.001
COPD, n (%)	1279 (8)	444 (7)	577 (10)	258 (7)	<0.001
Psychiatry, n (%)	1735 (11)	608 (10)	648 (12)	479 (13)	<0.001
Musculoskeletal pain, n (%)	2945 (19)	1071 (17)	1212 (22)	662 (18)	<0.001
Tumor, n (%)	1685 (11)	580 (9)	717 (13)	388 (11)	<0.001
<i>Comorbidities</i>					
1-3 diagnostic groups, n (%)	8635 (56)	3232 (51)	3332 (60)	2071 (57)	<0.001
≥4 diagnostic groups, n (%)	1605 (10)	385 (6)	713 (13)	507 (14)	<0.001
Note: n = number, IHD = ischemic heart disease, AF = atrial fibrillation, HF = heart failure, CVI = cerebrovascular insult, DM = diabetes mellitus, COPD = chronic obstructive pulmonary disease. Chi-2-square were used for p-value.					

The selected patient group made a total of 28342 visits to the ED. Pre-hospital conditions before the first ED-visit were registered. Patient with HF, COPD and ≥4 diagnostic groups had the highest number of ED-visits during the study period. LOS at the ED were over four hours for 45% of the population. Woman had a longer waiting time at the ED compared to men; 47% of the woman waited > 4h at the ED vs 44% for men. Patients with psychiatric- or musculoskeletal disorders had a slightly longer waiting time at the ED compared to other diagnostic groups. Of 28342 visits to the ED 16820 (59%) resulted in an admission to the hospital. A total of 101181 bed-days, where mean in-hospital LOS were 6.5 days per patient analyzed using Student's t-test. Previously healthy patients had the lowest admission rate at 53%. Patients with ≥4 diagnostic groups had an admission rate of 69% whereas patients with HF and tumors had an admission rate over 70%. Admission rate based on previous health status are given in Figure 1.



Note: IHD = ischemic heart disease, AF = atrial fibrillation, HF = heart failure, CVI = cerebrovascular insult, DM = diabetes mellitus, COPD = chronic obstructive pulmonary disease.

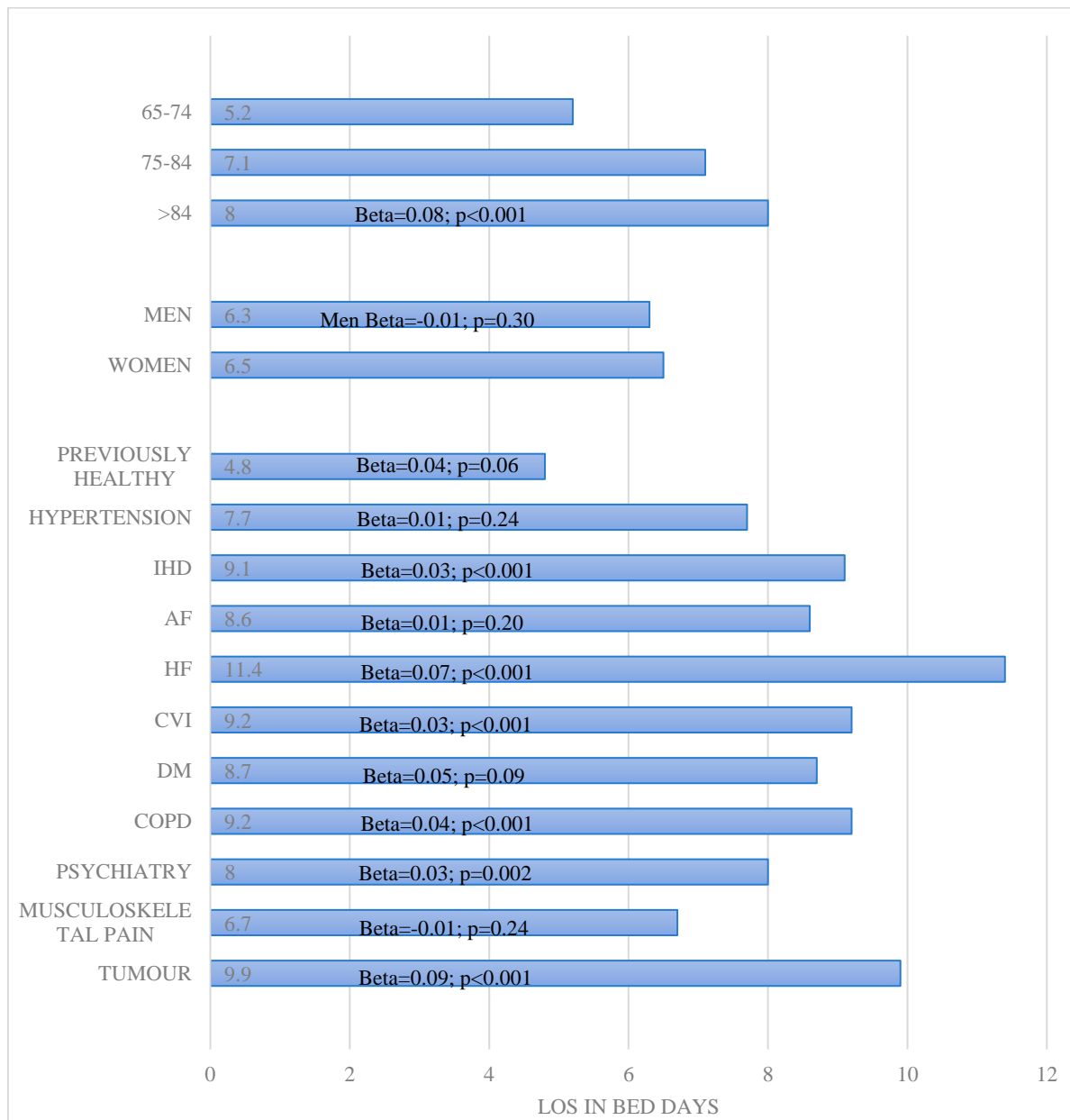
Figure 1. Admission rate based on previous health status. Of all visits made to the ED percentage of how many resulted in an admission to the hospital.

The most common diagnoses at the ED were from group R and Z in the ICD-10 classification (for example chest pain unspecified, dyspnea unspecified). They are described as symptom diagnoses and accounted for 11 136 visits followed by trauma 4761, CVD (cardiovascular disease) 2858 and GI-diseases (gastrointestinal). Patients with tumor and airway symptoms at the ED had the highest hospitalization rate 74 % compared to 73 %. Whereas patients with musculoskeletal pain were admitted at 26 % and patients with trauma were admitted at 41 %. ED-visits based on primary diagnoses at the ED and hospital rate are given in Table 3.

Table 3: The distribution of the most common diagnoses when visiting the emergency department in 2016 in relation to the hospitalization ratio.		
ED diagnose	Total visits to ED	Hospitalization
Airways	1127	819 (73)
CVD	2858	1827 (64)
MSP	1784	463 (26)
Nephrology	995	530 (53)
GI-diseases	1493	845 (57)
Trauma	4761	1946 (41)
Tumor	194	143 (74)
Symptom diagnoses	11136	6589 (59)
Total visits	28342	15047 (53)

Note: Airway diagnosis = ICD J, CVD (cardiovascular disease) = ICD I, MSP (musculoskeletal pain) = ICD M, Nephrology = ICD N, GI-diseases (gastrointestinal) = ICD K, Trauma = ICD S and T, Tumor = ICD C-D and Symptom diagnoses = ICD R and Z.

Previously healthy individuals had a mean in-hospital LOS at 4.8 bed-days for every admission whilst patients with HF on average stayed 11.4 days. In-hospital LOS in different age-groups, gender and pre-hospital health status are given in Figure 2.



Note: LOS=length of stay in number of bed-days. IHD = ischemic heart disease, AF = atrial fibrillation, HF = heart failure, CVI = cerebrovascular insult, DM = diabetes mellitus, COPD = chronic obstructive pulmonary disease.

Figure 2. Mean in-hospital LOS (bed-days) separated in age, gender, and pre-hospital health status. Includes risk analysis regarding association between LOS and probable risk factor with a linear regression.

The consistent trend for the study population were that in-hospital LOS increases with age. Healthcare consumption (ED-visits and admissions) for each age-group and diagnostic-group are given in Table 4.

Table 4. Illustrates mean number of visits to ED and hospital admissions during 2016 in total and for each age-category.

	Total	65-74	75-84	>84	p-value
Total number of patients, n (%)	15528 (100)	6331 (41)	5585 (36)	3612 (23)	<0.001
<i>Previously healthy</i>					
ED-visits, mean (SD)	1.6 (1.1)	1.5 (1.1)	1.6 (1.1)	1.7 (1.1)	<0.001
Admissions, mean (SD)	0.8 (1.0)	0.7 (1.0)	0.9 (1.0)	1.1 (0.9)	<0.001
<i>Hypertension</i>					
ED-visits, mean (SD)	2.0 (1.9)	2.0 (2.3)	2.0 (1.7)	2.0 (1.6)	0.5
Admissions, mean (SD)	1.3 (1.4)	1.2 (1.5)	1.2 (1.4)	1.4 (1.3)	<0.001
<i>IHD</i>					
ED-visits, mean (SD)	2.2 (1.9)	2.3 (2.2)	2.3 (1.8)	2.2 (1.8)	0.6
Admissions, mean (SD)	1.5 (1.6)	1.5 (1.9)	1.5 (1.6)	1.6 (1.4)	0.7
<i>AF</i>					
ED-visits, mean (SD)	2.3 (2.1)	2.3 (2.1)	2.4 (2.3)	2.2 (1.7)	0.06
Admissions, mean (SD)	1.5 (1.6)	1.5 (1.8)	1.6 (1.7)	1.5 (1.4)	0.6
<i>HF</i>					
ED-visits, mean (SD)	2.4 (1.9)	2.5 (2.3)	2.4 (2.0)	2.2 (1.7)	0.13
Admissions, mean (SD)	1.8 (1.7)	1.9 (2.1)	1.8 (1.7)	1.7 (1.4)	0.14
<i>CVI</i>					
ED-visits, mean (SD)	2.1 (1.7)	2.1 (1.8)	2.1 (1.8)	2 (1.5)	0.7
Admissions, mean (SD)	1.4 (1.4)	1.4 (1.5)	1.5 (1.4)	1.4 (1.2)	0.8
<i>DM</i>					
ED-visits, mean (SD)	2.1 (1.7)	2.1 (1.9)	2 (1.7)	2 (1.5)	0.75
Admissions, mean (SD)	1.4 (1.5)	1.2 (1.5)	1.4 (1.4)	1.5 (1.4)	0.01
<i>COPD</i>					
ED-visits, mean (SD)	2.4 (2.8)	2.7 (4.1)	2.3 (1.8)	2.1 (1.8)	0.02
Admissions, mean (SD)	1.5 (1.8)	1.7 (2.3)	1.5 (1.6)	1.5 (1.5)	0.3
<i>Psychiatry</i>					
ED-visits, mean (SD)	2.2 (2.8)	2.4 (3.5)	2.3 (2.7)	1.9 (1.5)	0.01
Admissions, mean (SD)	1.3 (1.5)	1.3 (1.8)	1.3 (1.5)	1.2 (1.1)	0.5
<i>Musculoskeletal pain</i>					
ED-visits, mean (SD)	2.1 (2.2)	2.1 (2.8)	2.1 (1.8)	2.1 (1.7)	0.9
Admissions, mean (SD)	1.2 (1.4)	1 (1.4)	1.2 (1.4)	1.4 (1.3)	<0.001
<i>Tumor</i>					
ED-visits, mean (SD)	2.1 (1.7)	2 (1.6)	2.1 (1.8)	2.2 (1.7)	0.5
Admissions, mean (SD)	1.5 (1.5)	1.4 (1.6)	1.5 (1.5)	1.5 (1.5)	0.5
<i>1-3 diagnostic groups</i>					
ED-visits, mean (SD)	1.9 (1.6)	1.8 (1.6)	1.9 (1.7)	1.9 (1.5)	0.007
Admissions, mean (SD)	1.1 (1.3)	1.0 (1.4)	1.2 (1.3)	1.3 (1.2)	<0.001
<i>≥4 diagnostic groups</i>					
ED-visits, mean (SD)	2.6 (2.9)	3.2 (4.6)	2.5 (2.2)	2.4 (1.9)	0.001
Admissions, mean (SD)	1.8 (1.8)	2.0 (2.1)	1.8 (1.7)	1.7 (1.5)	0.183

Note: One-way Anova were used for p-value. n = number, ED = emergency department, SD = standard deviation, IHD = ischemic heart disease, AF = atrial fibrillation, HF = heart failure, CVI = cerebrovascular insult, DM = diabetes mellitus, COPD = chronic obstructive pulmonary disease.

The risk for admission were higher amongst men compared to woman. Adults aged 85 or older were 2.5 more likely to be admitted and patients with HF had a 1.75 increased risk for hospital admission. Table 5 shows the risk for admission.

Table 5. Binary logistic regression analysis risk for admission.

	Hazard Ratio	p-value	Lower 95%C.I.	Upper 95% C.I.
Male	1.20	<0.001	1.12	1.28
65-74		<0.001		
75-84	1.54	<0.001	1.43	1.66
>84	2.56	<0.001	2.33	2.82
Previously healthy		0.15		
1-3 diagnoses	1.04	0.53	0.92	1.17
≥ 4 diagnoses	1.27	0.09	0.96	1.69
Hypertension	1.04	0.45	0.94	1.14
IHD	1.16	0.02	1.02	1.32
AF	1.25	<0.001	1.12	1.40
HF	1.75	<0.001	1.46	2.09
CVI	1.31	0.002	1.10	1.56
Diabetes	1.30	<0.001	1.15	1.46
COPD	1.30	<0.001	1.13	1.50
Psychiatry	1.10	0.12	0.98	1.25
Musculoskeletal pain	0.99	0.80	0.89	1.10
Tumor	1.52	<0.001	1.33	1.73

Note: IHD = ischemic heart disease, AF = atrial fibrillation, HF = heart failure, CVI = cerebrovascular insult, DM = diabetes mellitus, COPD = chronic obstructive pulmonary disease.

DISCUSSION

This is a comprehensive study including 15528 older adults ≥65 years of age visiting ED at least once in RH during 2016. Pre-hospital factors that increase the risk of hospital admission when visiting the ED were old age, male gender, and comorbidities. Patients with HF or tumors had a significant higher risk for hospitalization which is in line with previous research from Scandinavia²⁷. Woman had a longer LOS at the ED compared to men. Patients with HF and ≥4 diagnostic groups visited the ED more frequently than other patients, had a higher admission rate and a longer in-hospital LOS once admitted.

Along with previous studies our study showed that comorbidities are common for the older adults that visit the ED^{17,28}. Over 65% of the population had one or several diagnoses prior to their ED-visit. Cardiovascular diseases are dominating and in the oldest patient group only 29% are considered previously healthy. Patients with comorbidities had an admission rate of 70% which is in line with previous studies²⁹. Increasing risk for admission could be seen in the oldest patient group and for patients with HF and tumors. Men had a Hazard Ratio of 1.2 (CI 1.12-1.28) compared to woman. Patients aged 85 years or older had a 2.56 (CI 2.33-2.82) increased risk for admission and patients with HF had a 1.75 (CI 1.46-2.09) increased risk for admission to the hospital.

Old adults do not always present with typical symptoms at the ED when seriously ill. Results from our study showed that close to 40 % of the study population got a symptom diagnosis at the ED even though they were admitted in 59 % of the cases. This could indicate the difficulties to identify a certain diagnose in seriously ill older patients. Old age, heart failure and comorbidities were risk factors for hospitalization and more resources might be needed to manage such patients as they present to ED.

Our findings are relevant from a clinical point of view since they could be used in the ED for physicians to early identify patients at high risk for admission and make the transition from the ED to

the medical ward more efficient. For frail older patients, longer waiting time at the ED increases the risk of adverse events¹⁴. In this study, 45% of the population waited over 4h at the ED although nearly 60% later were admitted. We need strategies to improve our decision making at the ED to reduce LOS. Pre-hospital risk factors for admission could be one piece of the puzzle to identify which patients will be admitted from the ED.

The increasing population of older adults seeking medical care will put a great strain on emergency departments and hospital systems worldwide^{15,30}. Overcrowding at the ED with long waiting times and postponed admissions will affect not only the health of frail older adults but also the workflow at the ED and leave lesser resources to critically ill patients. Further studies are needed to evaluate if using pre-hospital conditions along with chief complaint and clinical findings could improve the care for older patients at the ED. Early identification of patients that need in-hospital care would reduce LOS at the ED and make the transition from the ED to an in-hospital bed more efficient.

LIMITATIONS

This study focused on pre-hospital health conditions and the ED-diagnoses were registered but symptoms or chief-complaint presented at the ED were not studied. Consequently, it is not elucidated the patient's reason to the ED visit or the chief complaint, which can be perceived as vague. Nevertheless, the objective of present study was to investigate the impact of the pre-hospital conditions of which the chief complaint should not be included in the analyses.

In the study, it is not possible to evaluate the degree of morbidity in terms other than the number of comorbidities. Nor can frailty be assessed, which is likely to be of decisive importance in this patient group.

It should be emphasized that the results in this study are only associations, and it is not possible to draw any conclusions regarding causality.

CONCLUSION

This study investigated the prehospital factors in older adults who visited the ED and the association with LOS at ED and hospital admission rate. Old age, HF and comorbidities have a significant higher risk for admission to the hospital and a longer in-hospital stay. Pre-hospital condition could be used in addition to chief complaint for early identification of patients that need in-hospital care and reduce LOS at the ED. Chief-complaint have undeniably an important value when identifying patients with high-risk for admission and further studies are needed to investigate the impact of chief complaint on admissions, re-visits to the ED and mortality. This study points towards the need for additional resources to effectively manage older and complex patients who are at risk for hospitalization and prolonged length of stay, which could lead to further functional decline in this group.

KEYWORDS

Older adults, elderly patients, Emergency Department, admissions, comorbidities, geriatric emergency medicine

AUTHOR AFFILIATIONS

Karin Erwander, MD	Department of clinical sciences, Lund University, Lund, Sweden
Kjell Ivarsson, MD PhD	Department of clinical sciences, Lund University, Lund, Sweden
Mona Landin Olsson, MD PhD	Department of clinical sciences, Lund University, Lund, Sweden
Björn Agvall, MD PhD	Department of Research and Development, Region Halland, Halmstad, Sweden

CORRESPONDING AUTHOR

Karin Erwander, MD

Department of clinical sciences, Lund University, Lund Sweden

Karin.ervander@med.lu.se

DECLARATIONS

Ethics Approval and Consent to Participate

The study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments and was approved by the Ethical Review Agency in Sweden (reference number 2016/20). The requirement for informed consent was waived by the Ethical Review Agency in Sweden since the study was openly announced to the public on Region Halland's website and there are instructions on how to opt out of participation in a present study. Simultaneously, the study is retrospective, and the data is retrieved pseudonymized and none of the researchers can deduce and identity among the participating individuals. Accordingly, the assessment has been that none of the included individuals has been exposed to the risk of being exposed regarding personal data or harm. All data provided for this study are treated confidentially and the results are presented at group level so that no individuals can be identified.

Consent for Publication

This issue has been addressed by the Ethical Review Agency in Sweden (reference number 2016/20). All data provided for this study are treated confidentially and the results are presented at group level so that no individuals can be identified. Based on these conditions, the study has been approved for publication by the Ethical Review Agency in Sweden.

Availability of Data and Materials

The datasets generated and/or analyzed during the current study are not publicly available due to the data is retrieved from patients' hospital records which is included in the Swedish Health Care act which applies to Swedish secrecy act according to Swedish legislation. The data will be shared on reasonable request to the corresponding author.

Conflicts of Interest

The authors report no conflicts of interest.

Funding

We also wish to thank the Gun and Bertil Stohne's Foundation (non-profit, Sweden) and the Stiftelsen Sigurd och Elsa Goljes minne (non-profit, Sweden) for project grants that made the study possible.

Authors' Contributions

KE is a major contributor to writing the manuscript. KE, BA and KI interpreted the statistical analyses. BA and KI supported writing the manuscript. BA was responsible for data collection. MLO provided final approval of the version to be published. All authors read and approved the final manuscript.

Acknowledgements

SWEAH – National Graduate School on Ageing and Health

REFERENCES

1. SCB. Summary of Population Statistics 1960–2020 www.scb.se/2021 [2022-01-06].

2. SBU. Omhändertagande av äldre som inkommer akut till sjukhus – med fokus på sköra äldre. 2013.
3. Pot AM, Portrait F, Visser G, Puts M, van Groenou MI, Deeg DJ. Utilization of acute and long-term care in the last year of life: comparison with survivors in a population-based study. *BMC Health Serv Res.* 2009;9:139.
4. Bahler C, Huber CA, Brungger B, Reich O. Multimorbidity, health care utilization and costs in an elderly community-dwelling population: a claims data based observational study. *BMC Health Serv Res.* 2015;15:23.
5. Abad-Diez JM, Calderon-Larranaga A, Poncel-Falco A, Poblador-Plou B, Calderon-Meza JM, Sicras-Mainar A, et al. Age and gender differences in the prevalence and patterns of multimorbidity in the older population. *BMC Geriatr.* 2014;14:75.
6. Legramante JM, Morciano L, Lucaroni F, Gilardi F, Caredda E, Pesaresi A, et al. Frequent Use of Emergency Departments by the Elderly Population When Continuing Care Is Not Well Established. *PLoS One.* 2016;11(12):e0165939.
7. Aminzadeh F, Dalziel WB. Older adults in the emergency department: a systematic review of patterns of use, adverse outcomes, and effectiveness of interventions. *Ann Emerg Med.* 2002;39(3):238-47.
8. Downing A, Wilson R. Older people's use of Accident and Emergency services. *Age Ageing.* 2005;34(1):24-30.
9. Yim VW, Graham CA, Rainer TH. A comparison of emergency department utilization by elderly and younger adult patients presenting to three hospitals in Hong Kong. *Int J Emerg Med.* 2009;2(1):19-24.
10. Sanders A, JE M. The older person and the emergency department. *J Am Geriatr Soc.* 1993;41(8):880-2.
11. Liew D, Kennedy M. Emergency department length of stay independently predicts excess inpatient length of stay. *Med J Aust.* 2003;179:524-6.
12. Bo M, Bonetto M, Bottignole G, Porrino P, Coppo E, Tibaldi M, et al. Length of Stay in the Emergency Department and Occurrence of Delirium in Older Medical Patients. *J Am Geriatr Soc.* 2016;64(5):1114-9.
13. Singer AJ, Thode HC, Jr., Viccellio P, Pines JM. The association between length of emergency department boarding and mortality. *Acad Emerg Med.* 2011;18(12):1324-9.
14. Chong CP, Haywood C, Barker A, Lim WK. Is Emergency Department length of stay associated with inpatient mortality? *Australas J Ageing.* 2013;32(2):122-4.
15. George G, Jell C, Todd BS. Effect of population ageing on emergency department speed and efficiency: a historical perspective from a district general hospital in the UK. *Emerg Med J.* 2006;23(5):379-83.
16. Rauch J, Denter M, Hubner U. Use of Emergency Departments by Frail Elderly Patients: Temporal Patterns and Case Complexity. *Stud Health Technol Inform.* 2019;267:215-23.
17. Gentili S, Emberti Gialloreti L, Riccardi F, Scarcella P, Liotta G. Predictors of Emergency Room Access and Not Urgent Emergency Room Access by the Frail Older Adults. *Front Public Health.* 2021;9:721634.
18. Limpawattana P, Phungoen P, Mitsungrern T, Laosuangkoon W, Tansangworn N. Atypical presentations of older adults at the emergency department and associated factors. *Arch Gerontol Geriatr.* 2016;62:97-102.
19. M.R. Hofman FvdH, I.N. Sierevelt, C.R. Tulner. Elderly patients with an atypical presentation of illness in the emergency department. *The Netherlands Journal of Medicine.* 2017;75(6):241-6.
20. McGowan H, Gopeesingh K, O'Kelly P, Gilligan P. Emergency Department Overcrowding And The Full Capacity Protocol Cross Over Study: What Patients Who Have Experienced Both Think About Being An Extra Patient In The Emergency Department Or On A Ward. *Ir Med J.* 2018;13;111(7):788.
21. Ho V, Chen C, Ho S, Hooi B, Chin LS, Merchant RA. Healthcare utilisation in the last year of life in internal medicine, young-old versus old-old. *BMC Geriatr.* 2020;20(1):495.
22. McPhail SM. Multimorbidity in chronic disease: impact on health care resources and costs. *Risk Manag Healthc Policy.* 2016;9:143-56.
23. Latham LP, Ackroyd-Stolarz S. Emergency department utilization by older adults: a descriptive study. *Can Geriatr J.* 2014;17(4):118-25.
24. Teixeira A, Arrigo M, Tolppanen H, Gayat E, Laribi S, Metra M, et al. Management of acute heart failure in elderly patients. *Arch Cardiovasc Dis.* 2016;109(6-7):422-30.

25. Lee SB, Oh JH, Park JH, Choi SP, Wee JH. Differences in youngest-old, middle-old, and oldest-old patients who visit the emergency department. *Clin Exp Emerg Med.* 2018;5(4):249-55.
26. Weber EJ, Mason S, Freeman JV, Coster J. Implications of England's four-hour target for quality of care and resource use in the emergency department. *Ann Emerg Med.* 2012;60(6):699-706.
27. Stäck P, Högberg M, Werr J, Edgren G. The risk of acute readmission can be predicted. Former care consumption patterns and certain diagnoses are strongly predictive. *Lakartidningen.* 2012(109(48)):2211-5.
28. Deschodt M, Devriendt E, Sabbe M, Knockaert D, Deboutte P, Boonen S, et al. Characteristics of older adults admitted to the emergency department (ED) and their risk factors for ED readmission based on comprehensive geriatric assessment: a prospective cohort study. *BMC Geriatr.* 2015;15:54.
29. Ting Xia JE, Christopher Pearce, Danielle Mazza, Lyle R Turner Predictors of ED attendance in older patients with chronic disease: a data linkage study. *Aust Health Rev.* 2020;44(4):550-6.
30. Sanders A. Care of the elderly in emergency departments: Conclusions and recommendations. *Ann Emerg Med.* 1992;21(7):830-4.