

BMJ Open Patients' aged ≥ 65 years dispositions during ambulance assignments, including factors associated with non-conveyance to hospital: a longitudinal and comparative study

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ABSTRACT

Objectives Patients ≥ 65 years old represent 30%–50% of all ambulance assignments (AAs), and the knowledge of which care level they are disposed to is limited and diverging. The aim of this study was therefore to describe and compare characteristics of patients' aged ≥ 65 years dispositions during AA, including determining changes over time and factors associated with non-conveyance to hospitals.

Design A longitudinal and comparative database study.

Setting Ambulance service in a Swedish region.

Participants 32 085 AAs with patients ≥ 65 years old during the years 2014, 2016 and 2018. Exclusion criteria: AAs with interhospital patient transfers and lack of patients' dispositions data.

Outcome measures Dependent factors: conveyance and non-conveyance to hospitals. Independent factors: age, sex, symptom, triage level, scene, time, day and season.

Results The majority (n=29 060; 90.6%) of patients' dispositions during AA were conveyance to hospitals. In total, the most common symptoms were circulatory (n=4953; 15.5%) and respiratory (n=4529; 14.1%). A significant increase, $p < 0.01$, of non-conveyance to hospitals was shown during 2014 and 2018, from 801 (7.8%) to 1295 (11.4%). Increasing age was associated with decreasing odds of non-conveyance, 85–89 years (OR=0.85, 95% CI=0.72 to 0.99) and 90 years or older (OR=0.80, 95% CI=0.68 to 0.93). Several factors were associated with non-conveyance, for example, symptoms of diabetes (OR=8.57, 95% CI=5.99 to 12.26) and mental disorders (OR=5.71, 95% CI=3.85 to 8.48) in comparison with infections.

Conclusions The study demonstrates several patient characteristics, and factors associated with non-conveyance to hospitals, such as age, symptom, triage level, scene, time, day and season. The increasing non-conveyance trend highlights the importance of further studies on optimal care levels for patients ≥ 65 years old.

INTRODUCTION

An ageing population is dependent on optimal care at optimal care levels due to the high risk of frailty and complex

Strengths and limitations of this study

- A longitudinal and comparative design to identify changes over time and associations with non-conveyance to hospitals.
- The first Swedish study analysing characteristics of patients' aged ≥ 65 years dispositions during ambulance assignments.
- Complete inclusion of data from ambulance medical records derived from a single region, within the years 2014, 2016 and 2018 (N=32 085).
- Limited amount of excluded or missed data (5.1%).
- Lack of data whether patients disposition were optimal.

symptoms caused by comorbidities and polypharmacy.^{1 2} Optimal care means safe,³ available and continuous care adjusted for each unique patient.⁴ The global discussion on how to meet an ageing population is focused on encouraging collaboration within the emergency care system to provide optimal care with extended out-of-hospital care.^{5 6} Ambulance services are an essential part in this development.⁷ Internationally, patients ≥ 65 years old represent 30%–50% of all ambulance assignments (AAs), and 44%–88% are conveyed to hospitals.^{8–10} During each AA, the ambulance personnel provide assessment and decide on optimal care level for patients' disposition,¹¹ meaning where patients are treated or conveyed for optimal care. Patients' dispositions during AAs are in this study divided into conveyance or non-conveyance to hospitals. By conveyance means transporting patients to hospital settings, for example, emergency department (ED), and non-conveyance to hospitals means discharging patients in out-of-hospital settings, for example, in their ordinary home,

nursing home or through transportation to primary care facilities.¹² Care level decisions are dependent on multi-factorial aspects, as expectations and information from patients or significant others, decision support tools and available resources and competence in the emergency care system.^{13 14} However, international studies focusing on the disposition of patients ≥ 65 years old during AAs are limited,¹⁴ and no European studies have been found thus far. Further mapping is therefore needed to fill this knowledge gap. Therefore, this study aimed to describe and compare characteristics of patients' aged ≥ 65 years dispositions during AA, including determining changes over time and factors associated with non-conveyance to hospitals.

METHODS

Study setting

This longitudinal and comparative study took place in a region in the southern part of Sweden with 200 000 inhabitants, of whom one-fifth were ≥ 65 years old. The population density in the region was 23 inhabitants per square kilometre. Sweden has tax-funded healthcare, and the region has two somatic and one psychiatric public care hospitals, with EDs available around the clock. Thirty-one primary health centres, the majority of which are within public care, with open hours in the daytime, except for two centres with open hours also in evenings and on weekends. The primary health centres were staffed by specialists in general medicine, physicians under specialist training, registered nurses (RNs) and associated nurses. Furthermore, the region holds seven public care ambulance stations, with eleven ambulances around the clock staffed by two ambulance personnel, mostly one RN and one specialist ambulance nurse (SAN). The ambulance personnel have three education levels: (1) emergency medical technician, with 1–3 years of secondary school; (2) RN, with 3 years of higher education in a bachelor's degree programme and (3) SAN, with 1 additional year in a master's degree programme within ambulance care.¹⁵ Moreover, the region holds six daytime ambulances, four staffed with a team of two, and two ambulances with one single ambulance personnel.¹⁶ The ambulance service has three regional care level guidelines, one is general, and the others focus on mental disorders and diabetic hypoglycaemia, developed in 2014, in 2015 and before 2010, respectively. For non-conveyance to hospitals, several patient conditions have to be fulfilled according to the guidelines: no suspicions of serious illness, normal vital parameters, no need for hospital admissions, patients' ability to make adequate decisions and patients' desire to stay at home. The general guideline also includes a triage level limit of green or blue according to the five-level rapid emergency triage and treatment system (RETTS). RETTS is based on patients' chief complaint, so-called emergency symptom and sign (ESS) and sorted into ESS algorithms together with patients' vital signs (VSs) (breathing rate, saturation, heart rate, blood pressure,

consciousness and body temperature). The triage level is obtained by combining ESS and VS into a colour indicating the severity and appropriate time for physician assessment. Both red and orange, life-threatening or potentially life-threatening conditions, indicate a need for immediate care. Yellow, green and blue are lower in severity, but all indicate non-life-threatening conditions that require care within a reasonable time.¹⁷ Moreover, the ambulance personnel must report a triage colour during every AA to fulfil the ambulance medical record.

Patients and data collection

An anonymous database was constructed from the region's ambulance medical records, including all AAs with patients ≥ 65 years old during the years 2014, 2016 and 2018 (N=32 085) and excluding AAs with interhospital patient transfers (n=1770; 5%) or lack of patients' dispositions data (n=33; 0.1%). The studied years were chosen to identify trends over 5 years with a manageable amount of data. Further, the years coincided with the regional implementation of earlier described care level guidelines, and a regional project focusing on optimal care for patients ≥ 65 years old (2016–2018).

Patient and public involvement

No patient involved.

Analysis

Age was categorised into five groups: 65–69, 70–74, 75–79 (younger older), 80–84 and 85–89 (older) according to the WHO's definition of older age,¹⁸ with a sixth age group added for those ≥ 90 years (older-older) representing 20% of the total study group. Care levels, such as ordinary home, nursing home, primary care and other, were added to the category of non-conveyance to hospitals. Moreover, RETTS ESS codes were assembled into 12 symptom groups related to large organ systems, aetiology and external causes, a system that originates from the international statistical classification of diseases and related health problems (ICD-10).¹⁹ The remaining symptoms, for example, patients with non-specific symptoms who did not conform to the earlier described symptom groups, were sorted into a group called other symptoms. Furthermore, the symptom group not in need of triage included patients whom ambulance personnel assessed as not needing a triage level; they were either being too healthy for ambulance care or being deceased. An obvious reference point in the logistical regression analysis of symptom, triage level, scene and time was lacking. The lowest adjusted odds of non-conveyance to hospitals was therefore chosen, as a reference, providing overall positive ORs facilitate the interpretation of the result. The characteristics of patients' dispositions were compared among the years 2014, 2016 and 2018 using a χ^2 test. The continuous variable age was later analysed for differences among the years using the Kruskal-Wallis one-sided analysis of variance (ANOVA) test. Statistical significance was set at p value < 0.05. The non-conveyance

Table 1 Characteristics of patients' aged ≥65 years dispositions during AA, including the years 2014, 2016 and 2018

	Conveyance to hospitals	Non-conveyance to hospitals	Total
Total, n (%)	29 060 (90.6)	3025 (9.4)	32 085
Age, median Q ₂ (Q ₁ ; Q ₃)	82 (75; 88)	80 (73; 87)	82 (74; 88)
Sex, n (%)			
Female	14 962 (51.5)	1509 (49.9)	16 471 (51.3)
Male	14 098 (48.5)	1516 (50.1)	15 614 (48.7)
Symptom, n (%)			
Abdominal	3054 (10.5)	152 (5.0)	3206 (10.0)
Circulatory	4594 (15.8)	359 (11.9)	4953 (15.5)
Diabetes	321 (1.1)	98 (3.2)	419 (1.3)
Infection	2372 (8.2)	74 (2.5)	2446 (7.6)
Injuries	4001 (13.8)	262 (8.7)	4263 (13.3)
Mental disorders	200 (0.7)	72 (2.4)	272 (0.8)
Musculoskeletal pain	1165 (4.0)	114 (3.8)	1279 (4.0)
Neurological	4099 (14.1)	273 (9.0)	4372 (13.7)
Not in need of triage	1284 (4.4)	816 (27.0)	2100 (6.6)
Other symptoms	3610 (12.4)	564 (18.7)	4174 (13.0)
Respiratory	4296 (14.8)	233 (7.7)	4529 (14.1)
Triage level, n (%)			
Red	3352 (11.7)	199 (6.7)	3551 (11.2)
Orange	8456 (29.4)	131 (4.4)	8587 (27.1)
Yellow	12 379 (43.0)	590 (19.9)	12 969 (40.9)
Green	3735 (13.0)	1438 (48.6)	5173 (16.3)
Blue	823 (2.9)	602 (20.3)	1425 (4.5)
Scene, n (%)			
Ordinary home	19 406 (66.7)	2193 (72.4)	21 621 (67.4)
Nursing home	3826 (13.2)	259 (8.6)	4085 (12.7)
Primary care	1272 (4.4)	19 (0.6)	1291 (4.0)
Other—public building	168 (0.6)	17 (0.6)	185 (0.6)
Other—public area, street	4388 (15.1)	537 (17.8)	4925 (15.3)
Time, n (%)			
Office hours, 8:00 to 17:00	17 744 (61.1)	1733 (57.3)	19 491 (60.7)
Out-of-office hours, 17:01 to 7:59	11 305 (38.9)	1291 (42.7)	12 596 (39.3)
Day, n (%)			
Weekday	21 277 (73.2)	2157 (71.3)	23 434 (73.0)
Weekend	7783 (26.8)	868 (28.7)	8651 (27.0)
Season, n (%)			
Spring	7326 (25.2)	701 (23.2)	8027 (25.0)
Summer	7120 (24.5)	798 (26.4)	7918 (24.7)
Autumn	7119 (24.5)	782 (25.8)	7901 (24.6)
Winter	7495 (25.8)	744 (24.6)	8239 (25.7)

 AA, ambulance assignment; median Q₂, second quartile; Q₁, first quartile; Q₃, third quartile.



Table 2 Longitudinal changes in patients' aged ≥ 65 years dispositions during ambulance assignments, divided into years 2014, 2016 and 2018

	Conveyance to hospitals	Non-conveyance to hospitals
2014, n (%)	9506 (92.1)*	801 (7.8)*
2016, n (%)	9508 (91)*	929 (8.9)*
2018, n (%)	10046 (88.5)*	1295 (11.4)*

* $p < 0.01$.

group was manually analysed to identify an approximate number of deceased, by comparing RETTS ESS code and VSs for each patient. A binary logistic regression analysis was conducted, including all data, and no multicollinearity problems were detected based on a variance inflation factor (VIF) < 2 . All analyses were performed by using IBM SPSS V.25.

RESULTS

The included AAs were distributed over the years as follows: 2014 (n=10 307), 2016 (n=10 437) and 2018 (n=11 341).

Characteristics of patients' dispositions during AA

In total, patients' dispositions during AA comprised conveyance 29 060 (90.6%) and non-conveyance to hospitals 3025 (9.4%), including ordinary homes (n=1896; 5.8%), primary care (n=534; 1.7%) nursing homes (n=276; 0.9%) and others (n=319; 1%). Table 1 demonstrates that women and men were equally represented, with a median age of 82 years. In total, the most common symptoms during AAs were circulatory (n=4953; 15.5%), respiratory (n=4529; 14.1%), neurological (n=4372; 13.7%) and injuries (n=4263; 13.3%). Furthermore, the most common triage levels were yellow (n=12 969; 40.9%), orange (n=8587; 27.1%) and green (n=5173; 16.3%). The majority of the AAs (n=19 491; 60.7%) were performed during office hours from 8:00 to 17:00.

Within the non-conveyance to hospitals group (n=3025) were 366 (12%) deceased, and thereby not conveyed. Of those, were 159 (43%) females, the symptoms were mainly circulatory (n=129; 35%) or assessed by the ambulance personnel as not in need of triage (n=196; 54%). Further, recorded triage levels were red (n=181; 49%) or blue (n=185; 51%).

Changes over time

When adjusted for age, there was a significant increase in non-conveyance to hospitals among the years 2014, 2016 and 2018 (table 2). The total patient median age decreased significantly ($p < 0.01$) during the years 2014 ($Q_1=75$; Q_2 median=83; $Q_3=89$), 2016 ($Q_1=74$; Q_2 median=82; $Q_3=88$) and 2018 ($Q_1=74$; Q_2 median=81; $Q_3=87$).

Factors associated with non-conveyance to hospitals

The binary logistic regression demonstrated that patients aged 85 years and older had significantly lower odds of non-conveyance compared with patients aged between 65 and 69 years. No difference in the disposition between men and women was shown. Increasing odds of non-conveyance was significantly associated with symptoms of diabetes, mental disorders, or not needing triage, as well as decreasing RETTS triage level severity. Moreover, scenes in ordinary homes, nursing homes or public building/areas, time outside office hours, weekends, as well as summer and autumn were significantly associated with non-conveyance (table 3).

DISCUSSION

Principal findings

The study result demonstrates that the majority of patients' dispositions during AA are conveyance to hospitals; an increasing trend for non-conveyance to hospitals is however identified over the studied years. Non-conveyance is associated with several patients and structural factors such as age, symptom, triage level, scene, time, day and season.

The strength of the study's internal validity and reliability is the complete inclusion of characteristics from all AAs medical records regarding patients ≥ 65 years old within a Swedish region comprising urban and rural areas, with a limited amount of excluded or missed data. The external validity, that is, generalising the results to regions with similar settings is reasonable. Nevertheless, the study has the limitations of not being able to reveal whether patients' dispositions were optimal or whether patients travelled to, for example, hospitals by their own car, as the study does not include data from hospitals medical records. Deceased patients within non-conveyance to hospitals group were triaged red or blue, complicating the interpretation of the result. The diverse registration was probably dependent on the situation as well as lack of consensus among ambulance personnel about how to register these data.

Results discussion

The majority (n=29 060; 90.6%) of patients' dispositions during AA are conveyance to hospitals. This figure is higher compared with a Swedish study including all ages, where 83.1% of the patients were conveyed,²⁰ which can be explained by different age groups. But the figure is also higher than international studies involving solely patients ≥ 65 years old showing that 44% to 88% of patients were conveyed.^{8–10} Differences in ambulance service organisations between and within countries, however, make international comparison difficult based on varying, for example, care level options,²¹ and continuity of care.²² Previous studies have found that 7%–16% of patients engaging AAs have symptoms that can be treated at the primary care level,^{23 24} indicating that more patients can receive optimal out-of-hospital care through extended

Table 3 Binary logistic regression, with crude and adjusted ORs and 95% CIs of factors associated with non-conveyance to hospitals during AA regarding patients ≥65 years old, including the years 2014, 2016 and 2018

	Crude		Adjusted	
	OR	95% CI	OR	95% CI
Age (years)				
65–69	Ref.		Ref.	
70–74	0.92	0.80 to 1.05	0.99	0.85 to 1.16
75–79	0.78	0.68 to 0.90	0.88	0.75 to 1.04
80–84	0.75	0.66 to 0.86	0.87	0.75 to 1.02
85–89	0.68	0.59 to 0.77	0.85	0.72 to 0.99
90+	0.62	0.54 to 0.72	0.80	0.68 to 0.93
Sex (male)	1.07	0.99 to 1.15	0.98	0.90 to 1.07
Symptom				
Infection	Ref.		Ref.	
Abdominal	1.59	1.20 to 2.12	1.15	0.85 to 1.54
Musculoskeletal pain	3.14	2.32 to 4.24	1.39	1.01 to 1.91
Injuries	2.10	1.61 to 2.73	1.48	1.13 to 1.96
Respiratory	1.74	1.33 to 2.27	1.56	1.18 to 2.06
Neurological	2.14	1.64 to 2.77	1.71	1.30 to 2.25
Circulatory	2.50	1.94 to 3.23	2.47	1.89 to 3.23
Other symptoms	5.00	3.90 to 6.42	2.74	2.10 to 3.56
Not in need of triage	20.37	15.90 to 26.10	4.96	3.66 to 6.72
Mental disorders	11.54	8.09 to 16.46	5.71	3.85 to 8.48
Diabetes	9.79	7.08 to 13.53	8.57	5.99 to 12.26
Triage level				
Orange	Ref.		Ref.	
Yellow	3.08	2.54 to 3.73	2.97	2.44 to 3.60
Red	3.83	3.06 to 4.80	3.96	3.15 to 4.97
Green	24.85	20.70 to 29.84	22.85	18.93 to 27.60
Blue	47.22	38.58 to 57.79	25.36	19.31 to 33.30
Scene				
Primary Care	Ref.		Ref.	
Public building/areas	8.14	5.13 to 12.92	3.80	2.35 to 6.13
Nursing home	4.53	2.83 to 7.25	6.29	3.86 to 10.26
Ordinary home	7.57	4.80 to 11.93	9.12	5.70 to 14.61
Time				
Office hours, 8:00 to 17:00	Ref.		Ref.	
Out-of-office hours, 17:01 to 7.59	1.17	1.08 to 1.26	1.12	1.02 to 1.22
Day				
Weekday	Ref.		Ref.	
Weekend	1.10	1.03 to 1.20	1.15	1.05 to 1.27
Season				
Spring	Ref.		Ref.	
Summer	1.17	1.05 to 1.30	1.13	1.00 to 1.28
Autumn	1.15	1.03 to 1.28	1.10	1.03 to 1.30
Winter	1.04	0.93 to 1.156	0.98	0.97 to 1.24

The table sortation is based on increasing adjusted odds, except for age and seasons being chronologically sorted. AA, ambulance assignment.

collaboration between organisations within the emergency care system.^{14 25}

The results demonstrate an increasing trend of non-conveyance to hospitals, that is, more patients receive care in out-of-hospital settings, which is in line with the global discussion of extended out-of-hospital care.⁵ The global discussion and the regional care level guidelines implemented during the studied period are possible factors affecting the trend.²⁶ The non-conveyance trend highlights the importance of studying the evidence for available guidelines as well as the patient and personnel perspectives of receiving and delivering out-of-hospital care.

Factors associated with non-conveyance to hospitals include, for example, age, symptoms and triage level. Patients aged 85 years and older have lower odds of non-conveyance, compared with those aged 65–69 years. This result is in line with previous research showing an association between younger older and non-conveyance, due to fewer comorbidities and medications.^{10 27} Further, age is linearly connected to being conveyed to hospitals, even after adjusting for comorbidities and depression.²⁸ It is however possible that older patients, due to a higher risk of frailty, benefit from receiving out-of-hospital care,²⁹ that is, in a familiar and calm environment.³⁰ This issue needs to be studied according to the risks and benefits for older patients.¹⁰ In this study, symptoms of mental disorders and diabetes had the highest odds of non-conveyance. The findings are similar to studies including all ages where mental disorders and minor injuries were associated with non-conveyance.^{31 32} Mental disorders exist among 28% of patients >60 years who engage ambulance services; common causes are cognitive impairment and depression.³³ This highlights an important competence among ambulance personnel in providing treatment in out-of-hospital settings for patients with mental disorders. The result demonstrates that the lowest triage levels, green and blue, that is, non-life-threatening conditions, have the highest odds of non-conveyance. Non-conveyance occurred within all triage levels, which is incongruent to the care level guidelines. However, the triage level red, indicating life-threatening condition, was primarily used for patients who died. A possible explanation for non-conveyance among patients with triage level orange is improved condition after treatment, without changing the triage level accordingly. RETTS is not developed to support decisions about optimal care levels,¹⁷ even though the mortality risk is low for patients triaged at level green or yellow.³⁴ Also, the RETTS reliability is questionable due to discrepancies of up to 41% of RNs' triage level decisions.³⁵ Furthermore, triage systems without adaption for older patients are misleading; not identifying atypical symptoms and VS response, with the result of undertriage.³⁴ National care level guidelines lack in Sweden,^{23 36} which creates uncertainty among ambulance personnel regarding whether the decision of non-conveyance to the hospital is optimal for those patients.³⁷

Approximately 250 AA/1000 inhabitants ≥65 years old were conducted within the study region each year. Of those, some patients received ambulance care several times. This number is similar to international studies comprising patients ≥65 years old.^{10 38} This aspect, among others, highlights the importance to focus on patients ≥65 years old during the upscaling of out-of-hospital care. To improve care education of geriatric assessment, care level decisions^{8 39} as well as the development of evidence-based decision tools^{11 13} adapted for patients ≥65 years old are necessary.

CONCLUSIONS

This is the first Swedish study depicting the characteristics of patients ≥65 years old and factors related to non-conveyance during AA. The study results demonstrated that the majority of patients' dispositions during AA were conveyance to hospitals. Several patient and structural factors were associated with non-conveyance, such as age, symptom, triage level, scene, time, day and season. The increasing trend of non-conveyance to hospitals indicates a need for extended collaboration within the emergency care system to develop out-of-hospital care systematically. Further studies should evaluate this implementation from the patient and healthcare personnel perspectives and evaluate the evidence for available care level guidelines to deliver emergency care at optimal care levels for patients ≥65 years old.

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Contributors All authors contributed to the study design. RA compiled the database. E-SF processed the data and performed the data analysis. MR supported the data analysis and the interpretation of data. CE, BF and AS collaborated with the other authors in discussions and the establishment of the results. All authors contributed, read and approved the final manuscript.

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