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# BMJ Open

## Elderly community-dwelling patients with low socioeconomic status are hospitalised more often after visiting the emergency department

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**Abstract**

**Objectives:** Elderly patients frequently visit the Emergency Department (ED). Socioeconomic State (SES) has an important impact on health and ED utilization, however, the association between SES and ED utilization in elderly remains unclear. The aim of this study was to investigate the association between SES in elderly patients visiting the ED on outcomes.

**Design:** A retrospective study.

**Participants:** elderly patients ( $\geq 65$  years) visiting the ED. SES was stratified into tertiles based on average household income at zip code level; low ( $< \text{€}1800/\text{month}$ ), intermediate ( $\text{€}1800\text{--}\text{€}2300/\text{month}$ ) and high ( $> \text{€}2300/\text{month}$ ).

**Primary outcomes:** hospitalisation, in-hospital mortality and 30-day ED-return visits.

**Results:** In total, 4828 elderly patients visited the ED during the study period. Low SES was associated with a higher risk of hospitalisation among community-dwelling patients compared with high SES (adjusted OR 1.3 95%CI 1.1-1.7). This association was not present for intermediate SES (adjusted OR 1.1 95%CI 0.95-1.4). In-hospital mortality was comparable between the low and high SES-group, even after adjustment for age, comorbidity and triage level (low OR 1.4 95%CI 0.8-2.6, intermediate OR 1.3 95%CI 0.8-2.2). Thirty-day ED-revisits among community-dwelling patients were also equal between the SES groups (low: adjusted OR 1.0 95%CI 0.7-1.4 and intermediate: adjusted OR 0.8 95%CI 0.6-1.1).

**Conclusion:** In elderly ED patients, low SES was associated with a higher risk of hospitalisation than high SES. However, SES had no impact on in-hospital mortality and 30-day ED-revisits after adjustment for confounders.

**Strengths and limitations of this study**

- This is one of the only studies to provide detailed insight into the impact of different socioeconomic status groups of elderly patients in the emergency care.
- Additionally, this study the living situation was used to differentiate between community-dwelling patients and institutionalized patients to observe differences in outcomes.
- This study used a retrospective cohort study and linked patient zip code with income data based on a well-defined database by Statistics Netherlands.
- A strength of our study is that we investigated a large undifferentiated group of elderly emergency care patients.
- Limitations were that we were not able to extract the data of cardiology and gynaecology patients and that we used zip code to define the socioeconomic status.

## Introduction

The burden on the Emergency Department (ED) capacity is increasing over the past decades, which is mostly due to a substantially increasing number of elderly patients ( $\geq 65$  years old) (1). Given the extent and complexity of the problems in these patients, it is essential to identify determinants that lead to the ED visits in order to maintain high quality of care of elderly ED patients (2).

Low socioeconomic status (SES) has already been identified as an important determinant of health status and is strongly associated with poor adverse health outcomes (3). Patients with a low SES visit the general practitioner more and the specialist less often than patients with a high SES (4,5). Moreover, patients with a low a SES use the ED more frequently and are admitted to the hospital more often than those with a high SES (4,6-8-10). However, most studies focused on the influence of SES on the quantity of ED utilization, rather than on the reasons for and outcomes of these ED visits in general (8,10-12) .

It is well-known that elderly patients are vulnerable and prone to adverse health outcomes, such as ED visits, ED return visits, hospitalisation and mortality (13). However, research on the effect of SES on ED visits and adverse health outcomes in these elderly patients is scarce (10,14,15). Some of these studies demonstrated contrasting results as where low SES patients had higher risk of adverse health outcomes (8,16,17), while other studies did not find such an increased risk (11,12,18). Moreover, most studies focused on patients with a specific diagnosis (e.g. heart failure, pneumonia or injury) and other studies merely studied ED utilization (10,14,18).

To understand the ED utilization patterns of elderly patients, it can be important to take their SES into account. Understanding the characteristics of elderly ED patients, including their SES, may be the first step to maintain or improve high quality of acute care. We hypothesize that low SES influences the risk of adverse health outcomes in the ED setting in a negative way and adds to the vulnerability of elderly ED patients even in a country in which health care access is organized for every inhabitant, regardless of SES.

The aim of this study was to determine differences between different SES groups among elderly patients and additionally and most importantly we investigated the association of SES with hospitalisation, in-hospital mortality and ED-revisits.

## Method

### *Study design, setting and population*

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3 A retrospective cohort study was performed in the Maxima Medical Centre, a 550-bed teaching hospital in the  
4 Netherlands. Yearly, approximately 30,000 patients visit the ED (19), of whom 30% are elderly ( $\geq 65$  years). In  
5 the Netherlands, patients are usually referred to the ED by a general practitioner. The general practitioners  
6 provide acute care all days of the week and every hour of the day, including out of office hours.  
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10 Elderly patients who visited the ED for all medical and surgical specialities in one year (between 1<sup>st</sup> of  
11 September 2011 and 31<sup>st</sup> of August 2012), were included. Data from the acute cardiac care unit and  
12 gynaecology unit were not available in the database, because these patients do not visit the ED .  
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15 Data of the ED visits were automatically extracted from the electronic patient records (Chipsoft-EZIS,  
16 version 5.2). The patients' zip code (on average 17 households per zip code) was used to determine the SES at a  
17 neighbourhood level by combining the median household income per month and mean value of the houses.  
18 Data on income were provided by Statistics Netherlands (20). This dataset excluded zip codes with less than 10  
19 households to guarantee anonymity. The median income data derived from the zip codes were linked to our  
20 database and subsequently divided into tertiles (21): low ( $<€1800$ /month), intermediate ( $€1800$ - $€2300$ /month)  
21 and high ( $>€2300$ /month). It was impossible to retrieve SES data for patients with unknown zip code or patients  
22 living abroad (Belgium), and therefore, these patients were excluded (N=511, 6.9%).  
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31 To investigate the effect of the living situation in the three SES groups, we made a subgroup analysis  
32 for the outcomes of community-dwelling patients and for patients who were institutionalized. Living situation  
33 was retrieved on basis of zip codes, including those of the nursing and care home facilities patients. The first ED  
34 visit in the study period was considered the index visit, other visits after the index visit were excluded to avoid  
35 duplicate analysis of the patients' characteristics and outcomes. The Institutional Review Board of Máxima  
36 Medical Centre approved this study and confirmed that the Medical Research Involving Human Subject Act  
37 (WMO) was not applicable.  
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#### 47 **Data collection & definitions**

48 The following data were retrieved from the electronic patient record: age, gender, zip code, comorbidity,  
49 number of used medications. The Charlson comorbidity index (CCI) was used to quantify comorbidity (22). For  
50 50% of the patients per SES group, comorbidity was retrieved. The patients' living situation was categorized  
51 into community-dwelling patients (living independently or with home care) and institutionalized patients (care  
52 home and nursing home).  
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3 To assess the severity of illness at presentation, the Manchester Triage Level (MTS) (23), vital parameters  
4 (systolic blood pressure, heart rate), laboratory tests (CRP and leukocytes) and the ED diagnoses were  
5 retrieved. The triage level based on the five-level MTS was categorised into 3 groups: urgent (red and orange),  
6 moderate (yellow), and low (green); in our ED the triage colour blue is not used. The diagnoses at the ED were  
7 classified according the International Classification of Disease-10 (ICD-10) (24). The group 'other', consisted out  
8 of diseases of the nervous system, musculoskeletal and connective tissue, skin and subcutaneous tissue, eye  
9 and adnexa, ear and mastoid and mental.

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12 Organizational factors retrieved were time of arrival, mode of referral (self-referral, GP, ambulance, specialist  
13 and other), specialism, number of diagnostic tests (sum of radiological tests, electrocardiogram, arterial blood  
14 gas analysis, laboratory tests, urine analysis, urine and blood culture), number of specialist consultations on the  
15 ED, ED-Length-of-Stay (LOS) and hospital-LOS. Time of presentation was classified into 3 shifts: day (8am-6pm),  
16 evening (6pm-12pm) and night (12pm-8am). The following specialties were considered surgical: (general)  
17 surgery, plastic surgery, urology, and orthopaedics. Pulmonology, neurology, internal medicine and  
18 gastroenterology were considered medical specialities. Hospital LOS was defined as the number of days  
19 between hospital admission and hospital discharge. Dates of death during hospital stay and of the ED-return  
20 visit were retrieved. The data were extracted by one trained medical abstractor who was blinded for the study  
21 hypothesis.

### 32 33 34 35 36 37 **Statistical analyses**

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39 All statistical analyses were performed using SPSS 22.0 (New York, Armonk, 2015). Comparisons to evaluate  
40 normally distributed differences between the SES groups were made using unpaired-t-tests for continuous  
41 data, and the Chi square test for categorical data. Continuous variables not normally distributed the Wilcoxon-  
42 Mann-Whitney-Test was used. Missing data were categorised as "unknown" and included in the analyses of  
43 categorical parameters, to explore the influence of missing values. To investigate the independent effect of SES  
44 on hospitalisation, in-hospital mortality, and 30-day ED-return visits, logistic regression analyses was  
45 performed. A difference of 10% in  $\beta$ -coefficient was used to determine confounders and was included into the  
46 multivariable regression analysis. Sensitivity analysis was performed to evaluate the effect of ED-revisits on  
47 mortality. For this analysis, those who died during hospitalisation were excluded (N=199). To estimate the  
48 effect of the living situation on the SES and their outcomes, patients were divided into community-dwelling  
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3 patients and institutionalized patients. Odds Ratios (OR) and corresponding 95% Confidence Intervals (CI) were  
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5 calculated for each of the outcomes. A p-value was considered significant when <0.05.  
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## 8 **Results**

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10 During the study period, 7205 ED visits by elderly patients were registered in our ED. In total, 511 patients  
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12 (7.1%) were excluded because income data were missing and 1866 visits (25.9%) because the visit was a revisit.  
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14 In total, 4828 index visits were included. Of these 1660 visits (33.1%) were classified as having a low SES, 1640  
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16 (34.0%) as intermediate and 1588 (32.9%) as having a high SES (Figure 1).  
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### 22 *Patient characteristics*

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24 The mean age of the study population was 77±7.7 years, and slightly less patients were male (44.5%) (Table 1).  
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26 In total, 4381 (90.7%) were community-dwelling patients and 9.2% lived institutionalized. Patients were mostly  
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28 referred by a GP (58.5%) and were triaged as having moderate urgency (43.8%). More than half (56.5%) of the  
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30 patients were hospitalised, and their median hospital-LOS was 5 days. In-hospital mortality was 4.1%.  
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**Table 1. Patient characteristics and SES of elderly patients visiting the ED**

Characteristics	Total population N = 4828	Socioeconomic Status			P-value
		Low N = 1660 (33.1%)	Intermediate N = 1640 (34.0%)	High N = 1588 (32.9%)	
<b>Age, years</b>					
Mean (SD)	77 (7.7)	80 (7.6)	76 (7.6)	75 (7.4)	<0.001#
Median (IQR)*	77 (12)	80 (11)	76 (12)	74 (12)	
<b>Gender (%)*</b>					<0.001
Male	2149 (44.5%)	618 (38.6%)	759 (46.3%)	772 (48.6%)	
Female	2679 (55.5%)	982 (61.4%)	881 (53.7%)	816 (51.4%)	
<b>CCI, median (IQR)</b>	1.2 (1.6)	1.0 (0-8)	1.0 (0-10)	1.0 (0-11)	0.09
Unknown		45 (5.3%)	49 (5.3%)	54 (6.2%)	
<b>No. of medications, mean (SD)*</b>	2.5 (4.3)	3.3 (4.7)	2.4 (4.2)	1.9 (3.9)	<0.001
<b>Mode of referral*</b>					
General Practitioner	2680 (55.5%)	937 (61.8%)	905 (57.8%)	838 (56.0%)	0.03
Self-referral	852 (17.6%)	215 (13.4%)	292 (17.8%)	345 (21.7%)	<0.001
Ambulance	664 (13.8%)	244 (15.3%)	237 (14.5%)	183 (11.5%)	0.01
Specialist	632 (13.1%)	204 (9.6%)	206 (9.9%)	222 (10.8%)	0.75
<b>Living situation*</b>					<0.001
Community-dwelling	4381 (90.7%)	1266 (79.1%)	1556 (94.9%)	1559 (98.2%)	
Institutionalized	443 (9.2%)	330 (20.6%)	84 (5.1%)	29 (1.8%)	
Missing	4 (100%)	4 (100%)	0	0	

SES = Socioeconomic status. SD = Standard deviation. CCI = Charlson comorbidity index. ED = Emergency Department. P-values P-values low, intermediate and high SES: using the Chi-square test, unpaired t-test and Mann-Whitney-U-test.

# = p-value low vs. intermediate <0.001, low vs. high <0.001, intermediate vs. high <0.001.

\* = p<0.05.

### Patient characteristics and Socioeconomic status

Patients with a low or intermediate SES were older than patients with a high SES (80 vs. 76 and 75 years resp.,  $p < 0.001$ ) (Table 1). Male patients less frequently had a low SES than intermediate and high SES patients (38.6% vs. 46.3% and 48.6% resp.,  $p < 0.001$ ). The GP had referred patients in the low SES-group more often than in the intermediate and high SES-group (61.8% vs. 57.8% and 56.0% resp.,  $p = 0.03$ ). Patients in the low SES-group used more medications than the high SES-group (3.3 vs. 1.9,  $p < 0.001$ ).

### Organizational and clinical parameters in the ED and SES

There were no differences in the specialties (surgical vs. medical) that treated the patients nor in time of presentation between the three SES groups (Table 2). In addition, the vital parameters at presentation were comparable between the three groups. Patients with a low SES more often had a higher urgent triage level than the high SES-group, however, this difference was not significant (15.4% vs. 12.1%,  $p = 0.02$ ). In the low and the intermediate SES-group, more diagnostics tests were performed than in the high SES-group (mean 2.3 vs. 2.1 vs. 2.0, resp.,  $p < 0.001$ ). Patients with low SES had a longer ED-LOS than patients with intermediate and high SES (140 min vs. 133 vs. 133, resp.  $p = 0.01$ ). There were some differences in diagnoses between the three groups. Endocrine diagnoses were more common in the low SES group (3.1%) than the intermediate or high SES group (1.7% and 1.6%,  $p = 0.03$ ), and the same applied for infectious diseases. (Table 2).

**Table 2. Organisational and clinical parameters of elderly ED patients within the different SES groups.**

	Socioeconomic Status			P-value
	Low N = 1660 (33.1%)	Intermediate N = 1640 (34.0%)	High N = 1588 (32.9%)	
<b>Specialism</b>				0.16
Medical	879 (54.9%)	858 (52.3%)	822 (51.8%)	
Surgical	721 (45.1%)	782 (47.7%)	766 (48.2%)	

<b>Shift</b>				0.15
Morning	1130 (70.9%)	1148 (70.2%)	1169 (73.7%)	
Evening	240 (21.3%)	354 (21.7%)	318 (20.0%)	
Night	124 (7.8%)	133 (8.1%)	100 (6.3%)	
<b>Level of triage</b>				
Low	628 (39.8%)	640 (39.7%)	687 (44.0%)	0.02
Moderate	702 (44.5%)	730 (35.3%)	683 (43.7%)	0.69
Urgent	246 (15.4%)	242 (14.8%)	192 (12.1%)	0.02
No triage	24 (1.5%)	28 (1.7%)	26 (1.6%)	0.98
<b>No. of extra consultations at ED</b>				0.80
None	1376 (86.0%)	1407 (85.6%)	1365 (86.0%)	
1	200 (12.5%)	215 (13.1%)	199 (12.5%)	
≥2	24 (0.5%)	18 (1.1%)	24 (1.4%)	
<b>Vital parameters</b>				
Systolic blood pressure (mmHg), mean (SD)	152 (31.7)	153 (31.3)	152 (30.8)	0.98
Missing	428 (26.9%)	530 (32.4%)	545 (35.5%)	
Heart rate (min), mean (SD)	81.5 (17.0)	82.5 (18.1)	82.1 (17.7)	0.49
Missing	734 (45.9%)	806 (49.1%)	819 (51.6%)	
<b>Medical procedures at ED</b>				
No. of diagnostic tests, mean (SD)	2.3 (1.8)	2.1 (1.8)	2.0 (1.7)	0.003#
Laboratory test (%)*	1081 (67.9%)	1046 (64.1%)	974 (61.7%)	<0.001
CRP (mg/L), median (IQR)	16 (60)	14 (55)	15 (66)	0.47
Leukocytes (x10 <sup>9</sup> /L), median (IQR)	9.2 (6)	9.3 (5)	8.8 (5)	0.91
<b>Diagnosis at ED</b>				
Injury	487 (30.6%)	504 (30.8%)	508 (32.2%)	0.56
Otherwise	280 (17.6%)	286 (17.5%)	289 (18.3%)	0.79
Circulatory / Respiratory	232 (14.6%)	257 (15.7%)	201 (12.7%)	0.06
Other	202 (12.7%)	217 (13.3%)	218 (18.3%)	0.64

Digestive	163 (10.2%)	175 (10.8%)	169 (10.7%)	0.88
Genito-urinary	68 (4.3%)	73 (4.5%)	58 (3.7%)	0.51
Infectious	65 (4.1%)	52 (3.2%)	45 (2.8%)	0.14
Endocrine / Metabolic	50 (3.1%)	28 (1.7%)	25 (1.6%)	0.03&
Neoplasm / haematology	47 (2.9%)	52 (3.2%)	70 (4.4%)	0.05^
Missing	6 (0.4%)	3 (0.2%)	9 (0.6%)	
<b>ED-LOS in minutes, median (IQR)*</b>	<b>140 (83)</b>	<b>133 (90)</b>	<b>133 (87)</b>	<b>0.01@</b>

SES = Socioeconomic Status. SD = Standard deviation. ED = Emergency department. CRP = C-reactive protein. ED-Diagnosis 'other' (ICD-10 classification) = diseases of the nervous system, musculoskeletal and connective tissue, skin and subcutaneous tissue, eye and adnexa, ear and mastoid and mental.

P-values low, intermediate and high SES: using the Chi-square test, unpaired t-test and Mann-Whitney-U-test.

\* =  $p < 0.05$ .

# = p-value low vs intermediate 0.003, low vs high  $< 0.001$ , intermediate vs. high  $< 0.01$ .

@ = p-value low vs intermediate 0.01, low vs high 0.004, intermediate vs. high  $< 0.93$ .

^ = p-value low vs intermediate 0.01, low vs high 0.004, intermediate vs. high  $< 0.93$ .

& = p-value low vs intermediate 0.70, low vs high 0.03, intermediate vs. high  $< 0.06$ .

### Patient outcomes and SES

Patients with a low SES were more frequently hospitalised than the intermediate and high SES-group (62.3% vs. 55.4% vs. 52.3%, resp.,  $p < 0.001$ , Table 3). In addition, patients with a low SES had a longer hospital-LOS than patients with a high SES (6.0 vs. 5.0 days,  $p < 0.001$ ). However, the hospital-LOS did not differ between intermediate SES and high SES patients (5 days in both groups,  $p = 0.45$ ). The finding that low SES patients were more often hospitalised than the high SES group turned out not to be independent of age and comorbidity (adjusted OR 1.3 95% CI 0.9–1.4, Table 3). When stratified according to living situation, low SES community-dwelling patients had a higher risk of hospitalisation with an OR of 1.3 (95% CI 1.1–1.7) compared with patients with a high SES. In contrast, institutionalized low SES patients had a lower risk of hospitalisation with an OR of 0.2 (95% CI:0.1–0.7). Intermediate SES patients did not have a higher odd for hospitalisation (OR 1.0 95% CI 0.95–1.4) than high SES patients.

**Table 3. Multivariable analysis of the effect on SES on ED outcomes and within different living situations.**

	Socioeconomic Status	Number (%)	All patients N = 4828 (OR 95%CI)	Community-dwelling patients N = 4381 (OR 95%CI)	Institutionalized patients N = 443 (OR 95%CI)
Hospitalisation <sup>1</sup>	Low	996/1660 (62.3%)	1.1 (0.9-1.4)	<b>1.3 (1.1-1.7)</b>	<b>0.2 (0.1-0.7)</b>
	Intermediate	909/1640 (55.4%)	1.1 (0.9-1.4)	1.1 (0.95-1.4)	0.4 (0.1-1.2)
	High	830/1588 (52.3%)	1.0	1.0	1.0
In-hospital mortality <sup>2</sup>	Low	86/996 (5.4%)	1.2 (0.7-2.0)	1.4 (0.8-2.6)	0.8 (0.1-6.8)
	Intermediate	58/909 (3.5%)	1.1 (0.6-1.9)	1.3 (0.8-2.2)	0.4 (0.1-4.0)
	High	55/830 (3.5%)	1.0	1.0	1.0
30-day ED-revisits <sup>3#</sup>	Low	184/1514 (11.5%)	1.0 (0.8-1.4)	1.0 (0.7-1.4)	1.0 (0.2-4.7)
	Intermediate	220/1582 (13.5%)	0.9 (0.7-1.1)	0.8 (0.6-1.1)	0.8 (0.2-4.6)
	High	196/1533 (12.3%)	1.0	1.0	1.0

ED = Emergency Department. OR = Odds Ratio. CI = confidence Interval.

1 = adjusted variable include age and Charlson comorbidity index.

2 = adjusted for age, Charlson comorbidity index, and triage level.

3 = adjusted for age, Charlson comorbidity index and gender. # = without patients who died during hospitalisation.

In-hospital mortality was higher for the low SES group (5.4%) compared with the intermediate (3.5%) and the high SES group (3.5%,  $p=0.01$ , unadjusted  $OR_{low\_vs\_high} : 0.6$  95% CI 0.4-0.9). The difference in in-hospital mortality between low and high SES patients was no longer significant when adjusted for age, comorbidity and triage level (adjusted OR 1.2 95% CI 0.7-2.0).

There was no difference in 30-day ED-revisit rate between the low, intermediate and high SES group (21.3%, 20.4% vs. 20.8%, resp.,  $p=0.88$ ). Neither was the 30-day ED-revisit rate different after correcting for age, comorbidity and gender (adjusted OR 1.0, 95% CI 0.8-1.4). Moreover, adjusting for the living situation did not alter the results significantly (Table 3).

## Discussion

Our study was a large population-based study that investigated the association of SES with ED visits of elderly ( $\geq 65$  years) patients. We found that elderly community-dwelling ED patients with a low SES have a higher risk

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3 of hospitalisation than patients with a high SES. However, in-hospital mortality and the number of ED-return  
4 visits were not different between the three SES groups.  
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6 We hypothesized that patients with low SES would be less healthy than those with a higher SES, which  
7 indirectly would result in higher admission rates and in-hospital mortality after presentation at the ED. Our  
8 data allowed us to determine important confounders, such as comorbidity, organisational factors and the  
9 severity of illness at the ED, which makes it possible to contribute important information to already existing  
10 evidence on the topic of SES, where the majority of studies did not adjust for potential confounders. Our study  
11 indeed observed a higher chance of hospitalisation (OR 1.3 CI 1.1-1.7) for community-dwelling patients with a  
12 low SES than for patients with intermediate/high SES. This finding is in line with other studies (9,25,26). It may  
13 be possible that part of the community-dwelling frail patients are admitted for care problems, which is not a  
14 reason for admission in institutionalized patients. In addition, ED visits by institutionalized patients have been  
15 shown to be potentially preventable and inappropriate resulting in immediate discharge back (27)(28).  
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25 In-hospital mortality and ED-revisits within 30 days were not associated with SES. This contrasts with  
26 other studies that found a higher risk of in-hospital mortality and readmissions in elderly patients with a low  
27 SES (8, 16,17), but is in line with other studies that did not found an association (11,12,18). The association of  
28 low SES and adverse outcomes was found in studies that included patients with a specific diagnosis (e.g.  
29 pneumonia or heart failure) (18,29) or that analysed the amount of ED visits per SES category (4,6,9,30),  
30 whereas our study focused on an undifferentiated, and therefore, more generalizable, elderly ED population.  
31 Another reason not finding an association between low SES and outcomes might be that most studies did not  
32 account for differences in living situation (17,31,32). We found that care and nursing homes were mostly  
33 situated in low SES areas, while their inhabitants will probably belong to all three SES (28). Additionally,  
34 institutionalized patients may influence revisit rates, because they are treated by their own doctor in the  
35 nursing home. It may be useful to take the living situation into account when using SES based on zip code,  
36 because care facilities structures at home influence ED outcomes.  
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48 The fact that we did not find an association between SES and in-hospital mortality and revisits may be  
49 due to the organisation of the health care system in the Netherlands and may underscore/reflect that our  
50 health care is indeed accessible to all patients, regardless of their SES. In the Netherlands, the health care  
51 system consists of a well organised GP-network, with 24-hours a day access for acute care patients, which is  
52 equally accessible for every inhabitant (30). This network selects the most severely ill patients for referral to  
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3 the ED. The acute health care system differs over the countries, and in some countries, for instance the United  
4 States, the ED is used as a safety-net for underserved and uninsured patients (33). Also, evenly important, the  
5 financial health care structure is different worldwide. In the Netherlands, care provided by the general  
6 practitioner is fully covered by the basic obligatory health insurance (34). Therefore this system provides equal  
7 access to health care by the general practitioner to every resident, despite their SES (5,35-37). In short,  
8 specifically regarding acute care, differences in organization and financial coverage of acute care make  
9 comparisons between countries difficult (38).

16 Apart from the above mentioned, the following study limitations should be mentioned. Firstly, our  
17 results are not generalizable to cardiology and gynaecology patients as we excluded these patients. For these  
18 cardiology patients, it is known that low SES may have a stronger association with adverse outcomes (39), and  
19 excluding these from our study may explain that we did not find associations between SES and outcome  
20 (except for hospitalisation in community dwelling patients). Secondly, we retrieved SES on basis of zip codes,  
21 which may be imprecise and yield smaller associations of SES with adverse outcomes (40). However, one zip  
22 code covers only 17 households and therefore, we consider this way of retrieving SES rather reliable. Thirdly,  
23 retrieving SES of patients living in a nursing home or other care home facilities on basis of zip code is probably  
24 not reliable. Therefore, we made subgroup analysis of community dwelling patients and institutionalized  
25 patients, which is a strong point of our study. Lastly, coding for the living situation may not be precise, but we  
26 think that this does not lead to an underestimation since the percentage of institutionalized patients (9.1%) is  
27 almost similar as percentages given in another study (9.0%) (41).

39 In this study, we provided important information in terms of health outcomes on the SES in the acute  
40 health care setting in the vulnerable elderly population. We investigated a large unselected group of elderly ED  
41 patients stratified to living situation, which provides additional knowledge on the care and problems of elderly  
42 patients in the ED. Our study shows that in a country with assumed equal health care access only minor  
43 outcome differences were observed between different SES groups. Therefore, physicians should be aware of  
44 the potential differences between SES groups given the higher chance of hospitalisation. Improvement in  
45 adequately diagnosing and treating elderly patients is important, but the additional value of SES in the  
46 emergency care should be evaluated further to develop effective interventions to ensure high quality of care.  
47 Given the differences between community-dwelling and institutionalized patients, it seems fair to take the  
48 living situation into account in future studies.



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In conclusion, low SES community-dwelling patients were more often hospitalised than high SES community-dwelling patients, but no differences in in-hospital mortality and ED-revisits between the SES groups.

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**Contributorship statement**

JW and SB conceived the study and designed the protocol. SL contributed to the design for the overall elderly project. JW, PS and ID analyzed and interpreted the data. HH supervised the conduct of the study and data collection. JW, PS and ID drafted the manuscript. MA helped with the statistical analyses. JW designed the database. JW, ID, PS, SB, MA, SL and HH contributed substantially to its revision and approved the final manuscript.

**Data sharing statement**

Data of the study is available from the data governance board of Maxima Medical Centre Institutional Data Access / Ethics Committee for researchers who meet the criteria for access to confidential data. Data are from the non-specific complaints study when contacting the data governance board (Jolanda.Luime@mmc.nl).

## References

- (1) Hoogendijk EO, van Hout HP, Heymans MW, van der Horst HE, Frijters DH, Broese van Groenou MI, et al. Explaining the association between educational level and frailty in older adults: results from a 13-year longitudinal study in the Netherlands. *Ann Epidemiol* 2014 Jul;24(7):538-44.e2.
- (2) Lowthian JA, Curtis AJ, Cameron PA, Stoelwinder JU, Cooke MW, McNeil JJ. Systematic review of trends in emergency department attendances: an Australian perspective. *Emerg Med J* 2011 May;28(5):373-377.
- (3) Mackenbach JP, Stirbu I, Roskam AJ, Schaap MM, Menvielle G, Leinsalu M, et al. Socioeconomic inequalities in health in 22 European countries. *N Engl J Med* 2008 Jun 5;358(23):2468-2481.
- (4) Droomers M, Westert GP. Do lower socioeconomic groups use more health services, because they suffer from more illnesses? *Eur J Public Health* 2004 Sep;14(3):311-313.
- (5) van Doorslaer E, Wagstaff A, van der Burg H, Christiansen T, De Graeve D, Duchesne I, et al. Equity in the delivery of health care in Europe and the US. *J Health Econ* 2000 Sep;19(5):553-583.
- (6) Khan Y, Glazier RH, Moineddin R, Schull MJ. A population-based study of the association between socioeconomic status and emergency department utilization in Ontario, Canada. *Acad Emerg Med* 2011 Aug;18(8):836-843.
- (7) Tozer AP, Belanger P, Moore K, Caudle J. Socioeconomic status of emergency department users in Ontario, 2003 to 2009. *CJEM* 2014 May;16(3):220-225.
- (8) Begley C, Basu R, Lairson D, Reynolds T, Dubinsky S, Newmark M, et al. Socioeconomic status, health care use, and outcomes: persistence of disparities over time. *Epilepsia* 2011 May;52(5):957-964.
- (9) Filc D, Davidovich N, Novack L, Balicer RD. Is socioeconomic status associated with utilization of health care services in a single-payer universal health care system? *Int J Equity Health* 2014 Nov 28;13:115-014-0115-1.
- (10) Ionescu-Ittu R, McCusker J, Ciampi A, Vadeboncoeur AM, Roberge D, Larouche D, et al. Continuity of primary care and emergency department utilization among elderly people. *CMAJ* 2007 Nov 20;177(11):1362-1368.
- (11) Ho KM, Dobb GJ, Knuiman M, Finn J, Webb SA. The effect of socioeconomic status on outcomes for seriously ill patients: a linked data cohort study. *Med J Aust* 2008 Jul 7;189(1):26-30.
- (12) Alter DA, Chong A, Austin PC, Mustard C, Iron K, Williams JI, et al. Socioeconomic status and mortality after acute myocardial infarction. *Ann Intern Med* 2006 Jan 17;144(2):82-93.
- (13) Samaras N, Chevalley T, Samaras D, Gold G. Older patients in the emergency department: a review. *Ann Emerg Med* 2010 Sep;56(3):261-269.
- (14) Ramos M. Impact of socioeconomic status on Brazilian elderly health. *Rev Saude Publica* 2007 Aug;41(4):616-624.
- (15) Cournane S, Conway R, Byrne D, O'Riordan D, Coveney S, Silke B. Social deprivation and the rate of emergency medical admission for older persons. *QJM* 2016 Oct;109(10):645-651.
- (16) Hutchings A, Raine R, Brady A, Wildman M, Rowan K. Socioeconomic status and outcome from intensive care in England and Wales. *Med Care* 2004 Oct;42(10):943-951.

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2  
3 (17) Rathore SS, Masoudi FA, Wang Y, Curtis JP, Foody JM, Havranek EP, et al. Socioeconomic status, treatment,  
4 and outcomes among elderly patients hospitalized with heart failure: findings from the National Heart Failure  
5 Project. *Am Heart J* 2006 Aug;152(2):371-378.
- 6  
7 (18) Izquierdo C, Oviedo M, Ruiz L, Sintes X, Vera I, Nebot M, et al. Influence of socioeconomic status on  
8 community-acquired pneumonia outcomes in elderly patients requiring hospitalization: a multicenter  
9 observational study. *BMC Public Health* 2010 Jul 15;10:421-2458-10-421.
- 10  
11 (19) Brouns SHA, Dortmans MKJ, Jonkers FS, Lambooi SLE, Kuijper A, Haak HR. Hyponatraemia in Elderly  
12 Emergency Department Patients: A Marker of Frailty. *Neth J Med* 2014;72(6):311-317.
- 13  
14 (20) Centraal bureau voor de statistiek. Inhoud kerncijfers postcodegebieden 2008-2010. 2012.
- 15  
16 (21) Kunst A.E. Bos V. Mackenbach J.P. Monitoring socioeconomic inequalities in health in the european union:  
17 guidelines and illustrations. EU Working Group on Socio-economic Inequalities in Health 2011.
- 18  
19 (22) Needham DM, Scales DC, Laupacis A, Pronovost PJ. A systematic review of the Charlson comorbidity index  
20 using Canadian administrative databases: a perspective on risk adjustment in critical care research. *J Crit Care*  
21 2005 Mar;20(1):12-19.
- 22  
23 (23) Zachariasse JM, Seiger N, Rood PP, Alves CF, Freitas P, Smit FJ, et al. Validity of the Manchester Triage  
24 System in emergency care: A prospective observational study. *PLoS One* 2017 Feb 2;12(2):e0170811.
- 25  
26 (24) Quan H, Sundararajan V, Halfon P, Fong A, Burnand B, Luthi JC, et al. Coding algorithms for defining  
27 comorbidities in ICD-9-CM and ICD-10 administrative data. *Med Care* 2005 Nov;43(11):1130-1139.
- 28  
29 (25) Robert S. Stern M, Joel S. Weissman P, Arnold M. Epstein, MD, MA. The emergency department as a  
30 pathway to admission for poor and high cost patients. *JAMA* 1991;266(16):2238-2243.
- 31  
32 (26) Raffaele Antonelli-Incalzi, Carla Ancona, Francesco Forastiere, Valeria Belleudi, Andrea Corsonello, Carlo A  
33 Perucci. Socioeconomic status and hospitalization in the very old: a retrospective study. *BMC Public Health*  
34 2007;7(227).
- 35  
36 (27) Brownell J, Wang J, Smith A, Stephens C, Hsia RY. Trends in emergency department visits for ambulatory  
37 care sensitive conditions by elderly nursing home residents, 2001 to 2010. *JAMA Intern Med* 2014  
38 Jan;174(1):156-158.
- 39  
40 (28) Arendts G, Howard K. The interface between residential aged care and the emergency department: a  
41 systematic review. *Age Ageing* 2010 May;39(3):306-312.
- 42  
43 (29) Bhayana R, Vermeulen MJ, Li Q, Hellings CR, Berdahl C, Schull MJ. Socioeconomic status and the use of  
44 computed tomography in the emergency department. *CJEM* 2014 Jul;16(4):288-295.
- 45  
46 (30) van der Meer JB, van den Bos J, Mackenbach JP. Socioeconomic differences in the utilization of health  
47 services in a Dutch population: the contribution of health status. *Health Policy* 1996 Jul;37(1):1-18.
- 48  
49 (31) Cressman AM, Macdonald EM, Yao Z, Austin PC, Gomes T, Paterson JM, et al. Socioeconomic status and  
50 risk of hemorrhage during warfarin therapy for atrial fibrillation: A population-based study. *Am Heart J* 2015  
51 Jul;170(1):133-40, 140.e1-3.
- 52  
53 (32) Govindarajan P, Gonzales R, Maselli JH, Johnston SC, Fahimi J, Poisson S, et al. Regional differences in  
54 emergency medical services use for patients with acute stroke (findings from the National Hospital Ambulatory  
55 Medical Care Survey Emergency Department Data File). *J Stroke Cerebrovasc Dis* 2013 Nov;22(8):e257-63.
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2  
3 (33) Di Somma S, Paladino L, Vaughan L, Lalle I, Magrini L, Magnanti M. Overcrowding in emergency  
4 department: an international issue. *Intern Emerg Med* 2015 Mar;10(2):171-175.  
5  
6 (34) van der Linden MC, Lindeboom R, de Haan R, van der Linden N, de Deckere ER, Lucas C, et al. Unscheduled  
7 return visits to a Dutch inner-city emergency department. *Int J Emerg Med* 2014 Jul 5;7:23-014-0023-6.  
8 eCollection 2014.  
9  
10 (35) Pines JM, Hilton JA, Weber EJ, Alkemade AJ, Al Shabanah H, Anderson PD, et al. International perspectives  
11 on emergency department crowding. *Acad Emerg Med* 2011;18(12):1358-1370.  
12  
13 (36) van der Linden MC, Lindeboom R, van der Linden N, van den Brand CL, Lam RC, Lucas C, et al. Self-referring  
14 patients at the emergency department: appropriateness of ED use and motives for self-referral. *Int J Emerg*  
15 *Med* 2014 Jul 16;7:28-014-0028-1. eCollection 2014.  
16  
17 (37) Holmes JL. Emergency medicine in the Netherlands. *Emergency Medicine Australasia* 2010;22(1):75-81.  
18  
19 (38) Grundy E, Holt G. The socioeconomic status of older adults: how should we measure it in studies of health  
20 inequalities? *J Epidemiol Community Health* 2001 Dec;55(12):895-904.  
21  
22 (39) Carlsson AC, Li X, Holzmann MJ, Wandell P, Gasevic D, Sundquist J, et al. Neighbourhood socioeconomic  
23 status and coronary heart disease in individuals between 40 and 50 years. *Heart* 2016 May 15;102(10):775-782.  
24  
25 (40) Aarts MJ, van der Aa MA, Coebergh JW, Louwman WJ. Reduction of socioeconomic inequality in cancer  
26 incidence in the South of the Netherlands during 1996-2008. *Eur J Cancer* 2010 Sep;46(14):2633-2646.  
27  
28 (41) Ribbe MW, Ljunggren G, Steel K, Topinkova E, Hawes C, Ikegami N, et al. Nursing homes in 10 nations: a  
29 comparison between countries and settings. *Age Ageing* 1997 Sep;26 Suppl 2:3-12.  
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3 **Figures**

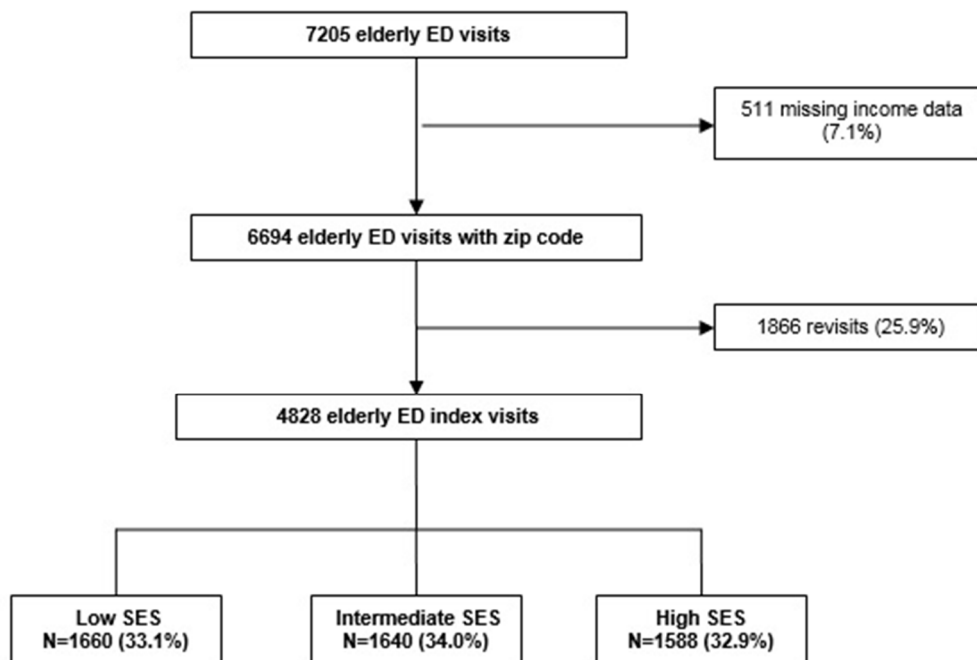
4 **Figure 1. The Flow chart of elderly patients divided into three SES groups.**

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6 ED = Emergency department. SES = Socioeconomic Status  
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**STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cohort studies***

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
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
<b>Methods</b>			
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) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	5
		(b) For matched studies, give matching criteria and number of exposed and unexposed	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	1
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	5-6
Bias	9	Describe any efforts to address potential sources of bias	6
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	6
		(b) Describe any methods used to examine subgroups and interactions	5-6
		(c) Explain how missing data were addressed	6
		(d) If applicable, explain how loss to follow-up was addressed	
		(e) Describe any sensitivity analyses	6
<b>Results</b>			

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 (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram	7
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest (c) Summarise follow-up time (eg, average and total amount)	7-8
Outcome data	15*	Report numbers of outcome events or summary measures over time	11-12
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 (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	11-12
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	11-12
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	
<b>Limitations</b>			
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	13-15
<b>Other information</b>			
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	14

\*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](http://www.strobe-statement.org).

# BMJ Open

## Older adult community-dwelling patients with low socioeconomic status are hospitalised more often after visiting the emergency department

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-019318.R1
Article Type:	Research
Date Submitted by the Author:	17-Oct-2017
Complete List of Authors:	Wachelder, Joyce; Maxima Medisch Centrum, Internal Medicine van Drunen, Isabelle ; Maxima Medisch Centrum, Internal Medicine Stassen, Patricia; Maastricht University CAPHRI School for Public Health and Primary Care; Maastricht Universitair Medisch Centrum+ Interne Geneeskunde, Internal Medicine Brouns , Steffie ; Maxima Medisch Centrum, Internal Medicine Lambooij, Suze ; Maxima Medisch Centrum, Internal Medicine Aarts, Mieke ; Netherlands Comprehensive Cancer Organisation Haak , Harm; Maxima Medisch Centrum, Eindhoven ; Maastricht University CAPHRI School for Public Health and Primary Care
<b>Primary Subject Heading</b>:	Emergency medicine
Secondary Subject Heading:	Geriatric medicine
Keywords:	Socioeconomic Status, Elderly, Emergency Department

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12 4 J.J.H. Wachelder<sup>12</sup>, I.S. van Drunen<sup>1#</sup>, P.M.Stassen<sup>24#</sup>, S.H.A Brouns<sup>12</sup>, S.L.E. Lambooi<sup>1</sup>, M.J. Aarts<sup>3</sup>, H.R. Haak<sup>124</sup>  
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38 19 Disclosure: There are no conflicts of interest. No funding was received.  
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41 21 Word count: 4072 (including tables)  
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43 22 Word count abstract: 250  
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45 23 Number of Tables: 3. Number of Figures: 1.  
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47 24 References: 46  
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50 26 **Keywords:** Socioeconomic Status; Older adult; Emergency Department  
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3 1 **Abstract**

4 2 **Objectives:** Older adults frequently visit the Emergency Department (ED). Socioeconomic State (SES) has an  
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6 3 important impact on health and ED utilization, however, the association between SES and ED utilization in  
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8 4 elderly remains unclear. The aim of this study was to investigate the association between SES in older adult  
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10 5 patients visiting the ED on outcomes.

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12 6 **Design:** A retrospective study.

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14 7 **Participants:** Older adults ( $\geq 65$  years) visiting the ED, in the Netherlands. SES was stratified into tertiles based  
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16 8 on average household income at zip code level; low ( $< \text{€}1800/\text{month}$ ), intermediate ( $\text{€}1800\text{--}\text{€}2300/\text{month}$ ) and  
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18 9 high ( $> \text{€}2300/\text{month}$ ).

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20 10 **Primary outcomes:** hospitalisation, in-hospital mortality and 30-day ED-return visits. Effect of SES on outcomes  
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22 11 for all groups were assessed by logistic regression and adjusted for confounders.

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24 12 **Results:** In total, 4828 older adults visited the ED during the study period. Low SES was associated with a higher  
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26 13 risk of hospitalisation among community-dwelling patients compared with high SES (adjusted OR 1.3 95%CI 1.1-  
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28 14 1.7). This association was not present for intermediate SES (adjusted OR 1.1 95%CI 0.95-1.4). In-hospital  
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30 15 mortality was comparable between the low and high SES-group, even after adjustment for age, comorbidity  
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32 16 and triage level (low OR 1.4 95%CI 0.8-2.6, intermediate OR 1.3 95%CI 0.8-2.2). Thirty-day ED-revisits among  
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34 17 community-dwelling patients were also equal between the SES groups (low: adjusted OR 1.0 95%CI 0.7-1.4 and  
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36 18 intermediate: adjusted OR 0.8 95%CI 0.6-1.1).

37  
38 19 **Conclusion:** In older adult ED patients, low SES was associated with a higher risk of hospitalisation than high  
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40 20 SES. However, SES had no impact on in-hospital mortality and 30-day ED-revisits after adjustment for  
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42 21 confounders.

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**Strengths and limitations of this study**

- This is one of the only studies to provide detailed insight into the impact of different socioeconomic status groups of older adults in the emergency care.
- Additionally, this study the living situation was used to differentiate between community-dwelling patients and institutionalized patients to observe differences in outcomes.
- This study used a retrospective cohort study and linked patient zip code with income data based on a well-defined database by Statistics Netherlands.
- A strength of our study is that we investigated a large undifferentiated group of older adult emergency care patients.
- Limitations were that we were not able to extract the data of cardiology and gynaecology patients and that we used zip code to define the socioeconomic status.

For peer review only

## 1 Introduction

2 The burden on the Emergency Department (ED) capacity has been increasing over the past decades, which is  
3 mostly due to a substantially increasing number of older adults ( $\geq 65$  years old) (1). Given the extent and  
4 complexity of the problems in these patients, it is essential to identify determinants that lead to the ED visits in  
5 order to maintain high quality of care of older adult ED patients (2).

6 Low socioeconomic status (SES) has already been identified as an important determinant of health  
7 status and is strongly associated with poor adverse health outcomes (3). Patients with a low SES visit the  
8 general practitioner more and the specialist less often than patients with a high SES (4,5). Moreover, patients  
9 with a low a SES use the ED more frequently and are admitted to the hospital more often than those with a  
10 high SES (4,6-10). However, most studies focused on the influence of SES on the quantity of ED utilization,  
11 rather than on the reasons for and outcomes of these ED visits in general (8,10-12).

12 It is well-known that older adults are vulnerable and prone to adverse health outcomes, such as ED  
13 visits, ED return visits, hospitalisation and mortality (13). However, research on the effect of SES on ED visits  
14 and adverse health outcomes in these older adults is scarce (10,14,15). Some of these studies demonstrated  
15 conflicting results as where low SES patients showed higher risk of adverse health outcomes (8,16,17), while  
16 other studies did not find such an increased risk (11,12,18). Moreover, most studies focused on patients with a  
17 specific diagnosis (e.g. heart failure, pneumonia or injury) and other studies merely studied ED utilization  
18 (10,14,18).

19 To understand the ED utilization patterns of older adults, it can be important to take their SES into  
20 account. Understanding the characteristics of older adult ED patients, including their SES, may be the first step  
21 to maintain or improve high quality of acute care. We hypothesize that low SES influences the risk of adverse  
22 health outcomes in the ED setting in a negative way and adds to the vulnerability of older adult ED patients  
23 even in a country in which health care access is organized for every inhabitant, regardless of SES.

24 The aim of this study was to determine differences between different SES groups among older adults s  
25 and additionally and most importantly we investigated the association of SES with hospitalisation, in-hospital  
26 mortality and ED-revisits.

## 28 Method

### 29 *Study design, setting and population*

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2  
3 1 A retrospective cohort study was performed in the Maxima Medical Centre, a 550-bed teaching hospital in the  
4  
5 2 Netherlands. Yearly, approximately 30,000 patients visit the ED (19), of whom 30% are older adults ( $\geq 65$  years).  
6  
7 3 In the Netherlands, patients are usually referred to the ED by a general practitioner. The general practitioners  
8  
9 4 provide acute care all days of the week and every hour of the day, including out of office hours.

10  
11 5 Older adults who visited the ED for all medical (including oncology) and surgical specialities in one year  
12  
13 6 (between 1<sup>st</sup> of September 2011 and 31<sup>st</sup> of August 2012), were included. Data from the acute cardiac care unit  
14  
15 7 and gynaecology unit were not available in the database, because these patients do not visit the ED .

16  
17 8 Data of the ED visits were automatically extracted from the electronic patient records (Chipsoft-EZIS,  
18  
19 9 version 5.2). Categorization of the data was done according a fixed data extraction form by one researcher  
20  
21 10 (JW). A random sample of all variables was checked by another researcher (ID). The patients' zip code (on  
22  
23 11 average 17 households per zip code) was used to determine the SES at a neighbourhood level by combining the  
24  
25 12 median household income per month and mean value of the houses. Data on income were provided by  
26  
27 13 Statistics Netherlands (20). This dataset excluded zip codes with less than 10 households to guarantee  
28  
29 14 anonymity. The median income data derived from zip codes in the database from Statistics Netherlands were  
30  
31 15 linked to our database and subsequently divided into tertiles (21): low ( $< \text{€}1800/\text{month}$ ), intermediate ( $\text{€}1800-$   
32  
33 16  $\text{€}2300/\text{month}$ ) and high ( $> \text{€}2300/\text{month}$ ). It was impossible to retrieve SES data for patients with unknown zip  
34  
35 17 code or patients living abroad (Belgium), and therefore, these patients were excluded (N=511, 6.9%).

36  
37 18 To investigate the effect of the living situation in the three SES groups, we conducted a subgroup  
38  
39 19 analysis for the outcomes of community-dwelling patients and for patients who were institutionalized. Living  
40  
41 20 situation was determined on basis of zip codes, including those of the nursing and care home patients. The first  
42  
43 21 ED visit in the study period was considered the index visit, other visits after the index visit were excluded to  
44  
45 22 avoid duplicate analysis of the patients' characteristics and outcomes. The Institutional Review Board of  
46  
47 23 Máxima Medical Centre approved this study and confirmed that the Medical Research Involving Human Subject  
48  
49 24 Act (WMO) was not applicable.

## 25 26 **Data collection & definitions**

27  
28 27 The following data were retrieved from the electronic patient record: age, gender, zip code, comorbidity,  
29  
30 28 number of used medications. The Charlson comorbidity index (CCI) was used to quantify comorbidity (22). All  
31  
32 29 electronic patient (both ED and hospital) records were assessed to retrieve comorbidity. For a random sample



1 of 50% of the patients per SES group, comorbidity was manually retrieved. It was not feasible to do this for all  
2 patients. The patients' living situation was categorized into community-dwelling patients (living independently  
3 or with home care) and institutionalized patients (care home and nursing home).

4 To assess the severity of illness at presentation, the Manchester Triage Level (MTS) (23), vital parameters  
5 (systolic blood pressure, heart rate), laboratory tests (CRP and leukocytes) and the ED diagnoses were  
6 retrieved. The triage level based on the five-level MTS was categorised into 3 groups: urgent (red and orange),  
7 moderate (yellow), and low (green). In our ED the triage colour blue is not used,  
8 because these patients almost never visit our ED. Classification of ED diagnoses was done according the  
9 International Classification of Disease-10 (ICD-10)" (24). The group 'other', consisted out of diseases of the  
10 nervous system, musculoskeletal and connective tissue, skin and subcutaneous tissue, eye and adnexa, ear and  
11 mastoid and mental.

12 Organizational factors retrieved were time of arrival, mode of referral (self-referral, GP, ambulance, specialist  
13 and other), specialty, number of diagnostic tests (sum of radiological tests, electrocardiogram, arterial blood  
14 gas analysis, laboratory tests, urine analysis, urine and blood culture), number of specialist consultations in the  
15 ED, ED-Length-of-Stay (LOS) and hospital-LOS. Time of presentation was classified into 3 shifts: day (8am-6pm),  
16 evening (6pm-12pm) and night (12pm-8am). The following specialties were considered surgical: (general)  
17 surgery, plastic surgery, urology, and orthopaedics. Pulmonology, neurology, internal medicine and  
18 gastroenterology were considered medical specialities. Hospital LOS was defined as the number of days  
19 between hospital admission and hospital discharge. Dates of death during hospital stay and of the ED-return  
20 visit were retrieved. The data were extracted by one trained medical abstractor who was blinded for the study  
21 hypothesis.

### 22 **Statistical analyses**

24 All statistical analyses were performed using SPSS 22.0 (Armonk, New York, 2015). Comparisons between two  
25 SES groups (low vs. intermediate, low vs. high and intermediate vs. high) were conducted using unpaired-t-  
26 tests for continuous data and the Chi square test for categorical data. For continuous variables that were not  
27 normally distributed, the Wilcoxon-Mann-Whitney-Test was used. Missing data were categorised as  
28 "unknown" and included in the analyses of categorical parameters, to explore the influence of missing values.  
29 To investigate the independent effect of SES on hospitalisation, in-hospital mortality, and 30-day ED-return

1 visits, logistic regression analyses was performed. Multivariable analysis was performed to calculate the  
2 adjusted Odds Ratio (OR) and in order to estimate the effect of confounders of age, gender, triage level and  
3 CCI. Age, CCI and medications were included as a linear variable in this analysis. For day of the week, a weekday  
4 was reference, and for sex, female was reference. Triage level was categorized as follows: urgent, intermediate  
5 and low (reference). Sensitivity analysis was performed to evaluate the effect of ED-revisits on mortality. For  
6 this analysis, those who died during hospitalisation were excluded (N=199). To estimate the effect of the living  
7 situation on the SES and their outcomes, patients were divided into community-dwelling patients and  
8 institutionalized patients. OR and corresponding 95% Confidence Intervals (CI) were calculated for each of the  
9 outcomes. A p-value was considered significant when <0.05.

10

## 11 **Results**

12 During the study period, 7205 ED visits by older adult patients were registered in our ED. In total, 511 patients  
13 (7.1%) were excluded because income data were missing and 1866 visits (25.9%) because the visit was a revisit.  
14 In total, 4828 index visits were included. Of these 1660 visits (33.1%) were classified as having a low SES, 1640  
15 (34.0%) as intermediate and 1588 (32.9%) as having a high SES (Figure 1).

16

17

### 18 *Patient characteristics*

19 The mean age of the study population was 77±7.7 years, and slightly less patients were male (44.5%) (Table 1).  
20 In total, 4381 (90.7%) were community-dwelling patients and 9.2% lived institutionalized. Patients were mostly  
21 referred by a GP (58.5%) and were triaged as having moderate urgency (43.8%). More than half (56.5%) of the  
22 patients were hospitalised, and their median hospital-LOS was 5 days. In-hospital mortality was 4.1%.

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1 **Table 1. Patient characteristics and SES of older adult patients visiting the ED**

2

Characteristics	Total population N = 4828	Socioeconomic Status			P-value
		Low N = 1660 (33.1%)	Intermediate N = 1640 (34.0%)	High N = 1588 (32.9%)	
<b>Age, years</b>					
Mean (SD)	77 (7.7)	80 (7.6)	76 (7.6)	75 (7.4)	<0.001#
Median (IQR)*	77 (12)	80 (11)	76 (12)	74 (12)	
<b>Gender (%)*</b>					<0.001
Male	2149 (44.5%)	618 (38.6%)	759 (46.3%)	772 (48.6%)	
Female	2679 (55.5%)	982 (61.4%)	881 (53.7%)	816 (51.4%)	
<b>CCI, median (IQR)</b>	1.2 (1.6)	1.0 (0-8)	1.0 (0-10)	1.0 (0-11)	0.09
Unknown		45 (5.3%)	49 (5.3%)	54 (6.2%)	
<b>No. of medications, mean (SD)*</b>	2.5 (4.3)	3.3 (4.7)	2.4 (4.2)	1.9 (3.9)	<0.001
<b>Mode of referral*</b>					
General Practitioner	2680 (55.5%)	937 (61.8%)	905 (57.8%)	838 (56.0%)	0.03
Self-referral	852 (17.6%)	215 (13.4%)	292 (17.8%)	345 (21.7%)	<0.001
Ambulance	664 (13.8%)	244 (15.3%)	237 (14.5%)	183 (11.5%)	0.01
Specialist	632 (13.1%)	204 (9.6%)	206 (9.9%)	222 (10.8%)	0.75
<b>Living situation*</b>					<0.001
Community-dwelling	4381 (90.7%)	1266 (79.1%)	1556 (94.9%)	1559 (98.2%)	
Institutionalized	443 (9.2%)	330 (20.6%)	84 (5.1%)	29 (1.8%)	
Missing	4 (100%)	4 (100%)	0	0	

3 SES = Socioeconomic status. SD = Standard deviation. CCI = Charlson comorbidity index. ED = Emergency  
4 Department. P-values P-values low, intermediate and high SES: using the Chi-square test, unpaired t-test and  
5 Mann-Whitney-U-test.

6 # = p-value low vs. intermediate <0.001, low vs. high <0.001, intermediate vs. high <0.001.

7 \* = p<0.05.

### 1 Patient characteristics and Socioeconomic status

2 Patients with a low or intermediate SES were older than patients with a high SES (80 vs. 76 and 75 years resp.,  
 3 p<0.001) (Table 1). Male patients less frequently had a low SES than intermediate and high SES patients (38.6%  
 4 vs. 46.3% and 48.6% resp., p<0.001). The GP had referred patients in the low SES-group more often than in the  
 5 intermediate and high SES-group (61.8% vs. 57.8% and 56.0% resp., p=0.03). Patients in the low SES-group used  
 6 more medications than the high SES-group (3.3 vs. 1.9, p<0.001).

### 8 Organizational and clinical parameters in the ED and SES

9 There were no differences in the specialties (surgical vs. medical) that treated the patients nor in time of  
 10 presentation between the three SES groups (Table 2). In addition, the vital parameters at presentation were  
 11 comparable between the three groups. Patients with a low SES more often had a higher urgent triage level  
 12 than the high SES-group, however, this difference was not significant (15.4% vs. 12.1%, p=0.02). In the low and  
 13 the intermediate SES-group, more diagnostics tests were performed than in the high SES-group (mean 2.3 vs.  
 14 2.1 vs. 2.0, resp., p<0.001). Patients with low SES had a longer ED-LOS than patients with intermediate and high  
 15 SES (140 min vs. 133 vs. 133, resp. p=0.01). Diagnoses differed between the three groups: endocrine diseases  
 16 were more common in the low SES group (3.1%) than the intermediate or high SES group (1.7% and 1.6%,  
 17 p=0.03), and the same was observed for infectious diseases. (Table 2).

20 **Table 2. Organisational and clinical parameters of older adult ED patients within the different SES groups.**

	Socioeconomic Status			P-value
	Low N = 1660 (33.1%)	Intermediate N = 1640 (34.0%)	High N = 1588 (32.9%)	
<b>Specialism</b>				0.16
Medical	879 (54.9%)	858 (52.3%)	822 (51.8%)	
Surgical	721 (45.1%)	782 (47.7%)	766 (48.2%)	
<b>Shift</b>				0.15
Morning	1130 (70.9%)	1148 (70.2%)	1169 (73.7%)	

Evening	240 (21.3%)	354 (21.7%)	318 (20.0%)	
Night	124 (7.8%)	133 (8.1%)	100 (6.3%)	
<b>Level of triage</b>				
Low*	628 (39.8%)	640 (39.7%)	687 (44.0%)	0.02
Moderate	702 (44.5%)	730 (35.3%)	683 (43.7%)	0.69
Urgent	246 (15.4%)	242 (14.8%)	192 (12.1%)	0.02
No triage	24 (1.5%)	28 (1.7%)	26 (1.6%)	0.98
<b>No. of extra consultations at ED</b>				0.80
None	1376 (86.0%)	1407 (85.6%)	1365 (86.0%)	
1	200 (12.5%)	215 (13.1%)	199 (12.5%)	
≥2	24 (0.5%)	18 (1.1%)	24 (1.4%)	
<b>Vital parameters</b>				
Systolic blood pressure (mmHg), mean (SD)	152 (31.7)	153 (31.3)	152 (30.8)	0.98
Missing	428 (26.9%)	530 (32.4%)	545 (35.5%)	
Heart rate (min), mean (SD)	81.5 (17.0)	82.5 (18.1)	82.1 (17.7)	0.49
Missing	734 (45.9%)	806 (49.1%)	819 (51.6%)	
<b>Medical procedures at ED</b>				
No. of diagnostic tests, mean (SD)	2.3 (1.8)	2.1 (1.8)	2.0 (1.7)	0.003#
Laboratory test (%)*	1081 (67.9%)	1046 (64.1%)	974 (61.7%)	<0.001
CRP (mg/L), median (IQR)	16 (60)	14 (55)	15 (66)	0.47
Leukocytes (x10 <sup>9</sup> /L), median (IQR)	9.2 (6)	9.3 (5)	8.8 (5)	0.91
<b>Diagnosis at ED</b>				
Injury	487 (30.6%)	504 (30.8%)	508 (32.2%)	0.56
Otherwise	280 (17.6%)	286 (17.5%)	289 (18.3%)	0.79
Circulatory / Respiratory	232 (14.6%)	257 (15.7%)	201 (12.7%)	0.06
Other	202 (12.7%)	217 (13.3%)	218 (18.3%)	0.64
Digestive	163 (10.2%)	175 (10.8%)	169 (10.7%)	0.88
Genito-urinary	68 (4.3%)	73 (4.5%)	58 (3.7%)	0.51

Infectious	65 (4.1%)	52 (3.2%)	45 (2.8%)	0.14
Endocrine / Metabolic	50 (3.1%)	28 (1.7%)	25 (1.6%)	0.03&
Neoplasm / haematology	47 (2.9%)	52 (3.2%)	70 (4.4%)	0.05^
<i>Missing</i>	6 (0.4%)	3 (0.2%)	9 (0.6%)	
<b>ED-LOS in minutes, median (IQR)*</b>	140 (83)	133 (90)	133 (87)	0.01@

1 SES = Socioeconomic Status. SD = Standard deviation. ED = Emergency department. CRP = C-reactive protein.  
 2 ED-Diagnosis 'other' (ICD-10 classification) = diseases of the nervous system, musculoskeletal and connective  
 3 tissue, skin and subcutaneous tissue, eye and adnexa, ear and mastoid and mental.

4 P-values low, intermediate and high SES: using the Chi-square test, unpaired t-test and Mann-Whitney-U-test.

5 \* =  $p < 0.05$ .

6 # = p-value low vs intermediate 0.003, low vs high  $< 0.001$ , intermediate vs. high  $< 0.01$ .

7 @ = p-value low vs intermediate 0.01, low vs high 0.004, intermediate vs. high  $< 0.93$ .

8 ^ = p-value low vs intermediate 0.01, low vs high 0.004, intermediate vs. high  $< 0.93$ .

9 & = p-value low vs intermediate 0.70, low vs high 0.03, intermediate vs. high  $< 0.06$ .

## 12 Patient outcomes and SES

13 Patients with a low SES were more frequently hospitalised than the intermediate and high SES-group (62.3% vs.  
 14 55.4% vs. 52.3%, resp.,  $p < 0.001$ , Table 3). In addition, patients with a low SES had a longer hospital-LOS than  
 15 patients with a high SES (6.0 vs. 5.0 days,  $p < 0.001$ ). However, the hospital-LOS did not differ between  
 16 intermediate SES and high SES patients (5 days in both groups,  $p = 0.45$ ). The finding that low SES patients were  
 17 more often hospitalised than the high SES group turned out not to be independent of age and comorbidity  
 18 (adjusted OR 1.3 95% CI 0.9–1.4, Table 3). When stratified according to living situation, low SES community-  
 19 dwelling patients had a higher risk of hospitalisation with an OR of 1.3 (95% CI 1.1–1.7) compared with patients  
 20 with a high SES. In contrast, institutionalized low SES patients had a lower risk of hospitalisation with an OR of  
 21 0.2 (95% CI: 0.1–0.7). Intermediate SES patients did not have a higher odd for hospitalisation (OR 1.0 95% CI  
 22 0.95–1.4) than high SES patients.

1 **Table 3. Multivariable analysis of the effect on SES on ED outcomes and within different living situations.**

	Socioeconomic Status	Number (%)	All patients N = 4828 (OR 95%CI)	Community-dwelling patients N = 4381 (OR 95%CI)	Institutionalized patients N = 443 (OR 95%CI)
Hospitalisation <sup>1</sup>	Low	996/1660 (62.3%)	1.1 (0.9-1.4)	<b>1.3 (1.1-1.7)</b>	<b>0.2 (0.1–0.7)</b>
	Intermediate	909/1640 (55.4%)	1.1 (0.9-1.4)	1.1 (0.95-1.4)	0.4 (0.1-1.2)
	High	830/1588 (52.3%)	1.0	1.0	1.0
In-hospital mortality <sup>2</sup>	Low	86/996 (5.4%)	1.2 (0.7-2.0)	1.4 (0.8-2.6)	0.8 (0.1-6.8)
	Intermediate	58/909 (3.5%)	1.1 (0.6-1.9)	1.3 (0.8-2.2)	0.4 (0.1-4.0)
	High	55/830 (3.5%)	1.0	1.0	1.0
30-day ED-revisits <sup>3#</sup>	Low	184/1514 (11.5%)	1.0 (0.8-1.4)	1.0 (0.7-1.4)	1.0 (0.2-4.7)
	Intermediate	220/1582 (13.5%)	0.9 (0.7-1.1)	0.8 (0.6-1.1)	0.8 (0.2-4.6)
	High	196/1533 (12.3%)	1.0	1.0	1.0

2 ED = Emergency Department. OR = Odds Ratio. CI = confidence Interval.

3 1 = adjusted variable include age and Charlson comorbidity index.

4 2 = adjusted for age, Charlson comorbidity index, and triage level.

5 3 = adjusted for age, Charlson comorbidity index and gender. # = without patients who died during  
6 hospitalisation.

8 In-hospital mortality was higher for the low SES group (5.4%) compared with the intermediate (3.5%)  
9 and the high SES group (3.5%,  $p=0.01$ , unadjusted  $OR_{low\_vs\_high} :0.6$  95% CI 0.4-0.9). The difference in in-hospital  
10 mortality between low and high SES patients was no longer significant when adjusted for age, comorbidity and  
11 triage level (adjusted OR 1.2 95% CI 0.7–2.0).

12 There was no difference in 30-day ED-revisit rate between the low, intermediate and high SES group  
13 (21.3%, 20.4% vs. 20.8%, resp.,  $p=0.88$ ). Neither was the 30-day ED-revisit rate different after correcting for  
14 age, comorbidity and gender (adjusted OR 1.0, 95% CI 0.8–1.4). Moreover, adjusting for the living situation did  
15 not alter the results significantly (Table 3).

## 17 Discussion

18 Our study was a large population-based study that investigated the association of SES with ED visits of older  
19 adult ( $\geq 65$  years) patients. We found that older adult community-dwelling ED patients with a low SES have a  
20 higher risk of hospitalisation than patients with a high SES. Moreover, low SES patients had more often a higher

1  
2  
3 1 triage level, had more diagnostics test and longer ED-LOS compared to other SES groups. However, in-hospital  
4  
5 2 mortality and the number of ED-return visits were not different between the three SES groups.

6  
7 3 We hypothesized that patients with low SES would be less healthy than those with a higher SES, which  
8  
9 4 indirectly would result in higher admission rates and in-hospital mortality after presentation at the ED. Our  
10  
11 5 data allowed us to determine important confounders, such as comorbidity, organisational factors and the  
12  
13 6 severity of illness at the ED, which makes it possible to contribute important information to already existing  
14  
15 7 evidence on the topic of SES, where some studies did not adjust for potential and important confounders  
16  
17 8 (7,25). Our study indeed observed a higher chance of hospitalisation (OR 1.3 CI 1.1-1.7) for community-dwelling  
18  
19 9 patients with a low SES than for patients with intermediate/high SES. This finding is in line with other studies  
20  
21 10 (9,26,27). It may be possible that part of the community-dwelling frail patients were admitted for care  
22  
23 11 problems, which is not a reason for admission for institutionalized patients as extra care is available for these  
24  
25 12 patients. Future studies should elaborate the living arrangements and social network of older adults to  
26  
27 13 investigate the influence of these matters on ED usage.

28  
29 14 In-hospital mortality and ED-revisits within 30 days were not associated with SES. This contrasts with  
30  
31 15 other studies that found a higher risk of in-hospital mortality and readmissions in older adult patients with a  
32  
33 16 low SES (8,16,17), but is in line with other studies that did not found an association (11,12,18). The association  
34  
35 17 of low SES and adverse outcomes was found in studies that included patients with a specific diagnosis (e.g.  
36  
37 18 pneumonia or heart failure) (18,28) or that analysed the number of ED visits per SES category (4,6,9,29),  
38  
39 19 whereas our study focused on an undifferentiated, and therefore, more generalizable, older adult ED  
40  
41 20 population. Another reason not finding an association between low SES and outcomes might be that most  
42  
43 21 studies did not account for differences in living situation (17,30,31). We found that care and nursing homes  
44  
45 22 were mostly situated in low SES areas, while their inhabitants will probably belong to all three SES (32).  
46  
47 23 Additionally, institutionalized patients may influence revisit rates, because they are treated by their own doctor  
48  
49 24 in the nursing home. It may be useful to take the living situation into account when using SES based on zip  
50  
51 25 code, because care facilities structures at home influence ED outcomes.

52  
53 26 The fact that we did not find an association between SES and in-hospital mortality and revisits may be  
54  
55 27 due to the organisation of the health care system in the Netherlands and may underscore/reflect that our  
56  
57 28 health care is indeed accessible to all patients, regardless of their SES. In the Netherlands, the health care  
58  
59 29 system consists of a well organised GP-network, with 24-hours a day access for acute care patients, which is



1  
2  
3 1 equally accessible for every inhabitant (29). In the Netherlands, care provided by the general practitioner is  
4  
5 2 fully covered by the basic obligatory health insurance (33). Therefore this system provides equal access to  
6  
7 3 health care by the general practitioner to every resident, independent of their SES (5,34-36). In addition, this  
8  
9 4 care selects the most severely ill patients for referral to the ED. The acute health care system differs over the  
10  
11 5 countries, and in some countries, for instance the United States, the ED is used as a safety-net for underserved  
12  
13 6 and uninsured patients (37). Also, even important, the financial health care structure is different worldwide In  
14  
15 7 short, specifically regarding acute care, differences in organization and financial coverage of acute care make  
16  
17 8 comparisons between countries difficult (38).

18  
19 9 In the Netherlands, older adults are, in general, financially well-covered (39), as only 3.5% of them are  
20  
21 10 poor (39). Concerning other studies on older adults and SES, the methods of determining SES differed  
22  
23 11 substantially, and some included education, income and occupancy, but none of the methods have proved to  
24  
25 12 be comprehensive enough (40). One study in Canada among older adults that determined factors of ED usage  
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27 13 matched postal codes with several indicators, such as income, employment and living alone (10). In a  
28  
29 14 Mediterranean study, SES was defined on years of education and the mean annual income of the family (41). In  
30  
31 15 conclusion, the comparison of studies on SES is complicated by different levels of SES in the general population  
32  
33 16 and of the way SES is defined.

34  
35 17 Apart from the above mentioned, the following study limitations should be mentioned. Firstly, our  
36  
37 18 results are not generalizable to cardiology and gynaecology patients as we excluded these patients. For these  
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39 19 cardiology patients, it is known that low SES may have a stronger association with adverse outcomes (42), and  
40  
41 20 excluding these from our study may explain that we did not find associations between SES and outcome  
42  
43 21 (except for hospitalisation in community dwelling patients). Secondly, we retrieved SES on basis of zip codes,  
44  
45 22 which may be imprecise and yield smaller associations of SES with adverse outcomes (43). However, one zip  
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47 23 code in the database of Statistics Netherlands covers only 17 households and therefore, we consider this way  
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49 24 of retrieving SES rather reliable (44,45). Thirdly, retrieving SES of patients living in a nursing home or other care  
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51 25 home facilities on basis of zip code is probably not reliable. Therefore, we made subgroup analysis of  
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53 26 community dwelling patients and institutionalized patients, which is a strong point of our study. Lastly, coding  
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55 27 for the living situation may not be precise, but we think that this does not lead to an underestimation since the  
56  
57 28 percentage of institutionalized patients (9.1%) is almost similar as percentages given in another study (9.0%)  
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59 29 (46).

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3 1 In this study, we provided important information in terms of health outcomes on the SES in the acute  
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5 2 health care setting in the vulnerable older adult population. We investigated a large unselected group of older  
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7 3 adult ED patients stratified to living situation, which provides additional knowledge on the care and problems  
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9 4 of older adult patients in the ED. Our study shows that in a country with assumed equal health care access only  
10  
11 5 minor outcome differences were observed between different SES groups. Therefore, physicians should be  
12  
13 6 aware of the potential differences between SES groups given the higher chance of hospitalisation.  
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15 7 Improvement in adequately diagnosing and treating older adult patients is important, but the additional value  
16  
17 8 of SES in the emergency care should be evaluated further to develop effective interventions to ensure high  
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19 9 quality of care. Future studies should elaborate the living arrangements and social network of older adults,  
20  
21 10 because these probably influences access to the ED and the number of (re-)admissions.

22 11 In conclusion, low SES community-dwelling older adults were more often hospitalised than high SES  
23  
24 12 community-dwelling patients, but no differences in in-hospital mortality and ED-revisits between the SES  
25  
26 13 groups.

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3 1 **Contributorship statement**

4 2 JW and SB conceived the study and designed the protocol. SL contributed to the design for the overall older  
5  
6 3 adults project. JW, PS and ID analyzed and interpreted the data. HH supervised the conduct of the study and  
7  
8 4 data collection. JW, PS and ID drafted the manuscript. MA helped with the statistical analyses. JW designed the  
9  
10 5 database. JW, ID, PS, SB, MA, SL and HH contributed substantially to its revision and approved the final  
11  
12 6 manuscript.  
13

14 7  
15  
16 8 **Data sharing statement**

17  
18 9 Data of the study is available from the data governance board of Maxima Medical Centre Institutional Data  
19  
20 10 Access / Ethics Committee for researchers who meet the criteria for access to confidential data. Data are from  
21  
22 11 the non-specific complaints study when contacting the data governance board (Jolanda.Luime@mmc.nl).  
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2 **References**

- 3 (1) Hoogendijk EO, van Hout HP, Heymans MW, van der Horst HE, Frijters DH, Broese van Groenou MI, et al.  
4 Explaining the association between educational level and frailty in older adults: results from a 13-year  
5 longitudinal study in the Netherlands. *Ann Epidemiol* 2014 Jul;24(7):538-44.e2.
- 6 (2) Lowthian JA, Curtis AJ, Cameron PA, Stoelwinder JU, Cooke MW, McNeil JJ. Systematic review of trends in  
7 emergency department attendances: an Australian perspective. *Emerg Med J* 2011 May;28(5):373-377.
- 8 (3) Mackenbach JP, Stirbu I, Roskam AJ, Schaap MM, Menvielle G, Leinsalu M, et al. Socioeconomic inequalities  
9 in health in 22 European countries. *N Engl J Med* 2008 Jun 5;358(23):2468-2481.
- 10 (4) Droomers M, Westert GP. Do lower socioeconomic groups use more health services, because they suffer  
11 from more illnesses? *Eur J Public Health* 2004 Sep;14(3):311-313.
- 12 (5) van Doorslaer E, Wagstaff A, van der Burg H, Christiansen T, De Graeve D, Duchesne I, et al. Equity in the  
13 delivery of health care in Europe and the US. *J Health Econ* 2000 Sep;19(5):553-583.
- 14 (6) Khan Y, Glazier RH, Moineddin R, Schull MJ. A population-based study of the association between  
15 socioeconomic status and emergency department utilization in Ontario, Canada. *Acad Emerg Med* 2011  
16 Aug;18(8):836-843.
- 17 (7) Tozer AP, Belanger P, Moore K, Caudle J. Socioeconomic status of emergency department users in Ontario,  
18 2003 to 2009. *CJEM* 2014 May;16(3):220-225.
- 19 (8) Begley C, Basu R, Lairson D, Reynolds T, Dubinsky S, Newmark M, et al. Socioeconomic status, health care  
20 use, and outcomes: persistence of disparities over time. *Epilepsia* 2011 May;52(5):957-964.
- 21 (9) Filc D, Davidovich N, Novack L, Balicer RD. Is socioeconomic status associated with utilization of health care  
22 services in a single-payer universal health care system? *Int J Equity Health* 2014 Nov 28;13:115-014-0115-1.
- 23 (10) Ionescu-Ittu R, McCusker J, Ciampi A, Vadeboncoeur AM, Roberge D, Larouche D, et al. Continuity of  
24 primary care and emergency department utilization among elderly people. *CMAJ* 2007 Nov 20;177(11):1362-  
25 1368.
- 26 (11) Ho KM, Dobb GJ, Knuiman M, Finn J, Webb SA. The effect of socioeconomic status on outcomes for  
27 seriously ill patients: a linked data cohort study. *Med J Aust* 2008 Jul 7;189(1):26-30.
- 28 (12) Alter DA, Chong A, Austin PC, Mustard C, Iron K, Williams JI, et al. Socioeconomic status and mortality after  
29 acute myocardial infarction. *Ann Intern Med* 2006 Jan 17;144(2):82-93.
- 30 (13) Samaras N, Chevalley T, Samaras D, Gold G. Older patients in the emergency department: a review. *Ann  
31 Emerg Med* 2010 Sep;56(3):261-269.
- 32 (14) Ramos M. Impact of socioeconomic status on Brazilian elderly health. *Rev Saude Publica* 2007  
33 Aug;41(4):616-624.
- 34 (15) Cournane S, Conway R, Byrne D, O'Riordan D, Coveney S, Silke B. Social deprivation and the rate of  
35 emergency medical admission for older persons. *QJM* 2016 Oct;109(10):645-651.
- 36 (16) Hutchings A, Raine R, Brady A, Wildman M, Rowan K. Socioeconomic status and outcome from intensive  
37 care in England and Wales. *Med Care* 2004 Oct;42(10):943-951.

- 1  
2  
3 1 (17) Rathore SS, Masoudi FA, Wang Y, Curtis JP, Foody JM, Havranek EP, et al. Socioeconomic status, treatment,  
4 2 and outcomes among elderly patients hospitalized with heart failure: findings from the National Heart Failure  
5 3 Project. *Am Heart J* 2006 Aug;152(2):371-378.
- 6  
7 4 (18) Izquierdo C, Oviedo M, Ruiz L, Sintes X, Vera I, Nebot M, et al. Influence of socioeconomic status on  
8 5 community-acquired pneumonia outcomes in elderly patients requiring hospitalization: a multicenter  
9 6 observational study. *BMC Public Health* 2010 Jul 15;10:421-2458-10-421.
- 10  
11 7 (19) Brouns SHA, Dortmans MKJ, Jonkers FS, Lambooj SLE, Kuijper A, Haak HR. Hyponatraemia in Elderly  
12 8 Emergency Department Patients: A Marker of Frailty. *Neth J Med* 2014;72(6):311-317.
- 13  
14 9 (20) Centraal bureau voor de statistiek. Inhoud kerncijfers postcodegebieden 2008-2010. 2012.
- 15  
16 10 (21) Kunst A.E. Bos V. Mackenback J.P. Monitoring socioeconomic inequalities in health in the european union:  
17 11 guidelines and illustrations. EU Working Group on Socio-economic Inequalities in Health 2011.
- 18  
19 12 (22) Needham DM, Scales DC, Laupacis A, Pronovost PJ. A systematic review of the Charlson comorbidity index  
20 13 using Canadian administrative databases: a perspective on risk adjustment in critical care research. *J Crit Care*  
21 14 2005 Mar;20(1):12-19.
- 22  
23 15 (23) Zachariasse JM, Seiger N, Rood PP, Alves CF, Freitas P, Smit FJ, et al. Validity of the Manchester Triage  
24 16 System in emergency care: A prospective observational study. *PLoS One* 2017 Feb 2;12(2):e0170811.
- 25  
26 17 (24) Quan H, Sundararajan V, Halfon P, Fong A, Burnand B, Luthi JC, et al. Coding algorithms for defining  
27 18 comorbidities in ICD-9-CM and ICD-10 administrative data. *Med Care* 2005 Nov;43(11):1130-1139.
- 28  
29 19 (25) Bagher A, Andersson L, Wingren CJ, Ottosson A, Wangejord S, Acosta S. Socio-economic status and major  
30 20 trauma in a Scandinavian urban city: A population-based case-control study. 2016;44:217-223.
- 31  
32 21 (26) Robert S. Stern M, Joel S. Weissman P, Arnold M. Epstein, MD, MA. The emergency department as a  
33 22 pathway to admission for poor and high cost patients. *JAMA* 1991;266(16):2238-2243.
- 34  
35 23 (27) Raffaele Antonelli-Incalzi, Carla Ancona, Francesco Forastiere, Valeria Belleudi, Andrea Corsonello, Carlo A  
36 24 Perucci. Socioeconomic status and hospitalization in the very old: a retrospective study. *BMC Public Health*  
37 25 2007;7(227).
- 38  
39 26 (28) Bhayana R, Vermeulen MJ, Li Q, Hellings CR, Berdahl C, Schull MJ. Socioeconomic status and the use of  
40 27 computed tomography in the emergency department. *CJEM* 2014 Jul;16(4):288-295.
- 41  
42 28 (29) van der Meer JB, van den Bos J, Mackenbach JP. Socioeconomic differences in the utilization of health  
43 29 services in a Dutch population: the contribution of health status. *Health Policy* 1996 Jul;37(1):1-18.
- 44  
45 30 (30) Cressman AM, Macdonald EM, Yao Z, Austin PC, Gomes T, Paterson JM, et al. Socioeconomic status and  
46 31 risk of hemorrhage during warfarin therapy for atrial fibrillation: A population-based study. *Am Heart J* 2015  
47 32 Jul;170(1):133-40, 140.e1-3.
- 48  
49 33 (31) Govindarajan P, Gonzales R, Maselli JH, Johnston SC, Fahimi J, Poisson S, et al. Regional differences in  
50 34 emergency medical services use for patients with acute stroke (findings from the National Hospital Ambulatory  
51 35 Medical Care Survey Emergency Department Data File). *J Stroke Cerebrovasc Dis* 2013 Nov;22(8):e257-63.
- 52  
53 36 (32) Arendts G, Howard K. The interface between residential aged care and the emergency department: a  
54 37 systematic review. *Age Ageing* 2010 May;39(3):306-312.

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2  
3 1 (33) van der Linden MC, Lindeboom R, de Haan R, van der Linden N, de Deckere ER, Lucas C, et al. Unscheduled  
4 2 return visits to a Dutch inner-city emergency department. *Int J Emerg Med* 2014 Jul 5;7:23-014-0023-6.  
5 3 eCollection 2014.
- 6  
7 4 (34) Pines JM, Hilton JA, Weber EJ, Alkemade AJ, Al Shabanah H, Anderson PD, et al. International perspectives  
8 5 on emergency department crowding. *Acad Emerg Med* 2011;18(12):1358-1370.
- 9  
10 6 (35) van der Linden MC, Lindeboom R, van der Linden N, van den Brand CL, Lam RC, Lucas C, et al. Self-referring  
11 7 patients at the emergency department: appropriateness of ED use and motives for self-referral. *Int J Emerg*  
12 8 *Med* 2014 Jul 16;7:28-014-0028-1. eCollection 2014.
- 13  
14 9 (36) Holmes JL. Emergency medicine in the Netherlands. *Emergency Medicine Australasia* 2010;22(1):75-81.
- 15  
16 10 (37) Di Somma S, Paladino L, Vaughan L, Lalle I, Magrini L, Magnanti M. Overcrowding in emergency  
17 11 department: an international issue. *Intern Emerg Med* 2015 Mar;10(2):171-175.
- 18  
19 12 (38) Grundy E, Holt G. The socioeconomic status of older adults: how should we measure it in studies of health  
20 13 inequalities? *J Epidemiol Community Health* 2001 Dec;55(12):895-904.
- 21  
22 14 (39) Smits CH, van den Beld HK, Aartsen MJ, Schroot JJ. Aging in the Netherlands: state of the art and science.  
23 15 *Gerontologist* 2014 Jun;54(3):335-343.
- 24  
25 16 (40) Martelin T. Mortality by indicators of socioeconomic status among the Finnish elderly. *Soc Sci Med* 1994  
26 17 May;38(9):1257-1278.
- 27  
28 18 (41) Katsarou A, Tyrovolas S, Psaltopoulou T, Zeimbekis A, Tsakountakis N, Bountziouka V, et al. Socio-economic  
29 19 status, place of residence and dietary habits among the elderly: the Mediterranean islands study. *Public Health*  
30 20 *Nutr* 2010 Oct;13(10):1614-1621.
- 31  
32 21 (42) Carlsson AC, Li X, Holzmann MJ, Wandell P, Gasevic D, Sundquist J, et al. Neighbourhood socioeconomic  
33 22 status and coronary heart disease in individuals between 40 and 50 years. *Heart* 2016 May 15;102(10):775-782.
- 34  
35 23 (43) Aarts MJ, van der Aa MA, Coebergh JW, Louwman WJ. Reduction of socioeconomic inequality in cancer  
36 24 incidence in the South of the Netherlands during 1996-2008. *Eur J Cancer* 2010 Sep;46(14):2633-2646.
- 37  
38 25 (44) Bos, V. Kunst, A.E., Mackenbach, J. in verslag aan de Programmacommissie Sociaal-economische  
39 26 gezondheidsverschillen II [In Dutch]. Instituut Maatschappelijke Gezondheidszorg, Erasmus Universiteit,  
40 27 Rotterdam 2000.
- 41  
42 28 (45) Smits, J. Keij, I. Mackenbach, J.P. in Sociaal-economische gezondheidsverschillen: Van verklaren naar  
43 29 verkleinen [In Dutch]. Zon/MW, Den Haag 2001.
- 44  
45 30 (46) Ribbe MW, Ljunggren G, Steel K, Topinkova E, Hawes C, Ikegami N, et al. Nursing homes in 10 nations: a  
46 31 comparison between countries and settings. *Age Ageing* 1997 Sep;26 Suppl 2:3-12.

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1 **Figures**

2 **Figure 1. The Flow chart of older adult patients divided into three SES groups.**

3 ED = Emergency department. SES = Socioeconomic Status

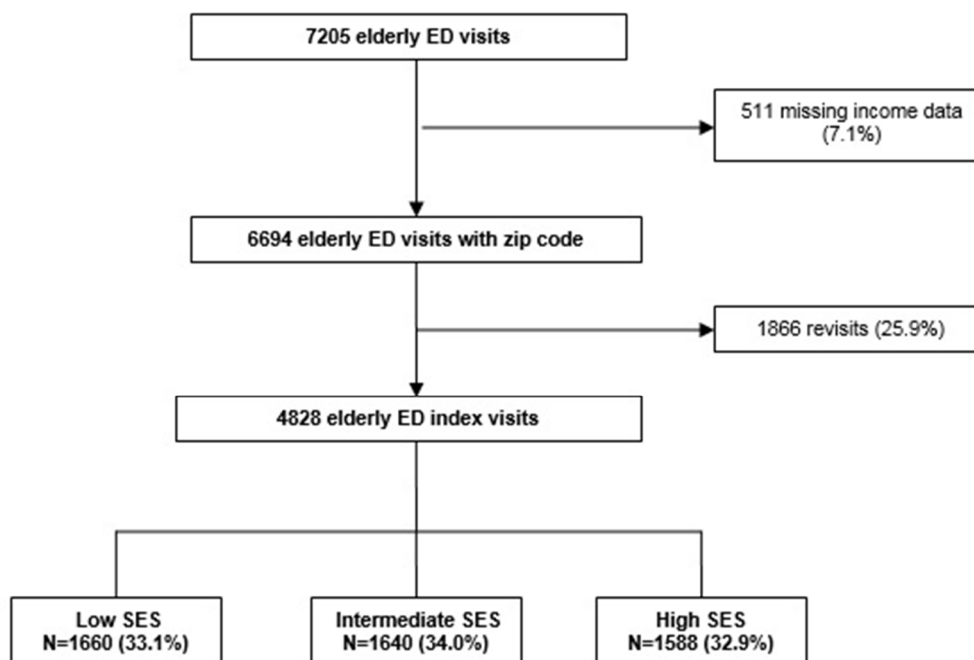
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**STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cohort studies***

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
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
<b>Methods</b>			
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) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	5
		(b) For matched studies, give matching criteria and number of exposed and unexposed	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	1
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	5-6
Bias	9	Describe any efforts to address potential sources of bias	6
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	6
		(b) Describe any methods used to examine subgroups and interactions	5-6
		(c) Explain how missing data were addressed	6
		(d) If applicable, explain how loss to follow-up was addressed	
		(e) Describe any sensitivity analyses	6
<b>Results</b>			

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 (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram	7
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest (c) Summarise follow-up time (eg, average and total amount)	7-8 7-12
Outcome data	15*	Report numbers of outcome events or summary measures over time	11-12
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 (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	11-12
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	11-12
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	
<b>Limitations</b>			
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 13-15
Generalisability	21	Discuss the generalisability (external validity) of the study results	14
<b>Other information</b>			
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	

\*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](http://www.strobe-statement.org).

# BMJ Open

## Older adult community-dwelling patients with low socioeconomic status are hospitalised more often after visiting the emergency department

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-019318.R2
Article Type:	Research
Date Submitted by the Author:	13-Nov-2017
Complete List of Authors:	Wachelder, Joyce; Maxima Medisch Centrum, Internal Medicine van Drunen, Isabelle ; Maxima Medisch Centrum, Internal Medicine Stassen, Patricia; Maastricht University CAPHRI School for Public Health and Primary Care; Maastricht Universitair Medisch Centrum+ Interne Geneeskunde, Internal Medicine Brouns , Steffie ; Maxima Medisch Centrum, Internal Medicine Lambooij, Suze ; Maxima Medisch Centrum, Internal Medicine Aarts, Mieke ; Netherlands Comprehensive Cancer Organisation Haak , Harm; Maxima Medisch Centrum, Eindhoven ; Maastricht University CAPHRI School for Public Health and Primary Care
<b>Primary Subject Heading</b>:	Emergency medicine
Secondary Subject Heading:	Geriatric medicine
Keywords:	Socioeconomic Status, Elderly, Emergency Department

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12 4 J.J.H. Wachelder<sup>12</sup>, I.S. van Drunen<sup>1#</sup>, P.M.Stassen<sup>24#</sup>, S.H.A Brouns<sup>12</sup>, S.L.E. Lambooi<sup>1</sup>, M.J. Aarts<sup>3</sup>, H.R. Haak<sup>124</sup>  
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39

40 18 Disclosure: There are no conflicts of interest. No funding was received.  
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44 20 Word count: 4072 (including tables)  
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46 21 Word count abstract: 250  
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48 22 Number of Tables: 3. Number of Figures: 1.  
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50 23 References: 46  
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54 25 **Keywords:** Socioeconomic Status; Older adult; Emergency Department  
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3 1 **Abstract**

4 2 **Objectives:** Older adults frequently visit the Emergency Department (ED). Socioeconomic State (SES) has an  
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6 3 important impact on health and ED utilization, however, the association between SES and ED utilization in  
7  
8 4 elderly remains unclear. The aim of this study was to investigate the association between SES in older adult  
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10 5 patients visiting the ED on outcomes.

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12 6 **Design:** A retrospective study.

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14 7 **Participants:** Older adults ( $\geq 65$  years) visiting the ED, in the Netherlands. SES was stratified into tertiles based  
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16 8 on average household income at zip code level; low ( $< \text{€}1800/\text{month}$ ), intermediate ( $\text{€}1800\text{--}\text{€}2300/\text{month}$ ) and  
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18 9 high ( $> \text{€}2300/\text{month}$ ).

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20 10 **Primary outcomes:** hospitalisation, in-hospital mortality and 30-day ED-return visits. Effect of SES on outcomes  
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22 11 for all groups were assessed by logistic regression and adjusted for confounders.

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24 12 **Results:** In total, 4828 older adults visited the ED during the study period. Low SES was associated with a higher  
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26 13 risk of hospitalisation among community-dwelling patients compared with high SES (adjusted OR 1.3 95%CI 1.1-  
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28 14 1.7). This association was not present for intermediate SES (adjusted OR 1.1 95%CI 0.95-1.4). In-hospital  
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30 15 mortality was comparable between the low and high SES-group, even after adjustment for age, comorbidity  
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32 16 and triage level (low OR 1.4 95%CI 0.8-2.6, intermediate OR 1.3 95%CI 0.8-2.2). Thirty-day ED-revisits among  
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34 17 community-dwelling patients were also equal between the SES groups (low: adjusted OR 1.0 95%CI 0.7-1.4 and  
35  
36 18 intermediate: adjusted OR 0.8 95%CI 0.6-1.1).

37  
38 19 **Conclusion:** In older adult ED patients, low SES was associated with a higher risk of hospitalisation than high  
39  
40 20 SES. However, SES had no impact on in-hospital mortality and 30-day ED-revisits after adjustment for  
41  
42 21 confounders.

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3 1 **Strengths and limitations of this study**  
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- 5 2 - This is one of the only studies to provide detailed insight into the impact of different socioeconomic  
6 3 status groups of older adults in the emergency care.  
7 4 - Additionally, this study the living situation was used to differentiate between community-dwelling  
8 5 patients and institutionalized patients to observe differences in outcomes.  
9 6 - This study used a retrospective cohort study and linked patient zip code with income data based on a  
10 7 well-defined database by Statistics Netherlands.  
11 8 - A strength of our study is that we investigated a large undifferentiated group of older adult emergency  
12 9 care patients.  
13 10 - Limitations were that we were not able to extract the data of cardiology and gynaecology patients and  
14 11 that we used zip code to define the socioeconomic status.  
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## 1 Introduction

2 The burden on the Emergency Department (ED) capacity has been increasing over the past decades, which is  
3 mostly due to a substantially increasing number of older adults ( $\geq 65$  years old) (1). Given the extent and  
4 complexity of the problems in these patients, it is essential to identify determinants that lead to the ED visits in  
5 order to maintain high quality of care of older adult ED patients (2).

6 Low socioeconomic status (SES) has already been identified as an important determinant of health  
7 status and is strongly associated with poor adverse health outcomes (3). Patients with a low SES visit the  
8 general practitioner more and the specialist less often than patients with a high SES (4,5). Moreover, patients  
9 with a low a SES use the ED more frequently and are admitted to the hospital more often than those with a  
10 high SES (4,6-10). However, most studies focused on the influence of SES on the quantity of ED utilization,  
11 rather than on the reasons for and outcomes of these ED visits in general (8,10-12) .

12 It is well-known that older adults are vulnerable and prone to adverse health outcomes, such as ED  
13 visits, ED return visits, hospitalisation and mortality (13). However, research on the effect of SES on ED visits  
14 and adverse health outcomes in these older adults is scarce (10,14,15). Some of these studies demonstrated  
15 conflicting results as where low SES patients showed higher risk of adverse health outcomes (8,16,17), while  
16 other studies did not find such an increased risk (11,12,18). Moreover, most studies focused on patients with a  
17 specific diagnosis (e.g. heart failure, pneumonia or injury) and other studies merely studied ED utilization  
18 (10,14,18).

19 To understand the ED utilization patterns of older adults, it can be important to take their SES into  
20 account. Understanding the characteristics of older adult ED patients, including their SES, may be the first step  
21 to maintain or improve high quality of acute care. We hypothesize that low SES influences the risk of adverse  
22 health outcomes in the ED setting in a negative way and adds to the vulnerability of older adult ED patients  
23 even in a country in which health care access is organized for every inhabitant, regardless of SES.

24 The aim of this study was to determine differences between different SES groups among older adults s  
25 and additionally and most importantly we investigated the association of SES with hospitalisation, in-hospital  
26 mortality and ED-revisits.

## 28 Method

29 *Study design, setting and population*



1  
2  
3 1 A retrospective cohort study was performed in the Maxima Medical Centre, a 550-bed teaching hospital in the  
4  
5 2 Netherlands. Yearly, approximately 30,000 patients visit the ED (19), of whom 30% are older adults ( $\geq 65$  years).  
6  
7 3 In the Netherlands, patients are usually referred to the ED by a general practitioner. The general practitioners  
8  
9 4 provide acute care all days of the week and every hour of the day, including out of office hours.

10  
11 5 Older adults who visited the ED for all medical (including oncology) and surgical specialities in one year  
12  
13 6 (between 1<sup>st</sup> of September 2011 and 31<sup>st</sup> of August 2012), were included. Data from the acute cardiac care unit  
14  
15 7 and gynaecology unit were not available in the database, because these patients do not visit the ED .

16  
17 8 Data of the ED visits were automatically extracted from the electronic patient records (Chipsoft-EZIS,  
18  
19 9 version 5.2). Categorization of the data was done according a fixed data extraction form by one researcher  
20  
21 10 (JW). A random sample of all variables was checked by another researcher (ID). The patients' zip code (on  
22  
23 11 average 17 households per zip code) was used to determine the SES at a neighbourhood level by combining the  
24  
25 12 median household income per month and mean value of the houses. Data on income were provided by  
26  
27 13 Statistics Netherlands (20). This dataset excluded zip codes with less than 10 households to guarantee  
28  
29 14 anonymity. The median income data derived from zip codes in the database from Statistics Netherlands were  
30  
31 15 linked to our database and subsequently divided into tertiles (21): low ( $< \text{€}1800/\text{month}$ ), intermediate ( $\text{€}1800-$   
32  
33 16  $\text{€}2300/\text{month}$ ) and high ( $> \text{€}2300/\text{month}$ ). It was impossible to retrieve SES data for patients with unknown zip  
34  
35 17 code or patients living abroad (Belgium), and therefore, these patients were excluded (N=511, 6.9%).

36  
37 18 To investigate the effect of the living situation in the three SES groups, we conducted a subgroup  
38  
39 19 analysis for the outcomes of community-dwelling patients and for patients who were institutionalized. Living  
40  
41 20 situation was determined on basis of zip codes, including those of the nursing and care home patients. The first  
42  
43 21 ED visit in the study period was considered the index visit, other visits after the index visit were excluded to  
44  
45 22 avoid duplicate analysis of the patients' characteristics and outcomes. The Institutional Review Board of  
46  
47 23 Máxima Medical Centre approved this study and confirmed that the Medical Research Involving Human Subject  
48  
49 24 Act (WMO) was not applicable.

50  
51 25

## 52 26 **Data collection & definitions**

53  
54 27 The following data were retrieved from the electronic patient record: age, gender, zip code, comorbidity,  
55  
56 28 number of used medications. The Charlson comorbidity index (CCI) was used to quantify comorbidity (22). All  
57  
58 29 electronic patient (both ED and hospital) records were assessed to retrieve comorbidity. For a random sample

1 of 50% of the patients per SES group, comorbidity was manually retrieved. It was not feasible to do this for all  
2 patients. The patients' living situation was categorized into community-dwelling patients (living independently  
3 or with home care) and institutionalized patients (care home and nursing home).

4 To assess the severity of illness at presentation, the Manchester Triage Level (MTS) (23), vital parameters  
5 (systolic blood pressure, heart rate), laboratory tests (CRP and leukocytes) and the ED diagnoses were  
6 retrieved. The triage level based on the five-level MTS was categorised into 3 groups: urgent (red and orange),  
7 moderate (yellow), and low (green). In our ED the triage colour blue is not used,  
8 because these patients almost never visit our ED. Classification of ED diagnoses was done according the  
9 International Classification of Disease-10 (ICD-10)" (24). The group 'other', consisted out of diseases of the  
10 nervous system, musculoskeletal and connective tissue, skin and subcutaneous tissue, eye and adnexa, ear and  
11 mastoid and mental.

12 Organizational factors retrieved were time of arrival, mode of referral (self-referral, GP, ambulance, specialist  
13 and other), specialty, number of diagnostic tests (sum of radiological tests, electrocardiogram, arterial blood  
14 gas analysis, laboratory tests, urine analysis, urine and blood culture), number of specialist consultations in the  
15 ED, ED-Length-of-Stay (LOS) and hospital-LOS. Time of presentation was classified into 3 shifts: day (8am-6pm),  
16 evening (6pm-12pm) and night (12pm-8am). The following specialties were considered surgical: (general)  
17 surgery, plastic surgery, urology, and orthopaedics. Pulmonology, neurology, internal medicine and  
18 gastroenterology were considered medical specialities. Hospital LOS was defined as the number of days  
19 between hospital admission and hospital discharge. Dates of death during hospital stay and of the ED-return  
20 visit were retrieved. The data were extracted by one trained medical abstractor who was blinded for the study  
21 hypothesis.

### 22 **Statistical analyses**

24 All statistical analyses were performed using SPSS 22.0 (Armonk, New York, 2015). Comparisons between two  
25 SES groups (low vs. intermediate, low vs. high and intermediate vs. high) were conducted using ANOVA (post-  
26 hoc Tukey test) for continuous data and the Chi square test for categorical data. For continuous variables that  
27 were not normally distributed, the Wilcoxon-Mann-Whitney-Test was used. Missing data were categorised as  
28 "unknown" and included in the analyses of categorical parameters, to explore the influence of missing values.  
29 To investigate the independent effect of SES on hospitalisation, in-hospital mortality, and 30-day ED-return

1 visits, logistic regression analyses was performed. Multivariable analysis was performed to calculate the  
2 adjusted Odds Ratio (OR) and in order to estimate the effect of confounders of age, gender, triage level and  
3 CCI. Age, CCI and medications were included as a linear variable in this analysis. For day of the week, a weekday  
4 was reference, and for sex, female was reference. Triage level was categorized as follows: urgent, intermediate  
5 and low (reference). Sensitivity analysis was performed to evaluate the effect of ED-revisits on mortality. For  
6 this analysis, those who died during hospitalisation were excluded (N=199). To estimate the effect of the living  
7 situation on the SES and their outcomes, patients were divided into community-dwelling patients and  
8 institutionalized patients. OR and corresponding 95% Confidence Intervals (CI) were calculated for each of the  
9 outcomes. A p-value was considered significant when <0.05.

## 11 Results

12 During the study period, 7205 ED visits by older adult patients were registered in our ED. In total, 511 patients  
13 (7.1%) were excluded because income data were missing and 1866 visits (25.9%) because the visit was a revisit.  
14 In total, 4828 index visits were included. Of these 1660 visits (33.1%) were classified as having a low SES, 1640  
15 (34.0%) as intermediate and 1588 (32.9%) as having a high SES (Figure 1).

### 18 Patient characteristics

19 The mean age of the study population was 77±7.7 years, and slightly less patients were male (44.5%) (Table 1).  
20 In total, 4381 (90.7%) were community-dwelling patients and 9.2% lived institutionalized. Patients were mostly  
21 referred by a GP (58.5%) and were triaged as having moderate urgency (43.8%). More than half (56.5%) of the  
22 patients were hospitalised, and their median hospital-LOS was 5 days. In-hospital mortality was 4.1%.

1 Table 1. Patient characteristics and SES of older adult patients visiting the ED  
2

Characteristics	Total population N = 4828	Socioeconomic Status			P-value
		Low N = 1660 (33.1%)	Intermediate N = 1640 (34.0%)	High N = 1588 (32.9%)	
<b>Age, years</b>					
Mean (SD)	77 (7.7)	80 (7.6)	76 (7.6)	75 (7.4)	<0.001#
Median (IQR)*	77 (12)	80 (11)	76 (12)	74 (12)	
<b>Gender (%)*</b>					<0.001
Male	2149 (44.5%)	618 (38.6%)	759 (46.3%)	772 (48.6%)	
Female	2679 (55.5%)	982 (61.4%)	881 (53.7%)	816 (51.4%)	
<b>CCI, median (IQR)</b>	1.2 (1.6)	1.0 (0-8)	1.0 (0-10)	1.0 (0-11)	0.09
Unknown		45 (5.3%)	49 (5.3%)	54 (6.2%)	
<b>No. of medications, mean (SD)*</b>	2.5 (4.3)	3.3 (4.7)	2.4 (4.2)	1.9 (3.9)	<0.001@
<b>Mode of referral*</b>					
General Practitioner	2680 (55.5%)	937 (61.8%)	905 (57.8%)	838 (56.0%)	0.03
Self-referral	852 (17.6%)	215 (13.4%)	292 (17.8%)	345 (21.7%)	<0.001
Ambulance	664 (13.8%)	244 (15.3%)	237 (14.5%)	183 (11.5%)	0.01
Specialist	632 (13.1%)	204 (9.6%)	206 (9.9%)	222 (10.8%)	0.75
<b>Living situation*</b>					<0.001
Community-dwelling	4381 (90.7%)	1266 (79.1%)	1556 (94.9%)	1559 (98.2%)	
Institutionalized	443 (9.2%)	330 (20.6%)	84 (5.1%)	29 (1.8%)	
Missing	4 (100%)	4 (100%)	0	0	

3 SES = Socioeconomic status. SD = Standard deviation. CCI = Charlson comorbidity index. ED = Emergency  
4 Department. P-values P-values low, intermediate and high SES: using the Chi-square test, ANOVA (post-hoc  
5 Tukey) and Mann-Whitney-U-test.

6 # = p-value low vs. intermediate <0.001, low vs. high <0.001, intermediate vs. high 0.001.

7 @ = p-value low vs. intermediate 0.001, low vs. high <0.001, intermediate vs. high 0.042.

1 \* = p<0.05.

2 Patient characteristics and Socioeconomic status

3 Patients with a low or intermediate SES were older than patients with a high SES (80 vs. 76 and 75 years resp.,  
4 p<0.001) (Table 1). Male patients less frequently had a low SES than intermediate and high SES patients (38.6%  
5 vs. 46.3% and 48.6% resp., p<0.001). The GP had referred patients in the low SES-group more often than in the  
6 intermediate and high SES-group (61.8% vs. 57.8% and 56.0% resp., p=0.03). Patients in the low SES-group used  
7 more medications than the high SES-group (3.3 vs. 1.9, p<0.001).

9 Organizational and clinical parameters in the ED and SES

10 There were no differences in the specialties (surgical vs. medical) that treated the patients nor in time of  
11 presentation between the three SES groups (Table 2). In addition, the vital parameters at presentation were  
12 comparable between the three groups. Patients with a low SES more often had a higher urgent triage level  
13 than the high SES-group, however, this difference was not significant (15.4% vs. 12.1%, p=0.02). In the low and  
14 the intermediate SES-group, more diagnostics tests were performed than in the high SES-group (mean 2.3 vs.  
15 2.1 vs. 2.0, resp., p<0.001). Patients with low SES had a longer ED-LOS than patients with intermediate and high  
16 SES (140 min vs. 133 vs. 133, resp. p=0.01). Diagnoses differed between the three groups: endocrine diseases  
17 were more common in the low SES group (3.1%) than the intermediate or high SES group (1.7% and 1.6%,  
18 p=0.03), and the same was observed for infectious diseases. (Table 2).

21 **Table 2. Organisational and clinical parameters of older adult ED patients within the different SES groups.**

	Socioeconomic Status			P-value
	Low N = 1660 (33.1%)	Intermediate N = 1640 (34.0%)	High N = 1588 (32.9%)	
<b>Specialism</b>				0.16
Medical	879 (54.9%)	858 (52.3%)	822 (51.8%)	
Surgical	721 (45.1%)	782 (47.7%)	766 (48.2%)	
<b>Shift</b>				0.15

Morning	1130 (70.9%)	1148 (70.2%)	1169 (73.7%)	
Evening	240 (21.3%)	354 (21.7%)	318 (20.0%)	
Night	124 (7.8%)	133 (8.1%)	100 (6.3%)	
<b>Level of triage</b>				
Low*	628 (39.8%)	640 (39.7%)	687 (44.0%)	0.02
Moderate	702 (44.5%)	730 (35.3%)	683 (43.7%)	0.69
Urgent	246 (15.4%)	242 (14.8%)	192 (12.1%)	0.02
No triage	24 (1.5%)	28 (1.7%)	26 (1.6%)	0.98
<b>No. of extra consultations at ED</b>				0.80
None	1376 (86.0%)	1407 (85.6%)	1365 (86.0%)	
1	200 (12.5%)	215 (13.1%)	199 (12.5%)	
≥2	24 (0.5%)	18 (1.1%)	24 (1.4%)	
<b>Vital parameters</b>				
Systolic blood pressure (mmHg), mean (SD)	152 (31.7)	153 (31.3)	152 (30.8)	0.94
Missing	428 (26.9%)	530 (32.4%)	545 (35.5%)	
Heart rate (min), mean (SD)	81.5 (17.0)	82.5 (18.1)	82.1 (17.7)	0.32
Missing	734 (45.9%)	806 (49.1%)	819 (51.6%)	
<b>Medical procedures at ED</b>				
No. of diagnostic tests, mean (SD)	2.3 (1.8)	2.1 (1.8)	2.0 (1.7)	<0.001#
Laboratory test (%)*	1081 (67.9%)	1046 (64.1%)	974 (61.7%)	<0.001
CRP (mg/L), median (IQR)	16 (60)	14 (55)	15 (66)	0.47
Leukocytes (x10 <sup>9</sup> /L), median (IQR)	9.2 (6)	9.3 (5)	8.8 (5)	0.91
<b>Diagnosis at ED</b>				
Injury	487 (30.6%)	504 (30.8%)	508 (32.2%)	0.56
Otherwise	280 (17.6%)	286 (17.5%)	289 (18.3%)	0.79
Circulatory / Respiratory	232 (14.6%)	257 (15.7%)	201 (12.7%)	0.06
Other	202 (12.7%)	217 (13.3%)	218 (18.3%)	0.64
Digestive	163 (10.2%)	175 (10.8%)	169 (10.7%)	0.88

Genito-urinary	68 (4.3%)	73 (4.5%)	58 (3.7%)	0.51
Infectious	65 (4.1%)	52 (3.2%)	45 (2.8%)	0.14
Endocrine / Metabolic	50 (3.1%)	28 (1.7%)	25 (1.6%)	0.03
Neoplasm / haematology	47 (2.9%)	52 (3.2%)	70 (4.4%)	0.05
<i>Missing</i>	6 (0.4%)	3 (0.2%)	9 (0.6%)	
<b>ED-LOS in minutes, median (IQR)*</b>	140 (83)	133 (90)	133 (87)	0.01@

1 SES = Socioeconomic Status. SD = Standard deviation. ED = Emergency department. CRP = C-reactive protein.  
 2 ED-Diagnosis 'other' (ICD-10 classification) = diseases of the nervous system, musculoskeletal and connective  
 3 tissue, skin and subcutaneous tissue, eye and adnexa, ear and mastoid and mental.

4 P-values low, intermediate and high SES: using the Chi-square test, ANOVA (post-hoc Tukey) and Mann-  
 5 Whitney-U-test.

6 \* =  $p < 0.05$ .

7 # = p-value low vs intermediate  $< 0.001$ , low vs high  $< 0.001$ , intermediate vs. high  $< 0.01$ .

8 @ = p-value low vs intermediate 0.01, low vs high 0.004, intermediate vs. high 0.93.

#### 11 Patient outcomes and SES

12 Patients with a low SES were more frequently hospitalised than the intermediate and high SES-group (62.3% vs.  
 13 55.4% vs. 52.3%, resp.,  $p < 0.001$ , Table 3). In addition, patients with a low SES had a longer hospital-LOS than  
 14 patients with a high SES (6.0 vs. 5.0 days,  $p < 0.001$ ). However, the hospital-LOS did not differ between  
 15 intermediate SES and high SES patients (5 days in both groups,  $p = 0.45$ ). The finding that low SES patients were  
 16 more often hospitalised than the high SES group turned out not to be independent of age and comorbidity  
 17 (adjusted OR 1.3 95% CI 0.9–1.4, Table 3). When stratified according to living situation, low SES community-  
 18 dwelling patients had a higher risk of hospitalisation with an OR of 1.3 (95% CI 1.1–1.7) compared with patients  
 19 with a high SES. In contrast, institutionalized low SES patients had a lower risk of hospitalisation with an OR of  
 20 0.2 (95% CI: 0.1–0.7). Intermediate SES patients did not have a higher odd for hospitalisation (OR 1.0 95% CI  
 21 0.95–1.4) than high SES patients.

1 **Table 3. Multivariable analysis of the effect on SES on ED outcomes and within different living situations.**

	Socioeconomic Status	Number (%)	All patients N = 4828 (OR 95%CI)	Community-dwelling patients N = 4381 (OR 95%CI)	Institutionalized patients N = 443 (OR 95%CI)
Hospitalisation <sup>1</sup>	Low	996/1660 (62.3%)	1.1 (0.9-1.4)	<b>1.3 (1.1-1.7)</b>	<b>0.2 (0.1–0.7)</b>
	Intermediate	909/1640 (55.4%)	1.1 (0.9-1.4)	1.1 (0.95-1.4)	0.4 (0.1-1.2)
	High	830/1588 (52.3%)	1.0	1.0	1.0
In-hospital mortality <sup>2</sup>	Low	86/996 (5.4%)	1.2 (0.7-2.0)	1.4 (0.8-2.6)	0.8 (0.1-6.8)
	Intermediate	58/909 (3.5%)	1.1 (0.6-1.9)	1.3 (0.8-2.2)	0.4 (0.1-4.0)
	High	55/830 (3.5%)	1.0	1.0	1.0
30-day ED-revisits <sup>3#</sup>	Low	184/1514 (11.5%)	1.0 (0.8-1.4)	1.0 (0.7-1.4)	1.0 (0.2-4.7)
	Intermediate	220/1582 (13.5%)	0.9 (0.7-1.1)	0.8 (0.6-1.1)	0.8 (0.2-4.6)
	High	196/1533 (12.3%)	1.0	1.0	1.0

2 ED = Emergency Department. OR = Odds Ratio. CI = confidence interval.  
3 1 = adjusted variable include age and Charlson comorbidity index.  
4 2 = adjusted for age, Charlson comorbidity index, and triage level.  
5 3 = adjusted for age, Charlson comorbidity index and gender. # = without patients who died during  
6 hospitalisation.  
7

8 In-hospital mortality was higher for the low SES group (5.4%) compared with the intermediate (3.5%)  
9 and the high SES group (3.5%,  $p=0.01$ , unadjusted  $OR_{low\_vs\_high} :0.6$  95% CI 0.4-0.9). The difference in in-hospital  
10 mortality between low and high SES patients was no longer significant when adjusted for age, comorbidity and  
11 triage level (adjusted OR 1.2 95% CI 0.7–2.0).

12 There was no difference in 30-day ED-revisit rate between the low, intermediate and high SES group  
13 (21.3%, 20.4% vs. 20.8%, resp.,  $p=0.88$ ). Neither was the 30-day ED-revisit rate different after correcting for  
14 age, comorbidity and gender (adjusted OR 1.0, 95% CI 0.8–1.4). Moreover, adjusting for the living situation did  
15 not alter the results significantly (Table 3).  
16

## 17 Discussion

18 Our study was a large population-based study that investigated the association of SES with ED visits of older  
19 adult ( $\geq 65$  years) patients. We found that older adult community-dwelling ED patients with a low SES have a  
20 higher risk of hospitalisation than patients with a high SES. Moreover, low SES patients had more often a higher



1  
2  
3 1 triage level, had more diagnostics test and longer ED-LOS compared to other SES groups. However, in-hospital  
4  
5 2 mortality and the number of ED-return visits were not different between the three SES groups.

6  
7 3 We hypothesized that patients with low SES would be less healthy than those with a higher SES, which  
8  
9 4 indirectly would result in higher admission rates and in-hospital mortality after presentation at the ED. Our  
10  
11 5 data allowed us to determine important confounders, such as comorbidity, organisational factors and the  
12  
13 6 severity of illness at the ED, which makes it possible to contribute important information to already existing  
14  
15 7 evidence on the topic of SES, where some studies did not adjust for potential and important confounders  
16  
17 8 (7,25). Our study indeed observed a higher chance of hospitalisation (OR 1.3 CI 1.1-1.7) for community-dwelling  
18  
19 9 patients with a low SES than for patients with intermediate/high SES. This finding is in line with other studies  
20  
21 10 (9,26,27). It may be possible that part of the community-dwelling frail patients were admitted for care  
22  
23 11 problems, which is not a reason for admission for institutionalized patients as extra care is available for these  
24  
25 12 patients. Future studies should elaborate the living arrangements and social network of older adults to  
26  
27 13 investigate the influence of these matters on ED usage.

28  
29 14 In-hospital mortality and ED-revisits within 30 days were not associated with SES. This contrasts with  
30  
31 15 other studies that found a higher risk of in-hospital mortality and readmissions in older adult patients with a  
32  
33 16 low SES (8,16,17), but is in line with other studies that did not found an association (11,12,18). The association  
34  
35 17 of low SES and adverse outcomes was found in studies that included patients with a specific diagnosis (e.g.  
36  
37 18 pneumonia or heart failure) (18,28) or that analysed the number of ED visits per SES category (4,6,9,29),  
38  
39 19 whereas our study focused on an undifferentiated, and therefore, more generalizable, older adult ED  
40  
41 20 population. Another reason not finding an association between low SES and outcomes might be that most  
42  
43 21 studies did not account for differences in living situation (17,30,31). We found that care and nursing homes  
44  
45 22 were mostly situated in low SES areas, while their inhabitants will probably belong to all three SES (32).  
46  
47 23 Additionally, institutionalized patients may influence revisit rates, because they are treated by their own doctor  
48  
49 24 in the nursing home. It may be useful to take the living situation into account when using SES based on zip  
50  
51 25 code, because care facilities structures at home influence ED outcomes.

52  
53 26 The fact that we did not find an association between SES and in-hospital mortality and revisits may be  
54  
55 27 due to the organisation of the health care system in the Netherlands and may underscore/reflect that our  
56  
57 28 health care is indeed accessible to all patients, regardless of their SES. In the Netherlands, the health care  
58  
59 29 system consists of a well organised GP-network, with 24-hours a day access for acute care patients, which is  
60

1  
2  
3 1 equally accessible for every inhabitant (29). In the Netherlands, care provided by the general practitioner is  
4  
5 2 fully covered by the basic obligatory health insurance (33). Therefore this system provides equal access to  
6  
7 3 health care by the general practitioner to every resident, independent of their SES (5,34-36). In addition, this  
8  
9 4 care selects the most severely ill patients for referral to the ED. The acute health care system differs over the  
10  
11 5 countries, and in some countries, for instance the United States, the ED is used as a safety-net for underserved  
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13 6 and uninsured patients (37). Also, even important, the financial health care structure is different worldwide In  
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15 7 short, specifically regarding acute care, differences in organization and financial coverage of acute care make  
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17 8 comparisons between countries difficult (38).

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19 9 In the Netherlands, older adults are, in general, financially well-covered (39), as only 3.5% of them are  
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21 10 poor (39). Concerning other studies on older adults and SES, the methods of determining SES differed  
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23 11 substantially, and some included education, income and occupancy, but none of the methods have proved to  
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25 12 be comprehensive enough (40). One study in Canada among older adults that determined factors of ED usage  
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27 13 matched postal codes with several indicators, such as income, employment and living alone (10). In a  
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29 14 Mediterranean study, SES was defined on years of education and the mean annual income of the family (41). In  
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31 15 conclusion, the comparison of studies on SES is complicated by different levels of SES in the general population  
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33 16 and of the way SES is defined.

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35 17 Apart from the above mentioned, the following study limitations should be mentioned. Firstly, our  
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37 18 results are not generalizable to cardiology and gynaecology patients as we excluded these patients. For these  
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39 19 cardiology patients, it is known that low SES may have a stronger association with adverse outcomes (42), and  
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41 20 excluding these from our study may explain that we did not find associations between SES and outcome  
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43 21 (except for hospitalisation in community dwelling patients). Secondly, we retrieved SES on basis of zip codes,  
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45 22 which may be imprecise and yield smaller associations of SES with adverse outcomes (43). However, one zip  
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47 23 code in the database of Statistics Netherlands covers only 17 households and therefore, we consider this way  
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49 24 of retrieving SES rather reliable (44,45). Thirdly, retrieving SES of patients living in a nursing home or other care  
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51 25 home facilities on basis of zip code is probably not reliable. Therefore, we made subgroup analysis of  
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53 26 community dwelling patients and institutionalized patients, which is a strong point of our study. Lastly, coding  
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55 27 for the living situation may not be precise, but we think that this does not lead to an underestimation since the  
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57 28 percentage of institutionalized patients (9.1%) is almost similar as percentages given in another study (9.0%)  
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59 29 (46).  
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3 1 In this study, we provided important information in terms of health outcomes on the SES in the acute  
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5 2 health care setting in the vulnerable older adult population. We investigated a large unselected group of older  
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7 3 adult ED patients stratified to living situation, which provides additional knowledge on the care and problems  
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9 4 of older adult patients in the ED. Our study shows that in a country with assumed equal health care access only  
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11 5 minor outcome differences were observed between different SES groups. Therefore, physicians should be  
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13 6 aware of the potential differences between SES groups given the higher chance of hospitalisation.  
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15 7 Improvement in adequately diagnosing and treating older adult patients is important, but the additional value  
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17 8 of SES in the emergency care should be evaluated further to develop effective interventions to ensure high  
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19 9 quality of care. Future studies should elaborate the living arrangements and social network of older adults,  
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21 10 because these probably influences access to the ED and the number of (re-)admissions.

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23 11 In conclusion, low SES community-dwelling older adults were more often hospitalised than high SES  
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25 12 community-dwelling patients, but no differences in in-hospital mortality and ED-revisits between the SES  
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27 13 groups.

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3 **1 Contributorship statement**

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5 2 JW and SB conceived the study and designed the protocol. SL contributed to the design for the overall older  
6  
7 3 adults project. JW, PS and ID analyzed and interpreted the data. HH supervised the conduct of the study and  
8  
9 4 data collection. JW, PS and ID drafted the manuscript. MA helped with the statistical analyses. JW designed the  
10  
11 5 database. JW, ID, PS, SB, MA, SL and HH contributed substantially to its revision and approved the final  
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13 6 manuscript.

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17 **8 Data sharing statement**

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19 9 Data of the study is available from the data governance board of Maxima Medical Centre Institutional Data  
20  
21 10 Access / Ethics Committee for researchers who meet the criteria for access to confidential data. Data are from  
22  
23 11 the non-specific complaints study when contacting the data governance board (Jolanda.Luime@mmc.nl).  
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2 **References**

- 3 (1) Hoogendijk EO, van Hout HP, Heymans MW, van der Horst HE, Frijters DH, Broese van Groenou MI, et al.  
4 Explaining the association between educational level and frailty in older adults: results from a 13-year  
5 longitudinal study in the Netherlands. *Ann Epidemiol* 2014 Jul;24(7):538-44.e2.
- 6 (2) Lowthian JA, Curtis AJ, Cameron PA, Stoelwinder JU, Cooke MW, McNeil JJ. Systematic review of trends in  
7 emergency department attendances: an Australian perspective. *Emerg Med J* 2011 May;28(5):373-377.
- 8 (3) Mackenbach JP, Stirbu I, Roskam AJ, Schaap MM, Menvielle G, Leinsalu M, et al. Socioeconomic inequalities  
9 in health in 22 European countries. *N Engl J Med* 2008 Jun 5;358(23):2468-2481.
- 10 (4) Droomers M, Westert GP. Do lower socioeconomic groups use more health services, because they suffer  
11 from more illnesses? *Eur J Public Health* 2004 Sep;14(3):311-313.
- 12 (5) van Doorslaer E, Wagstaff A, van der Burg H, Christiansen T, De Graeve D, Duchesne I, et al. Equity in the  
13 delivery of health care in Europe and the US. *J Health Econ* 2000 Sep;19(5):553-583.
- 14 (6) Khan Y, Glazier RH, Moineddin R, Schull MJ. A population-based study of the association between  
15 socioeconomic status and emergency department utilization in Ontario, Canada. *Acad Emerg Med* 2011  
16 Aug;18(8):836-843.
- 17 (7) Tozer AP, Belanger P, Moore K, Caudle J. Socioeconomic status of emergency department users in Ontario,  
18 2003 to 2009. *CJEM* 2014 May;16(3):220-225.
- 19 (8) Begley C, Basu R, Lairson D, Reynolds T, Dubinsky S, Newmark M, et al. Socioeconomic status, health care  
20 use, and outcomes: persistence of disparities over time. *Epilepsia* 2011 May;52(5):957-964.
- 21 (9) Filc D, Davidovich N, Novack L, Balicer RD. Is socioeconomic status associated with utilization of health care  
22 services in a single-payer universal health care system? *Int J Equity Health* 2014 Nov 28;13:115-014-0115-1.
- 23 (10) Ionescu-Ittu R, McCusker J, Ciampi A, Vadeboncoeur AM, Roberge D, Larouche D, et al. Continuity of  
24 primary care and emergency department utilization among elderly people. *CMAJ* 2007 Nov 20;177(11):1362-  
25 1368.
- 26 (11) Ho KM, Dobb GJ, Knuiman M, Finn J, Webb SA. The effect of socioeconomic status on outcomes for  
27 seriously ill patients: a linked data cohort study. *Med J Aust* 2008 Jul 7;189(1):26-30.
- 28 (12) Alter DA, Chong A, Austin PC, Mustard C, Iron K, Williams JI, et al. Socioeconomic status and mortality after  
29 acute myocardial infarction. *Ann Intern Med* 2006 Jan 17;144(2):82-93.
- 30 (13) Samaras N, Chevalley T, Samaras D, Gold G. Older patients in the emergency department: a review. *Ann  
31 Emerg Med* 2010 Sep;56(3):261-269.
- 32 (14) Ramos M. Impact of socioeconomic status on Brazilian elderly health. *Rev Saude Publica* 2007  
33 Aug;41(4):616-624.
- 34 (15) Cournane S, Conway R, Byrne D, O'Riordan D, Coveney S, Silke B. Social deprivation and the rate of  
35 emergency medical admission for older persons. *QJM* 2016 Oct;109(10):645-651.
- 36 (16) Hutchings A, Raine R, Brady A, Wildman M, Rowan K. Socioeconomic status and outcome from intensive  
37 care in England and Wales. *Med Care* 2004 Oct;42(10):943-951.

- 1  
2  
3 1 (17) Rathore SS, Masoudi FA, Wang Y, Curtis JP, Foody JM, Havranek EP, et al. Socioeconomic status, treatment,  
4 2 and outcomes among elderly patients hospitalized with heart failure: findings from the National Heart Failure  
5 3 Project. *Am Heart J* 2006 Aug;152(2):371-378.  
6  
7 4 (18) Izquierdo C, Oviedo M, Ruiz L, Sintes X, Vera I, Nebot M, et al. Influence of socioeconomic status on  
8 5 community-acquired pneumonia outcomes in elderly patients requiring hospitalization: a multicenter  
9 6 observational study. *BMC Public Health* 2010 Jul 15;10:421-2458-10-421.  
10  
11 7 (19) Brouns SHA, Dortmans MKJ, Jonkers FS, Lambooj SLE, Kuijper A, Haak HR. Hyponatraemia in Elderly  
12 8 Emergency Department Patients: A Marker of Frailty. *Neth J Med* 2014;72(6):311-317.  
13  
14 9 (20) Centraal bureau voor de statistiek. Inhoud kerncijfers postcodegebieden 2008-2010. 2012.  
15  
16 10 (21) Kunst A.E. Bos V. Mackenbach J.P. Monitoring socioeconomic inequalities in health in the european union:  
17 11 guidelines and illustrations. EU Working Group on Socio-economic Inequalities in Health 2011.  
18  
19 12 (22) Needham DM, Scales DC, Laupacis A, Pronovost PJ. A systematic review of the Charlson comorbidity index  
20 13 using Canadian administrative databases: a perspective on risk adjustment in critical care research. *J Crit Care*  
21 14 2005 Mar;20(1):12-19.  
22  
23 15 (23) Zachariasse JM, Seiger N, Rood PP, Alves CF, Freitas P, Smit FJ, et al. Validity of the Manchester Triage  
24 16 System in emergency care: A prospective observational study. *PLoS One* 2017 Feb 2;12(2):e0170811.  
25  
26 17 (24) Quan H, Sundararajan V, Halfon P, Fong A, Burnand B, Luthi JC, et al. Coding algorithms for defining  
27 18 comorbidities in ICD-9-CM and ICD-10 administrative data. *Med Care* 2005 Nov;43(11):1130-1139.  
28  
29 19 (25) Bagher A, Andersson L, Wingren CJ, Ottosson A, Wangejord S, Acosta S. Socio-economic status and major  
30 20 trauma in a Scandinavian urban city: A population-based case-control study. 2016;44:217-223.  
31  
32 21 (26) Robert S. Stern M, Joel S. Weissman P, Arnold M. Epstein, MD, MA. The emergency department as a  
33 22 pathway to admission for poor and high cost patients. *JAMA* 1991;266(16):2238-2243.  
34  
35 23 (27) Raffaele Antonelli-Incalzi, Carla Ancona, Francesco Forastiere, Valeria Belleudi, Andrea Corsonello, Carlo A  
36 24 Perucci. Socioeconomic status and hospitalization in the very old: a retrospective study. *BMC Public Health*  
37 25 2007;7(227).  
38  
39 26 (28) Bhayana R, Vermeulen MJ, Li Q, Hellings CR, Berdahl C, Schull MJ. Socioeconomic status and the use of  
40 27 computed tomography in the emergency department. *CJEM* 2014 Jul;16(4):288-295.  
41  
42 28 (29) van der Meer JB, van den Bos J, Mackenbach JP. Socioeconomic differences in the utilization of health  
43 29 services in a Dutch population: the contribution of health status. *Health Policy* 1996 Jul;37(1):1-18.  
44  
45 30 (30) Cressman AM, Macdonald EM, Yao Z, Austin PC, Gomes T, Paterson JM, et al. Socioeconomic status and  
46 31 risk of hemorrhage during warfarin therapy for atrial fibrillation: A population-based study. *Am Heart J* 2015  
47 32 Jul;170(1):133-40, 140.e1-3.  
48  
49 33 (31) Govindarajan P, Gonzales R, Maselli JH, Johnston SC, Fahimi J, Poisson S, et al. Regional differences in  
50 34 emergency medical services use for patients with acute stroke (findings from the National Hospital Ambulatory  
51 35 Medical Care Survey Emergency Department Data File). *J Stroke Cerebrovasc Dis* 2013 Nov;22(8):e257-63.  
52  
53 36 (32) Arendts G, Howard K. The interface between residential aged care and the emergency department: a  
54 37 systematic review. *Age Ageing* 2010 May;39(3):306-312.  
55  
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2  
3 1 (33) van der Linden MC, Lindeboom R, de Haan R, van der Linden N, de Deckere ER, Lucas C, et al. Unscheduled  
4 2 return visits to a Dutch inner-city emergency department. *Int J Emerg Med* 2014 Jul 5;7:23-014-0023-6.  
5 3 eCollection 2014.
- 6  
7 4 (34) Pines JM, Hilton JA, Weber EJ, Alkemade AJ, Al Shabanah H, Anderson PD, et al. International perspectives  
8 5 on emergency department crowding. *Acad Emerg Med* 2011;18(12):1358-1370.
- 9  
10 6 (35) van der Linden MC, Lindeboom R, van der Linden N, van den Brand CL, Lam RC, Lucas C, et al. Self-referring  
11 7 patients at the emergency department: appropriateness of ED use and motives for self-referral. *Int J Emerg*  
12 8 *Med* 2014 Jul 16;7:28-014-0028-1. eCollection 2014.
- 13  
14 9 (36) Holmes JL. Emergency medicine in the Netherlands. *Emergency Medicine Australasia* 2010;22(1):75-81.
- 15  
16 10 (37) Di Somma S, Paladino L, Vaughan L, Lalle I, Magrini L, Magnanti M. Overcrowding in emergency  
17 11 department: an international issue. *Intern Emerg Med* 2015 Mar;10(2):171-175.
- 18  
19 12 (38) Grundy E, Holt G. The socioeconomic status of older adults: how should we measure it in studies of health  
20 13 inequalities? *J Epidemiol Community Health* 2001 Dec;55(12):895-904.
- 21  
22 14 (39) Smits CH, van den Beld HK, Aartsen MJ, Schroots JJ. Aging in the Netherlands: state of the art and science.  
23 15 *Gerontologist* 2014 Jun;54(3):335-343.
- 24  
25 16 (40) Martelin T. Mortality by indicators of socioeconomic status among the Finnish elderly. *Soc Sci Med* 1994  
26 17 May;38(9):1257-1278.
- 27  
28 18 (41) Katsarou A, Tyrovolas S, Psaltopoulou T, Zeimbekis A, Tsakountakis N, Bountziouka V, et al. Socio-economic  
29 19 status, place of residence and dietary habits among the elderly: the Mediterranean islands study. *Public Health*  
30 20 *Nutr* 2010 Oct;13(10):1614-1621.
- 31  
32 21 (42) Carlsson AC, Li X, Holzmann MJ, Wandell P, Gasevic D, Sundquist J, et al. Neighbourhood socioeconomic  
33 22 status and coronary heart disease in individuals between 40 and 50 years. *Heart* 2016 May 15;102(10):775-782.
- 34  
35 23 (43) Aarts MJ, van der Aa MA, Coebergh JW, Louwman WJ. Reduction of socioeconomic inequality in cancer  
36 24 incidence in the South of the Netherlands during 1996-2008. *Eur J Cancer* 2010 Sep;46(14):2633-2646.
- 37  
38 25 (44) Bos, V. Kunst, A.E., Mackenbach, J. in verslag aan de Programmacommissie Sociaal-economische  
39 26 gezondheidsverschillen II [In Dutch]. Instituut Maatschappelijke Gezondheidszorg, Erasmus Universiteit,  
40 27 Rotterdam 2000.
- 41  
42 28 (45) Smits, J. Keij, I. Mackenbach, J.P. in Sociaal-economische gezondheidsverschillen: Van verklaren naar  
43 29 verkleinen [In Dutch]. Zon/MW, Den Haag 2001.
- 44  
45  
46 30 (46) Ribbe MW, Ljunggren G, Steel K, Topinkova E, Hawes C, Ikegami N, et al. Nursing homes in 10 nations: a  
47 31 comparison between countries and settings. *Age Ageing* 1997 Sep;26 Suppl 2:3-12.
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1 **Figures**

2 **Figure 1. The Flow chart of older adult patients divided into three SES groups.**

3 ED = Emergency department. SES = Socioeconomic Status  
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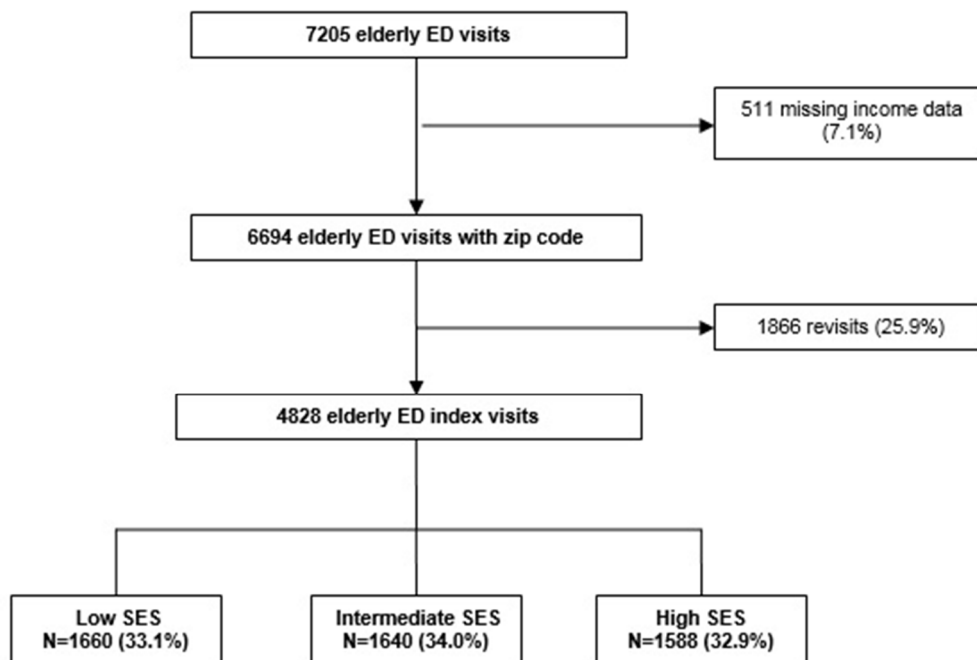
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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of cohort studies

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
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
<b>Methods</b>			
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) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	5
		(b) For matched studies, give matching criteria and number of exposed and unexposed	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	1
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	5-6
Bias	9	Describe any efforts to address potential sources of bias	6
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	6
		(b) Describe any methods used to examine subgroups and interactions	5-6
		(c) Explain how missing data were addressed	6
		(d) If applicable, explain how loss to follow-up was addressed	
		(e) Describe any sensitivity analyses	6
<b>Results</b>			

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 (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram	7
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest (c) Summarise follow-up time (eg, average and total amount)	7-8 7-12
Outcome data	15*	Report numbers of outcome events or summary measures over time	11-12
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 (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	11-12
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	11-12
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	
<b>Limitations</b>			
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 13-15
Generalisability	21	Discuss the generalisability (external validity) of the study results	14
<b>Other information</b>			
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	

\*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](http://www.strobe-statement.org).

# BMJ Open

## Association of socioeconomic status on outcomes in older adult community-dwelling patients after visiting the emergency department: a retrospective cohort study.

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-019318.R3
Article Type:	Research
Date Submitted by the Author:	16-Nov-2017
Complete List of Authors:	Wachelder, Joyce; Maxima Medisch Centrum, Internal Medicine van Drunen, Isabelle ; Maxima Medisch Centrum, Internal Medicine Stassen, Patricia; Maastricht University CAPHRI School for Public Health and Primary Care; Maastricht Universitair Medisch Centrum+ Interne Geneeskunde, Internal Medicine Brouns , Steffie ; Maxima Medisch Centrum, Internal Medicine Lambooij, Suze ; Maxima Medisch Centrum, Internal Medicine Aarts, Mieke ; Netherlands Comprehensive Cancer Organisation Haak , Harm; Maxima Medisch Centrum, Eindhoven ; Maastricht University CAPHRI School for Public Health and Primary Care
<b>Primary Subject Heading</b>:	Emergency medicine
Secondary Subject Heading:	Geriatric medicine
Keywords:	Socioeconomic Status, Elderly, Emergency Department

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Manuscripts

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12 4 J.J.H. Wachelder<sup>12</sup>, I.S. van Drunen<sup>1#</sup>, P.M.Stassen<sup>24#</sup>, S.H.A Brouns<sup>12</sup>, S.L.E. Lambooi<sup>1</sup>, M.J. Aarts<sup>3</sup>, H.R. Haak<sup>124</sup>  
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38 19 Disclosure: There are no conflicts of interest. No funding was received.  
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50 26 **Keywords:** Socioeconomic Status; Older adult; Emergency Department  
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3 1 **Abstract**

4 2 **Objectives:** Older adults frequently visit the Emergency Department (ED). Socioeconomic State (SES) has an  
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6 3 important impact on health and ED utilization, however, the association between SES and ED utilization in  
7  
8 4 elderly remains unclear. The aim of this study was to investigate the association between SES in older adult  
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10 5 patients visiting the ED on outcomes.

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12 6 **Design:** A retrospective study.

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14 7 **Participants:** Older adults ( $\geq 65$  years) visiting the ED, in the Netherlands. SES was stratified into tertiles based  
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16 8 on average household income at zip code level; low ( $< \text{€}1800/\text{month}$ ), intermediate ( $\text{€}1800\text{--}\text{€}2300/\text{month}$ ) and  
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18 9 high ( $> \text{€}2300/\text{month}$ ).

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20 10 **Primary outcomes:** hospitalisation, in-hospital mortality and 30-day ED-return visits. Effect of SES on outcomes  
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22 11 for all groups were assessed by logistic regression and adjusted for confounders.

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24 12 **Results:** In total, 4828 older adults visited the ED during the study period. Low SES was associated with a higher  
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26 13 risk of hospitalisation among community-dwelling patients compared with high SES (adjusted OR 1.3 95%CI 1.1-  
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28 14 1.7). This association was not present for intermediate SES (adjusted OR 1.1 95%CI 0.95-1.4). In-hospital  
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30 15 mortality was comparable between the low and high SES-group, even after adjustment for age, comorbidity  
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32 16 and triage level (low OR 1.4 95%CI 0.8-2.6, intermediate OR 1.3 95%CI 0.8-2.2). Thirty-day ED-revisits among  
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34 17 community-dwelling patients were also equal between the SES groups (low: adjusted OR 1.0 95%CI 0.7-1.4 and  
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36 18 intermediate: adjusted OR 0.8 95%CI 0.6-1.1).

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38 19 **Conclusion:** In older adult ED patients, low SES was associated with a higher risk of hospitalisation than high  
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40 20 SES. However, SES had no impact on in-hospital mortality and 30-day ED-revisits after adjustment for  
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42 21 confounders.

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1 **Strengths and limitations of this study**

- 2 - This is one of the only studies to provide detailed insight into the impact of different socioeconomic
- 3 status groups of older adults in the emergency care.
- 4 - Additionally, this study the living situation was used to differentiate between community-dwelling
- 5 patients and institutionalized patients to observe differences in outcomes.
- 6 - This study used a retrospective cohort study and linked patient zip code with income data based on a
- 7 well-defined database by Statistics Netherlands.
- 8 - A strength of our study is that we investigated a large undifferentiated group of older adult emergency
- 9 care patients.
- 10 - Limitations were that we were not able to extract the data of cardiology and gynaecology patients and
- 11 that we used zip code to define the socioeconomic status.

For peer review only



## 1 Introduction

2 The burden on the Emergency Department (ED) capacity has been increasing over the past decades, which is  
3 mostly due to a substantially increasing number of older adults ( $\geq 65$  years old) (1). Given the extent and  
4 complexity of the problems in these patients, it is essential to identify determinants that lead to the ED visits in  
5 order to maintain high quality of care of older adult ED patients (2).

6 Low socioeconomic status (SES) has already been identified as an important determinant of health  
7 status and is strongly associated with poor adverse health outcomes (3). Patients with a low SES visit the  
8 general practitioner more and the specialist less often than patients with a high SES (4,5). Moreover, patients  
9 with a low a SES use the ED more frequently and are admitted to the hospital more often than those with a  
10 high SES (4,6-10). However, most studies focused on the influence of SES on the quantity of ED utilization,  
11 rather than on the reasons for and outcomes of these ED visits in general (8,10-12).

12 It is well-known that older adults are vulnerable and prone to adverse health outcomes, such as ED  
13 visits, ED return visits, hospitalisation and mortality (13). However, research on the effect of SES on ED visits  
14 and adverse health outcomes in these older adults is scarce (10,14,15). Some of these studies demonstrated  
15 conflicting results as where low SES patients showed higher risk of adverse health outcomes (8,16,17), while  
16 other studies did not find such an increased risk (11,12,18). Moreover, most studies focused on patients with a  
17 specific diagnosis (e.g. heart failure, pneumonia or injury) and other studies merely studied ED utilization  
18 (10,14,18).

19 To understand the ED utilization patterns of older adults, it can be important to take their SES into  
20 account. Understanding the characteristics of older adult ED patients, including their SES, may be the first step  
21 to maintain or improve high quality of acute care. We hypothesize that low SES influences the risk of adverse  
22 health outcomes in the ED setting in a negative way and adds to the vulnerability of older adult ED patients  
23 even in a country in which health care access is organized for every inhabitant, regardless of SES.

24 The aim of this study was to determine differences between different SES groups among older adults s  
25 and additionally and most importantly we investigated the association of SES with hospitalisation, in-hospital  
26 mortality and ED-revisits.

## 28 Method

29 *Study design, setting and population*

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3 1 A retrospective cohort study was performed in the Maxima Medical Centre, a 550-bed teaching hospital in the  
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5 2 Netherlands. Yearly, approximately 30,000 patients visit the ED (19), of whom 30% are older adults ( $\geq 65$  years).  
6  
7 3 In the Netherlands, patients are usually referred to the ED by a general practitioner. The general practitioners  
8  
9 4 provide acute care all days of the week and every hour of the day, including out of office hours.

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11 5 Older adults who visited the ED for all medical (including oncology) and surgical specialities in one year  
12  
13 6 (between 1<sup>st</sup> of September 2011 and 31<sup>st</sup> of August 2012), were included. Data from the acute cardiac care unit  
14  
15 7 and gynaecology unit were not available in the database, because these patients do not visit the ED .

16  
17 8 Data of the ED visits were automatically extracted from the electronic patient records (Chipsoft-EZIS,  
18  
19 9 version 5.2). Categorization of the data was done according a fixed data extraction form by one researcher  
20  
21 10 (JW). A random sample of all variables was checked by another researcher (ID). The patients' zip code (on  
22  
23 11 average 17 households per zip code) was used to determine the SES at a neighbourhood level by combining the  
24  
25 12 median household income per month and mean value of the houses. Data on income were provided by  
26  
27 13 Statistics Netherlands (20). This dataset excluded zip codes with less than 10 households to guarantee  
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29 14 anonymity. The median income data derived from zip codes in the database from Statistics Netherlands were  
30  
31 15 linked to our database and subsequently divided into tertiles (21): low ( $< \text{€}1800/\text{month}$ ), intermediate ( $\text{€}1800-$   
32  
33 16  $\text{€}2300/\text{month}$ ) and high ( $> \text{€}2300/\text{month}$ ). It was impossible to retrieve SES data for patients with unknown zip  
34  
35 17 code or patients living abroad (Belgium), and therefore, these patients were excluded (N=511, 6.9%).

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37 18 To investigate the effect of the living situation in the three SES groups, we conducted a subgroup  
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39 19 analysis for the outcomes of community-dwelling patients and for patients who were institutionalized. Living  
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41 20 situation was determined on basis of zip codes, including those of the nursing and care home patients. The first  
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43 21 ED visit in the study period was considered the index visit, other visits after the index visit were excluded to  
44  
45 22 avoid duplicate analysis of the patients' characteristics and outcomes. The Institutional Review Board of  
46  
47 23 Máxima Medical Centre approved this study and confirmed that the Medical Research Involving Human Subject  
48  
49 24 Act (WMO) was not applicable.

## 50 26 **Data collection & definitions**

51  
52 27 The following data were retrieved from the electronic patient record: age, gender, zip code, comorbidity,  
53  
54 28 number of used medications. The Charlson comorbidity index (CCI) was used to quantify comorbidity (22). All  
55  
56 29 electronic patient (both ED and hospital) records were assessed to retrieve comorbidity. For a random sample

1 of 50% of the patients per SES group, comorbidity was manually retrieved. It was not feasible to do this for all  
2 patients. The patients' living situation was categorized into community-dwelling patients (living independently  
3 or with home care) and institutionalized patients (care home and nursing home).

4 To assess the severity of illness at presentation, the Manchester Triage Level (MTS) (23), vital parameters  
5 (systolic blood pressure, heart rate), laboratory tests (CRP and leukocytes) and the ED diagnoses were  
6 retrieved. The triage level based on the five-level MTS was categorised into 3 groups: urgent (red and orange),  
7 moderate (yellow), and low (green). In our ED the triage colour blue is not used,  
8 because these patients almost never visit our ED. Classification of ED diagnoses was done according the  
9 International Classification of Disease-10 (ICD-10)" (24). The group 'other', consisted out of diseases of the  
10 nervous system, musculoskeletal and connective tissue, skin and subcutaneous tissue, eye and adnexa, ear and  
11 mastoid and mental.

12 Organizational factors retrieved were time of arrival, mode of referral (self-referral, GP, ambulance, specialist  
13 and other), specialty, number of diagnostic tests (sum of radiological tests, electrocardiogram, arterial blood  
14 gas analysis, laboratory tests, urine analysis, urine and blood culture), number of specialist consultations in the  
15 ED, ED-Length-of-Stay (LOS) and hospital-LOS. Time of presentation was classified into 3 shifts: day (8am-6pm),  
16 evening (6pm-12pm) and night (12pm-8am). The following specialties were considered surgical: (general)  
17 surgery, plastic surgery, urology, and orthopaedics. Pulmonology, neurology, internal medicine and  
18 gastroenterology were considered medical specialities. Hospital LOS was defined as the number of days  
19 between hospital admission and hospital discharge. Dates of death during hospital stay and of the ED-return  
20 visit were retrieved. The data were extracted by one trained medical abstractor who was blinded for the study  
21 hypothesis.

### 22 23 **Statistical analyses**

24 All statistical analyses were performed using SPSS 22.0 (Armonk, New York, 2015). Comparisons between two  
25 SES groups (low vs. intermediate, low vs. high and intermediate vs. high) were conducted using ANOVA (post-  
26 hoc Tukey test) for continuous data and the Chi square test for categorical data. For continuous variables that  
27 were not normally distributed, the Wilcoxon-Mann-Whitney-Test was used. Missing data were categorised as  
28 "unknown" and included in the analyses of categorical parameters, to explore the influence of missing values.

29 To investigate the independent effect of SES on hospitalisation, in-hospital mortality, and 30-day ED-return

1 visits, logistic regression analyses was performed. Multivariable analysis was performed to calculate the  
2 adjusted Odds Ratio (OR) and in order to estimate the effect of confounders of age, gender, triage level and  
3 CCI. Age, CCI and medications were included as a linear variable in this analysis. For day of the week, a weekday  
4 was reference, and for sex, female was reference. Triage level was categorized as follows: urgent, intermediate  
5 and low (reference). Sensitivity analysis was performed to evaluate the effect of ED-revisits on mortality. For  
6 this analysis, those who died during hospitalisation were excluded (N=199). To estimate the effect of the living  
7 situation on the SES and their outcomes, patients were divided into community-dwelling patients and  
8 institutionalized patients. OR and corresponding 95% Confidence Intervals (CI) were calculated for each of the  
9 outcomes. A p-value was considered significant when <0.05.

10

## 11 **Results**

12 During the study period, 7205 ED visits by older adult patients were registered in our ED. In total, 511 patients  
13 (7.1%) were excluded because income data were missing and 1866 visits (25.9%) because the visit was a revisit.  
14 In total, 4828 index visits were included. Of these 1660 visits (33.1%) were classified as having a low SES, 1640  
15 (34.0%) as intermediate and 1588 (32.9%) as having a high SES (Figure 1).

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### 18 *Patient characteristics*

19 The mean age of the study population was 77±7.7 years, and slightly less patients were male (44.5%) (Table 1).  
20 In total, 4381 (90.7%) were community-dwelling patients and 9.2% lived institutionalized. Patients were mostly  
21 referred by a GP (58.5%) and were triaged as having moderate urgency (43.8%). More than half (56.5%) of the  
22 patients were hospitalised, and their median hospital-LOS was 5 days. In-hospital mortality was 4.1%.

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1 **Table 1. Patient characteristics and SES of older adult patients visiting the ED**

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Characteristics	Total population N = 4828	Socioeconomic Status			P-value
		Low N = 1660 (33.1%)	Intermediate N = 1640 (34.0%)	High N = 1588 (32.9%)	
<b>Age, years</b>					
Mean (SD)	77 (7.7)	80 (7.6)	76 (7.6)	75 (7.4)	<0.001#
Median (IQR)*	77 (12)	80 (11)	76 (12)	74 (12)	
<b>Gender (%)*</b>					<0.001
Male	2149 (44.5%)	618 (38.6%)	759 (46.3%)	772 (48.6%)	
Female	2679 (55.5%)	982 (61.4%)	881 (53.7%)	816 (51.4%)	
<b>CCI, median (IQR)</b>	1.2 (1.6)	1.0 (0-8)	1.0 (0-10)	1.0 (0-11)	0.09
Unknown		45 (5.3%)	49 (5.3%)	54 (6.2%)	
<b>No. of medications, mean (SD)*</b>	2.5 (4.3)	3.3 (4.7)	2.4 (4.2)	1.9 (3.9)	<0.001@
<b>Mode of referral*</b>					
General Practitioner	2680 (55.5%)	937 (61.8%)	905 (57.8%)	838 (56.0%)	0.03
Self-referral	852 (17.6%)	215 (13.4%)	292 (17.8%)	345 (21.7%)	<0.001
Ambulance	664 (13.8%)	244 (15.3%)	237 (14.5%)	183 (11.5%)	0.01
Specialist	632 (13.1%)	204 (9.6%)	206 (9.9%)	222 (10.8%)	0.75
<b>Living situation*</b>					<0.001
Community-dwelling	4381 (90.7%)	1266 (79.1%)	1556 (94.9%)	1559 (98.2%)	
Institutionalized	443 (9.2%)	330 (20.6%)	84 (5.1%)	29 (1.8%)	
Missing	4 (100%)	4 (100%)	0	0	

3 SES = Socioeconomic status. SD = Standard deviation. CCI = Charlson comorbidity index. ED = Emergency  
4 Department. P-values P-values low, intermediate and high SES: using the Chi-square test, ANOVA (post-hoc  
5 Tukey) and Mann-Whitney-U-test.

6 # = p-value low vs. intermediate <0.001, low vs. high <0.001, intermediate vs. high 0.001.

7 @ = p-value low vs. intermediate 0.001, low vs. high <0.001, intermediate vs. high 0.042.

\* =  $p < 0.05$ .

#### Patient characteristics and Socioeconomic status

Patients with a low or intermediate SES were older than patients with a high SES (80 vs. 76 and 75 years resp.,  $p < 0.001$ ) (Table 1). Male patients less frequently had a low SES than intermediate and high SES patients (38.6% vs. 46.3% and 48.6% resp.,  $p < 0.001$ ). The GP had referred patients in the low SES-group more often than in the intermediate and high SES-group (61.8% vs. 57.8% and 56.0% resp.,  $p = 0.03$ ). Patients in the low SES-group used more medications than the high SES-group (3.3 vs. 1.9,  $p < 0.001$ ).

#### Organizational and clinical parameters in the ED and SES

There were no differences in the specialties (surgical vs. medical) that treated the patients nor in time of presentation between the three SES groups (Table 2). In addition, the vital parameters at presentation were comparable between the three groups. Patients with a low SES more often had a higher urgent triage level than the high SES-group, however, this difference was not significant (15.4% vs. 12.1%,  $p = 0.02$ ). In the low and the intermediate SES-group, more diagnostics tests were performed than in the high SES-group (mean 2.3 vs. 2.1 vs. 2.0, resp.,  $p < 0.001$ ). Patients with low SES had a longer ED-LOS than patients with intermediate and high SES (140 min vs. 133 vs. 133, resp.  $p = 0.01$ ). Diagnoses differed between the three groups: endocrine diseases were more common in the low SES group (3.1%) than the intermediate or high SES group (1.7% and 1.6%,  $p = 0.03$ ), and the same was observed for infectious diseases. (Table 2).

**Table 2. Organisational and clinical parameters of older adult ED patients within the different SES groups.**

	Socioeconomic Status			P-value
	Low N = 1660 (33.1%)	Intermediate N = 1640 (34.0%)	High N = 1588 (32.9%)	
<b>Specialism</b>				0.16
Medical	879 (54.9%)	858 (52.3%)	822 (51.8%)	
Surgical	721 (45.1%)	782 (47.7%)	766 (48.2%)	
<b>Shift</b>				0.15

Morning	1130 (70.9%)	1148 (70.2%)	1169 (73.7%)	
Evening	240 (21.3%)	354 (21.7%)	318 (20.0%)	
Night	124 (7.8%)	133 (8.1%)	100 (6.3%)	
<b>Level of triage</b>				
Low*	628 (39.8%)	640 (39.7%)	687 (44.0%)	0.02
Moderate	702 (44.5%)	730 (35.3%)	683 (43.7%)	0.69
Urgent	246 (15.4%)	242 (14.8%)	192 (12.1%)	0.02
No triage	24 (1.5%)	28 (1.7%)	26 (1.6%)	0.98
<b>No. of extra consultations at ED</b>				0.80
None	1376 (86.0%)	1407 (85.6%)	1365 (86.0%)	
1	200 (12.5%)	215 (13.1%)	199 (12.5%)	
≥2	24 (0.5%)	18 (1.1%)	24 (1.4%)	
<b>Vital parameters</b>				
Systolic blood pressure (mmHg), mean (SD)	152 (31.7)	153 (31.3)	152 (30.8)	0.94
Missing	428 (26.9%)	530 (32.4%)	545 (35.5%)	
Heart rate (min), mean (SD)	81.5 (17.0)	82.5 (18.1)	82.1 (17.7)	0.32
Missing	734 (45.9%)	806 (49.1%)	819 (51.6%)	
<b>Medical procedures at ED</b>				
No. of diagnostic tests, mean (SD)	2.3 (1.8)	2.1 (1.8)	2.0 (1.7)	<0.001#
Laboratory test (%)*	1081 (67.9%)	1046 (64.1%)	974 (61.7%)	<0.001
CRP (mg/L), median (IQR)	16 (60)	14 (55)	15 (66)	0.47
Leukocytes (x10 <sup>9</sup> /L), median (IQR)	9.2 (6)	9.3 (5)	8.8 (5)	0.91
<b>Diagnosis at ED</b>				
Injury	487 (30.6%)	504 (30.8%)	508 (32.2%)	0.56
Otherwise	280 (17.6%)	286 (17.5%)	289 (18.3%)	0.79
Circulatory / Respiratory	232 (14.6%)	257 (15.7%)	201 (12.7%)	0.06
Other	202 (12.7%)	217 (13.3%)	218 (18.3%)	0.64
Digestive	163 (10.2%)	175 (10.8%)	169 (10.7%)	0.88

Genito-urinary	68 (4.3%)	73 (4.5%)	58 (3.7%)	0.51
Infectious	65 (4.1%)	52 (3.2%)	45 (2.8%)	0.14
Endocrine / Metabolic	50 (3.1%)	28 (1.7%)	25 (1.6%)	0.03
Neoplasm / haematology	47 (2.9%)	52 (3.2%)	70 (4.4%)	0.05
<i>Missing</i>	6 (0.4%)	3 (0.2%)	9 (0.6%)	
<b>ED-LOS in minutes, median (IQR)*</b>	140 (83)	133 (90)	133 (87)	0.01@

1 SES = Socioeconomic Status. SD = Standard deviation. ED = Emergency department. CRP = C-reactive protein.  
 2 ED-Diagnosis 'other' (ICD-10 classification) = diseases of the nervous system, musculoskeletal and connective  
 3 tissue, skin and subcutaneous tissue, eye and adnexa, ear and mastoid and mental.

4 P-values low, intermediate and high SES: using the Chi-square test, ANOVA (post-hoc Tukey) and Mann-  
 5 Whitney-U-test.

6 \* =  $p < 0.05$ .

7 # = p-value low vs intermediate  $< 0.001$ , low vs high  $< 0.001$ , intermediate vs. high  $< 0.01$ .

8 @ = p-value low vs intermediate 0.01, low vs high 0.004, intermediate vs. high 0.93.

### 11 Patient outcomes and SES

12 Patients with a low SES were more frequently hospitalised than the intermediate and high SES-group (62.3% vs.  
 13 55.4% vs. 52.3%, resp.,  $p < 0.001$ , Table 3). In addition, patients with a low SES had a longer hospital-LOS than  
 14 patients with a high SES (6.0 vs. 5.0 days,  $p < 0.001$ ). However, the hospital-LOS did not differ between  
 15 intermediate SES and high SES patients (5 days in both groups,  $p = 0.45$ ). The finding that low SES patients were  
 16 more often hospitalised than the high SES group turned out not to be independent of age and comorbidity  
 17 (adjusted OR 1.3 95% CI 0.9–1.4, Table 3). When stratified according to living situation, low SES community-  
 18 dwelling patients had a higher risk of hospitalisation with an OR of 1.3 (95% CI 1.1–1.7) compared with patients  
 19 with a high SES. In contrast, institutionalized low SES patients had a lower risk of hospitalisation with an OR of  
 20 0.2 (95% CI: 0.1–0.7). Intermediate SES patients did not have a higher odd for hospitalisation (OR 1.0 95% CI  
 21 0.95–1.4) than high SES patients.



1 **Table 3. Multivariable analysis of the effect on SES on ED outcomes and within different living situations.**

	Socioeconomic Status	Number (%)	All patients N = 4828 (OR 95%CI)	Community-dwelling patients N = 4381 (OR 95%CI)	Institutionalized patients N = 443 (OR 95%CI)
Hospitalisation <sup>1</sup>	Low	996/1660 (62.3%)	1.1 (0.9-1.4)	<b>1.3 (1.1-1.7)</b>	<b>0.2 (0.1–0.7)</b>
	Intermediate	909/1640 (55.4%)	1.1 (0.9-1.4)	1.1 (0.95-1.4)	0.4 (0.1-1.2)
	High	830/1588 (52.3%)	1.0	1.0	1.0
In-hospital mortality <sup>2</sup>	Low	86/996 (5.4%)	1.2 (0.7-2.0)	1.4 (0.8-2.6)	0.8 (0.1-6.8)
	Intermediate	58/909 (3.5%)	1.1 (0.6-1.9)	1.3 (0.8-2.2)	0.4 (0.1-4.0)
	High	55/830 (3.5%)	1.0	1.0	1.0
30-day ED-revisits <sup>3#</sup>	Low	184/1514 (11.5%)	1.0 (0.8-1.4)	1.0 (0.7-1.4)	1.0 (0.2-4.7)
	Intermediate	220/1582 (13.5%)	0.9 (0.7-1.1)	0.8 (0.6-1.1)	0.8 (0.2-4.6)
	High	196/1533 (12.3%)	1.0	1.0	1.0

2 ED = Emergency Department. OR = Odds Ratio. CI = confidence Interval.  
3 1 = adjusted variable include age and Charlson comorbidity index.  
4 2 = adjusted for age, Charlson comorbidity index, and triage level.  
5 3 = adjusted for age, Charlson comorbidity index and gender. # = without patients who died during  
6 hospitalisation.

8 In-hospital mortality was higher for the low SES group (5.4%) compared with the intermediate (3.5%)  
9 and the high SES group (3.5%,  $p=0.01$ , unadjusted  $OR_{low\_vs\_high} :0.6$  95% CI 0.4-0.9). The difference in in-hospital  
10 mortality between low and high SES patients was no longer significant when adjusted for age, comorbidity and  
11 triage level (adjusted OR 1.2 95% CI 0.7–2.0).

12 There was no difference in 30-day ED-revisit rate between the low, intermediate and high SES group  
13 (21.3%, 20.4% vs. 20.8%, resp.,  $p=0.88$ ). Neither was the 30-day ED-revisit rate different after correcting for  
14 age, comorbidity and gender (adjusted OR 1.0, 95% CI 0.8–1.4). Moreover, adjusting for the living situation did  
15 not alter the results significantly (Table 3).

## 17 Discussion

18 Our study was a large population-based study that investigated the association of SES with ED visits of older  
19 adult ( $\geq 65$  years) patients. We found that older adult community-dwelling ED patients with a low SES have a  
20 higher risk of hospitalisation than patients with a high SES. Moreover, low SES patients had more often a higher

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3 1 triage level, had more diagnostics test and longer ED-LOS compared to other SES groups. However, in-hospital  
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5 2 mortality and the number of ED-return visits were not different between the three SES groups.

6  
7 3 We hypothesized that patients with low SES would be less healthy than those with a higher SES, which  
8  
9 4 indirectly would result in higher admission rates and in-hospital mortality after presentation at the ED. Our  
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11 5 data allowed us to determine important confounders, such as comorbidity, organisational factors and the  
12  
13 6 severity of illness at the ED, which makes it possible to contribute important information to already existing  
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15 7 evidence on the topic of SES, where some studies did not adjust for potential and important confounders  
16  
17 8 (7,25). Our study indeed observed a higher chance of hospitalisation (OR 1.3 CI 1.1-1.7) for community-dwelling  
18  
19 9 patients with a low SES than for patients with intermediate/high SES. This finding is in line with other studies  
20  
21 10 (9,26,27). It may be possible that part of the community-dwelling frail patients were admitted for care  
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23 11 problems, which is not a reason for admission for institutionalized patients as extra care is available for these  
24  
25 12 patients. Future studies should elaborate the living arrangements and social network of older adults to  
26  
27 13 investigate the influence of these matters on ED usage.

28  
29 14 In-hospital mortality and ED-revisits within 30 days were not associated with SES. This contrasts with  
30  
31 15 other studies that found a higher risk of in-hospital mortality and readmissions in older adult patients with a  
32  
33 16 low SES (8,16,17), but is in line with other studies that did not found an association (11,12,18). The association  
34  
35 17 of low SES and adverse outcomes was found in studies that included patients with a specific diagnosis (e.g.  
36  
37 18 pneumonia or heart failure) (18,28) or that analysed the number of ED visits per SES category (4,6,9,29),  
38  
39 19 whereas our study focused on an undifferentiated, and therefore, more generalizable, older adult ED  
40  
41 20 population. Another reason not finding an association between low SES and outcomes might be that most  
42  
43 21 studies did not account for differences in living situation (17,30,31). We found that care and nursing homes  
44  
45 22 were mostly situated in low SES areas, while their inhabitants will probably belong to all three SES (32).  
46  
47 23 Additionally, institutionalized patients may influence revisit rates, because they are treated by their own doctor  
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49 24 in the nursing home. It may be useful to take the living situation into account when using SES based on zip  
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51 25 code, because care facilities structures at home influence ED outcomes.

52  
53 26 The fact that we did not find an association between SES and in-hospital mortality and revisits may be  
54  
55 27 due to the organisation of the health care system in the Netherlands and may underscore/reflect that our  
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57 28 health care is indeed accessible to all patients, regardless of their SES. In the Netherlands, the health care  
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59 29 system consists of a well organised GP-network, with 24-hours a day access for acute care patients, which is

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3 1 equally accessible for every inhabitant (29). In the Netherlands, care provided by the general practitioner is  
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5 2 fully covered by the basic obligatory health insurance (33). Therefore this system provides equal access to  
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7 3 health care by the general practitioner to every resident, independent of their SES (5,34-36). In addition, this  
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9 4 care selects the most severely ill patients for referral to the ED. The acute health care system differs over the  
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11 5 countries, and in some countries, for instance the United States, the ED is used as a safety-net for underserved  
12  
13 6 and uninsured patients (37). Also, even important, the financial health care structure is different worldwide In  
14  
15 7 short, specifically regarding acute care, differences in organization and financial coverage of acute care make  
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17 8 comparisons between countries difficult (38).

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19 9 In the Netherlands, older adults are, in general, financially well-covered (39), as only 3.5% of them are  
20  
21 10 poor (39). Concerning other studies on older adults and SES, the methods of determining SES differed  
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23 11 substantially, and some included education, income and occupancy, but none of the methods have proved to  
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25 12 be comprehensive enough (40). One study in Canada among older adults that determined factors of ED usage  
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27 13 matched postal codes with several indicators, such as income, employment and living alone (10). In a  
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29 14 Mediterranean study, SES was defined on years of education and the mean annual income of the family (41). In  
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31 15 conclusion, the comparison of studies on SES is complicated by different levels of SES in the general population  
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33 16 and of the way SES is defined.

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35 17 Apart from the above mentioned, the following study limitations should be mentioned. Firstly, our  
36  
37 18 results are not generalizable to cardiology and gynaecology patients as we excluded these patients. For these  
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39 19 cardiology patients, it is known that low SES may have a stronger association with adverse outcomes (42), and  
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41 20 excluding these from our study may explain that we did not find associations between SES and outcome  
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43 21 (except for hospitalisation in community dwelling patients). Secondly, we retrieved SES on basis of zip codes,  
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45 22 which may be imprecise and yield smaller associations of SES with adverse outcomes (43). However, one zip  
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47 23 code in the database of Statistics Netherlands covers only 17 households and therefore, we consider this way  
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49 24 of retrieving SES rather reliable (44,45). Thirdly, retrieving SES of patients living in a nursing home or other care  
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51 25 home facilities on basis of zip code is probably not reliable. Therefore, we made subgroup analysis of  
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53 26 community dwelling patients and institutionalized patients, which is a strong point of our study. Lastly, coding  
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55 27 for the living situation may not be precise, but we think that this does not lead to an underestimation since the  
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57 28 percentage of institutionalized patients (9.1%) is almost similar as percentages given in another study (9.0%)  
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59 29 (46).

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3 1 In this study, we provided important information in terms of health outcomes on the SES in the acute  
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5 2 health care setting in the vulnerable older adult population. We investigated a large unselected group of older  
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7 3 adult ED patients stratified to living situation, which provides additional knowledge on the care and problems  
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9 4 of older adult patients in the ED. Our study shows that in a country with assumed equal health care access only  
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11 5 minor outcome differences were observed between different SES groups. Therefore, physicians should be  
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13 6 aware of the potential differences between SES groups given the higher chance of hospitalisation.  
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15 7 Improvement in adequately diagnosing and treating older adult patients is important, but the additional value  
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17 8 of SES in the emergency care should be evaluated further to develop effective interventions to ensure high  
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19 9 quality of care. Future studies should elaborate the living arrangements and social network of older adults,  
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21 10 because these probably influences access to the ED and the number of (re-)admissions.

22 11 In conclusion, low SES community-dwelling older adults were more often hospitalised than high SES  
23  
24 12 community-dwelling patients, but no differences in in-hospital mortality and ED-revisits between the SES  
25  
26 13 groups.

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3 1 **Contributorship statement**

4 2 JW and SB conceived the study and designed the protocol. SL contributed to the design for the overall older  
5  
6 3 adults project. JW, PS and ID analyzed and interpreted the data. HH supervised the conduct of the study and  
7  
8 4 data collection. JW, PS and ID drafted the manuscript. MA helped with the statistical analyses. JW designed the  
9  
10 5 database. JW, ID, PS, SB, MA, SL and HH contributed substantially to its revision and approved the final  
11  
12 6 manuscript.  
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16 8 **Data sharing statement**

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18 9 Data of the study is available from the data governance board of Maxima Medical Centre Institutional Data  
19  
20 10 Access / Ethics Committee for researchers who meet the criteria for access to confidential data. Data are from  
21  
22 11 the non-specific complaints study when contacting the data governance board (Jolanda.Luime@mmc.nl).  
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2 **References**

- 3 (1) Hoogendijk EO, van Hout HP, Heymans MW, van der Horst HE, Frijters DH, Broese van Groenou MI, et al.  
4 Explaining the association between educational level and frailty in older adults: results from a 13-year  
5 longitudinal study in the Netherlands. *Ann Epidemiol* 2014 Jul;24(7):538-44.e2.
- 6 (2) Lowthian JA, Curtis AJ, Cameron PA, Stoelwinder JU, Cooke MW, McNeil JJ. Systematic review of trends in  
7 emergency department attendances: an Australian perspective. *Emerg Med J* 2011 May;28(5):373-377.
- 8 (3) Mackenbach JP, Stirbu I, Roskam AJ, Schaap MM, Menvielle G, Leinsalu M, et al. Socioeconomic inequalities  
9 in health in 22 European countries. *N Engl J Med* 2008 Jun 5;358(23):2468-2481.
- 10 (4) Droomers M, Westert GP. Do lower socioeconomic groups use more health services, because they suffer  
11 from more illnesses? *Eur J Public Health* 2004 Sep;14(3):311-313.
- 12 (5) van Doorslaer E, Wagstaff A, van der Burg H, Christiansen T, De Graeve D, Duchesne I, et al. Equity in the  
13 delivery of health care in Europe and the US. *J Health Econ* 2000 Sep;19(5):553-583.
- 14 (6) Khan Y, Glazier RH, Moineddin R, Schull MJ. A population-based study of the association between  
15 socioeconomic status and emergency department utilization in Ontario, Canada. *Acad Emerg Med* 2011  
16 Aug;18(8):836-843.
- 17 (7) Tozer AP, Belanger P, Moore K, Caudle J. Socioeconomic status of emergency department users in Ontario,  
18 2003 to 2009. *CJEM* 2014 May;16(3):220-225.
- 19 (8) Begley C, Basu R, Lairson D, Reynolds T, Dubinsky S, Newmark M, et al. Socioeconomic status, health care  
20 use, and outcomes: persistence of disparities over time. *Epilepsia* 2011 May;52(5):957-964.
- 21 (9) Filc D, Davidovich N, Novack L, Balicer RD. Is socioeconomic status associated with utilization of health care  
22 services in a single-payer universal health care system? *Int J Equity Health* 2014 Nov 28;13:115-014-0115-1.
- 23 (10) Ionescu-Ittu R, McCusker J, Ciampi A, Vadeboncoeur AM, Roberge D, Larouche D, et al. Continuity of  
24 primary care and emergency department utilization among elderly people. *CMAJ* 2007 Nov 20;177(11):1362-  
25 1368.
- 26 (11) Ho KM, Dobb GJ, Knuiman M, Finn J, Webb SA. The effect of socioeconomic status on outcomes for  
27 seriously ill patients: a linked data cohort study. *Med J Aust* 2008 Jul 7;189(1):26-30.
- 28 (12) Alter DA, Chong A, Austin PC, Mustard C, Iron K, Williams JI, et al. Socioeconomic status and mortality after  
29 acute myocardial infarction. *Ann Intern Med* 2006 Jan 17;144(2):82-93.
- 30 (13) Samaras N, Chevalley T, Samaras D, Gold G. Older patients in the emergency department: a review. *Ann  
31 Emerg Med* 2010 Sep;56(3):261-269.
- 32 (14) Ramos M. Impact of socioeconomic status on Brazilian elderly health. *Rev Saude Publica* 2007  
33 Aug;41(4):616-624.
- 34 (15) Cournane S, Conway R, Byrne D, O'Riordan D, Coveney S, Silke B. Social deprivation and the rate of  
35 emergency medical admission for older persons. *QJM* 2016 Oct;109(10):645-651.
- 36 (16) Hutchings A, Raine R, Brady A, Wildman M, Rowan K. Socioeconomic status and outcome from intensive  
37 care in England and Wales. *Med Care* 2004 Oct;42(10):943-951.

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2  
3 1 (17) Rathore SS, Masoudi FA, Wang Y, Curtis JP, Foody JM, Havranek EP, et al. Socioeconomic status, treatment,  
4 2 and outcomes among elderly patients hospitalized with heart failure: findings from the National Heart Failure  
5 3 Project. *Am Heart J* 2006 Aug;152(2):371-378.
- 6  
7 4 (18) Izquierdo C, Oviedo M, Ruiz L, Sintes X, Vera I, Nebot M, et al. Influence of socioeconomic status on  
8 5 community-acquired pneumonia outcomes in elderly patients requiring hospitalization: a multicenter  
9 6 observational study. *BMC Public Health* 2010 Jul 15;10:421-2458-10-421.
- 10  
11 7 (19) Brouns SHA, Dortmans MKJ, Jonkers FS, Lambooj SLE, Kuijper A, Haak HR. Hyponatraemia in Elderly  
12 8 Emergency Department Patients: A Marker of Frailty. *Neth J Med* 2014;72(6):311-317.
- 13  
14 9 (20) Centraal bureau voor de statistiek. Inhoud kerncijfers postcodegebieden 2008-2010. 2012.
- 15  
16 10 (21) Kunst A.E. Bos V. Mackenback J.P. Monitoring socioeconomic inequalities in health in the european union:  
17 11 guidelines and illustrations. EU Working Group on Socio-economic Inequalities in Health 2011.
- 18  
19 12 (22) Needham DM, Scales DC, Laupacis A, Pronovost PJ. A systematic review of the Charlson comorbidity index  
20 13 using Canadian administrative databases: a perspective on risk adjustment in critical care research. *J Crit Care*  
21 14 2005 Mar;20(1):12-19.
- 22  
23 15 (23) Zachariasse JM, Seiger N, Rood PP, Alves CF, Freitas P, Smit FJ, et al. Validity of the Manchester Triage  
24 16 System in emergency care: A prospective observational study. *PLoS One* 2017 Feb 2;12(2):e0170811.
- 25  
26 17 (24) Quan H, Sundararajan V, Halfon P, Fong A, Burnand B, Luthi JC, et al. Coding algorithms for defining  
27 18 comorbidities in ICD-9-CM and ICD-10 administrative data. *Med Care* 2005 Nov;43(11):1130-1139.
- 28  
29 19 (25) Bagher A, Andersson L, Wingren CJ, Ottosson A, Wangejord S, Acosta S. Socio-economic status and major  
30 20 trauma in a Scandinavian urban city: A population-based case-control study. 2016;44:217-223.
- 31  
32 21 (26) Robert S. Stern M, Joel S. Weissman P, Arnold M. Epstein, MD, MA. The emergency department as a  
33 22 pathway to admission for poor and high cost patients. *JAMA* 1991;266(16):2238-2243.
- 34  
35 23 (27) Raffaele Antonelli-Incalzi, Carla Ancona, Francesco Forastiere, Valeria Belleudi, Andrea Corsonello, Carlo A  
36 24 Perucci. Socioeconomic status and hospitalization in the very old: a retrospective study. *BMC Public Health*  
37 25 2007;7(227).
- 38  
39 26 (28) Bhayana R, Vermeulen MJ, Li Q, Hellings CR, Berdahl C, Schull MJ. Socioeconomic status and the use of  
40 27 computed tomography in the emergency department. *CJEM* 2014 Jul;16(4):288-295.
- 41  
42 28 (29) van der Meer JB, van den Bos J, Mackenbach JP. Socioeconomic differences in the utilization of health  
43 29 services in a Dutch population: the contribution of health status. *Health Policy* 1996 Jul;37(1):1-18.
- 44  
45 30 (30) Cressman AM, Macdonald EM, Yao Z, Austin PC, Gomes T, Paterson JM, et al. Socioeconomic status and  
46 31 risk of hemorrhage during warfarin therapy for atrial fibrillation: A population-based study. *Am Heart J* 2015  
47 32 Jul;170(1):133-40, 140.e1-3.
- 48  
49 33 (31) Govindarajan P, Gonzales R, Maselli JH, Johnston SC, Fahimi J, Poisson S, et al. Regional differences in  
50 34 emergency medical services use for patients with acute stroke (findings from the National Hospital Ambulatory  
51 35 Medical Care Survey Emergency Department Data File). *J Stroke Cerebrovasc Dis* 2013 Nov;22(8):e257-63.
- 52  
53 36 (32) Arendts G, Howard K. The interface between residential aged care and the emergency department: a  
54 37 systematic review. *Age Ageing* 2010 May;39(3):306-312.

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2  
3 1 (33) van der Linden MC, Lindeboom R, de Haan R, van der Linden N, de Deckere ER, Lucas C, et al. Unscheduled  
4 2 return visits to a Dutch inner-city emergency department. *Int J Emerg Med* 2014 Jul 5;7:23-014-0023-6.  
5 3 eCollection 2014.
- 6  
7 4 (34) Pines JM, Hilton JA, Weber EJ, Alkemade AJ, Al Shabanah H, Anderson PD, et al. International perspectives  
8 5 on emergency department crowding. *Acad Emerg Med* 2011;18(12):1358-1370.
- 9  
10 6 (35) van der Linden MC, Lindeboom R, van der Linden N, van den Brand CL, Lam RC, Lucas C, et al. Self-referring  
11 7 patients at the emergency department: appropriateness of ED use and motives for self-referral. *Int J Emerg*  
12 8 *Med* 2014 Jul 16;7:28-014-0028-1. eCollection 2014.
- 13  
14 9 (36) Holmes JL. Emergency medicine in the Netherlands. *Emergency Medicine Australasia* 2010;22(1):75-81.
- 15  
16 10 (37) Di Somma S, Paladino L, Vaughan L, Lalle I, Magrini L, Magnanti M. Overcrowding in emergency  
17 11 department: an international issue. *Intern Emerg Med* 2015 Mar;10(2):171-175.
- 18  
19 12 (38) Grundy E, Holt G. The socioeconomic status of older adults: how should we measure it in studies of health  
20 13 inequalities? *J Epidemiol Community Health* 2001 Dec;55(12):895-904.
- 21  
22 14 (39) Smits CH, van den Beld HK, Aartsen MJ, Schroot JJ. Aging in the Netherlands: state of the art and science.  
23 15 *Gerontologist* 2014 Jun;54(3):335-343.
- 24  
25 16 (40) Martelin T. Mortality by indicators of socioeconomic status among the Finnish elderly. *Soc Sci Med* 1994  
26 17 May;38(9):1257-1278.
- 27  
28 18 (41) Katsarou A, Tyrovolas S, Psaltopoulou T, Zeimbekis A, Tsakountakis N, Bountziouka V, et al. Socio-economic  
29 19 status, place of residence and dietary habits among the elderly: the Mediterranean islands study. *Public Health*  
30 20 *Nutr* 2010 Oct;13(10):1614-1621.
- 31  
32 21 (42) Carlsson AC, Li X, Holzmann MJ, Wandell P, Gasevic D, Sundquist J, et al. Neighbourhood socioeconomic  
33 22 status and coronary heart disease in individuals between 40 and 50 years. *Heart* 2016 May 15;102(10):775-782.
- 34  
35 23 (43) Aarts MJ, van der Aa MA, Coebergh JW, Louwman WJ. Reduction of socioeconomic inequality in cancer  
36 24 incidence in the South of the Netherlands during 1996-2008. *Eur J Cancer* 2010 Sep;46(14):2633-2646.
- 37  
38 25 (44) Bos, V. Kunst, A.E., Mackenbach, J. in verslag aan de Programmacommissie Sociaal-economische  
39 26 gezondheidsverschillen II [In Dutch]. Instituut Maatschappelijke Gezondheidszorg, Erasmus Universiteit,  
40 27 Rotterdam 2000.
- 41  
42 28 (45) Smits, J. Keij, I. Mackenbach, J.P. in Sociaal-economische gezondheidsverschillen: Van verklaren naar  
43 29 verkleinen [In Dutch]. Zon/MW, Den Haag 2001.
- 44  
45 30 (46) Ribbe MW, Ljunggren G, Steel K, Topinkova E, Hawes C, Ikegami N, et al. Nursing homes in 10 nations: a  
46 31 comparison between countries and settings. *Age Ageing* 1997 Sep;26 Suppl 2:3-12.



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1 **Figures**

2 **Figure 1. The Flow chart of older adult patients divided into three SES groups.**

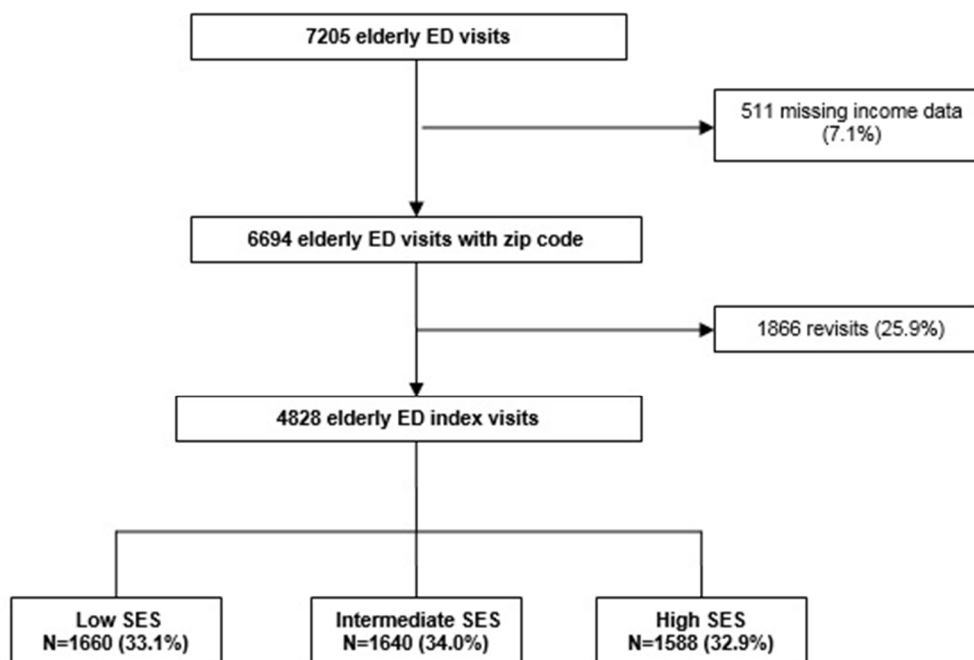
3 ED = Emergency department. SES = Socioeconomic Status

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**STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cohort studies***

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
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
<b>Methods</b>			
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) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	5
		(b) For matched studies, give matching criteria and number of exposed and unexposed	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	1
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	5-6
Bias	9	Describe any efforts to address potential sources of bias	6
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	6
		(b) Describe any methods used to examine subgroups and interactions	5-6
		(c) Explain how missing data were addressed	6
		(d) If applicable, explain how loss to follow-up was addressed	
		(e) Describe any sensitivity analyses	6
<b>Results</b>			

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 (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram	7
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest (c) Summarise follow-up time (eg, average and total amount)	7-8 7-12
Outcome data	15*	Report numbers of outcome events or summary measures over time	11-12
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 (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	11-12
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	11-12
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	
<b>Limitations</b>			
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 13-15
Generalisability	21	Discuss the generalisability (external validity) of the study results	14
<b>Other information</b>			
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	

\*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](http://www.strobe-statement.org).