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Background and importance **Although aging societies in Western Europe use presenting complaints (PCs) in emergency departments (EDs) triage systems to determine the urgency and severity of the care demand, it is unclear whether their prognostic value is age-dependent.**

Objective **To assess the frequency and association of PCs with hospitalization and mortality across age categories.**

Methods **An observational multicenter study using all consecutive visits of three EDs in the Netherlands Emergency department Evaluation Database. Patients were stratified by age category (0–18; 19–50; 51–65; 66–80; >80 years), in which the association between PCs and case-mix adjusted hospitalization and mortality was studied using multivariable logistic regression analysis (adjusting for demographics, hospital, disease severity, comorbidity and other PCs)**

Results **We included 172 104 ED-visits. The most frequent PCs were 'extremity problems' [range across age categories (13.5–40.8%)], 'feeling unwell' (9.5–23.4%), 'abdominal pain' (6.0–13.9%), 'dyspnea' (4.5–13.3%) and 'chest pain' (0.6–10.7%). For most PCs, the observed and the case-mix-adjusted odds for hospitalization and mortality increased the higher the age category. The most common PCs with the highest adjusted odds ratios (AORs, 95% CI) for hospitalization were 'diarrhea and vomiting' [2.30 (2.02–2.62)] and 'feeling unwell' [1.60 (1.48–1.73)]. Low hospitalization risk was found for 'chest pain' [0.58 (0.53–0.63)] and 'palpitations' [0.64 (0.58–0.71)].**

Conclusions **Frequency of PCs in ED patients varies with age, but the same PCs occur in all age categories. For most PCs, (case-mix adjusted) hospitalization and mortality vary across age categories. 'Chest pain' and 'palpitations,' usually triaged 'very urgent', carry a low risk for hospitalization and mortality.** ***European Journal of Emergency Medicine*** **29: 33–41 Copyright © 2021 Wolters Kluwer Health, Inc. All rights reserved.**

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Background

The chief presenting complaint of an emergency department (ED) patient represents the most patient-centered and low-cost clinical characteristic. Although in aging societies such as Western Europe, presenting complaints are used in triage systems of EDs to determine the urgency and severity of the care demand, it is unclear whether their prognostic value is age dependent. In addition, whereas presenting complaints like chest pain or neurologic deficits have already been proven important in (pre)hospital triage and risk stratification algorithms [1,2] it is unclear whether this is also true for other presenting complaints.

Several studies have shown the prognostic importance of presenting complaints with regard to relevant clinical outcomes [3–8]. However, most of these studies had a small sample size or were limited to ED patients consisting of nonsurgical or nontrauma patients, elderly patients

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or patients with nonspecific presenting complaints. Also, in most studies examining the association between presenting complaints and clinical outcomes, only a small number of covariates were adjusted for. More importantly, none of these studies have taken into account that the prognostic importance of presenting complaints may be affected by age, that is presenting complaints are likely to reflect different underlying diseases and etiologies in younger compared to older patients, with noncomparable prognostic performance [9,10]. The distribution of presenting complaints is known to differ between age groups, suggesting that other management strategies may be appropriate for different age groups [9,11–13].

If the number and prognostic performance of presenting complaints differ per age category, this has several consequences for clinical practice: First, the use of presenting complaints in many triage systems may therefore need to be adjusted by age, which is especially important because most European populations are aging, resulting in more ED visits of older patients for whom efficiency in resource and treatment allocation is essential to limit healthcare costs [14,15]. Second, better use of patient-oriented characteristics such as presenting complaints will facilitate optimal diagnostic work-up, risk stratification and disposition to an appropriate level of care [16], reducing the pressure on scarce hospital resources. Finally, if presenting complaint's number and prognostic performance depend on age, this may also have consequences for prehospital risk stratification and patient distribution in the near future. For example, in the Netherlands, patient journeys, using presenting complaints rather than diagnoses as a starting point, are suggested to determine to which EDs a patient has to be transported. Given the importance of a symptom-oriented approach in triage, work-up and disposition at the ED, it is not unlikely that this approach will be increasingly applied in the chain acute care organization [17].

The aim of this study was therefore two-fold. First, to assess the frequency of presenting complaints in ED patients of different age categories. Second, to investigate the association between presenting complaints and clinical outcomes (hospitalization and in-hospital mortality) in different age categories in a Dutch ED setting.

Methods

Study design and setting

An observational multicenter study, conducted in three EDs in the Netherlands: the Leiden University Medical center (LUMC; tertiary care center), Medical center Leeuwarden (MCL; urban care center) and the Catharina Hospital Eindhoven (CHE; urban care center). After inclusion, patients were stratified into five age categories: 0–18 years (children), 19–50 years (young adults), 51–65 years (middle-aged), 66–80 years (older patients) and >80 years (very old). The study was approved by the medical ethics committee of the LUMC and registered in the Netherlands Trial Register (NL8743).

Selection of participants

All consecutive ED patients with a registered presenting complaint in the Netherlands Emergency Department Evaluation Database (NEED) database were included in the study.

Data collection

Data were collected from NEED, the Dutch quality registry for EDs, at LUMC (1 January 2017–8 June 2019), at MCL (1 January 2017–31 December 2019) and at CHE (1 January 2019–12 January 2020). The EDs used different triage systems to register presenting complaints: the Dutch Triage Standard [14] (NTS) in CHE and MCL (1 January 2017–29 August 2018) and the Manchester Triage System [15] (MTS) in the LUMC and MCL (30 August 2018–31 December 2019). NTS and MTS were merged into one list of synchronized presenting complaints (Supplementary File 1, Supplemental digital content 1, *http://links.lww.com/EJEM/A316*). Data on the following potential confounders were used to adjust for in the analyses: demographics, proxies for urgency, disease severity, and comorbidity and complexity. For urgency, triage categories were used. Proxies of disease severity include Glasgow Coma Scale (GCS), amount of fluid administration and the 'vital score', a categorical item composed of the vital signs (respiratory rate, O_2 saturation, SBP and DBP, heart rate and temperature), as seen in Supplementary File 2, Supplemental digital content 1, *http://links.lww.com/EJEM/A316*. The following proxies of comorbidity and complexity associated with a prolonged ED length of stay (LOS) [18], were used: number of consultations, treating specialty, blood testing, radiology imaging and time of ED visit. In Supplementary File 3, Supplemental digital content 1, *http://links.lww.com/EJEM/A316* the data-dictionary of all items collected in the NEED and their definitions in detail are shown.

The participating hospitals use nurses who received additional training for triage. During triage, the triage nurse determined which presenting complaint was best used for the patient's triage algorithm, determining the urgency with additional questions. This presenting complaint was subsequently registered in the electronic patient file. Top 10 presenting complaints were used for each age category for analyses, which resulted in 16 presenting complaints. This includes 'extremity problems', 'feeling unwell', 'abdominal pain', 'dyspnea', 'chest pain', 'wounds', 'trauma', 'collapse', 'palpitations', 'urinary problems', 'headache', 'falls',

'overdose and poisoning', 'eye complaints', 'facial problems' and 'seizures'. Subsequently, 'behaving strangely or suicidal' and 'diarrhea and vomiting' were added because of high absolute hospitalization and mortality rates. The category 'other' contained all other presenting complaints.

Outcomes measures

The primary outcome was hospitalization on a regular ward, transfer to another hospital, or admission to a high care unit for a specific care need, such as a cardiac care unit (CCU), medium care unit (MCU) or ICU. In a Dutch CCU, patients are predominantly admitted pending emergency coronary angiography, receive telemetric rhythm detection, and may be treated with inotropics or vasopressors, but no invasive ventilation is performed. Patients are admitted to an MCU when they require close observation, or inotropic or vasopressive medication or noninvasive ventilation for non-cardiac conditions. For more intensive treatments such as invasive ventilation, continuous venovenous hemodialysis or extracorporeal membrane oxygenation, and so on, patients are admitted to the ICU. Patients who died in the ED were scored as hospitalized.

The secondary outcome was in-hospital mortality defined as death in the hospital before discharge, including death in the ED and death on arrival at the ED. Patients who were discharged home were scored as survivors.

Data analysis

Sample size calculation

Using the rule of thumb, approximately 5–10 events per variable are needed to prevent overfitting [19,20]. To adjust for 24 potential confounders in the regression analyses, 120–240 events would be required per age category. The NEED contained 164 145 ED visits with presenting complaints measured at the time of this study. Based on previous studies [21,22] we estimated the hospitalization rate ~25% and in-hospital mortality would be ~2%. Assuming an equal distribution of patients among age categories, we would have ~160 000 divided by 5 = 32 000 ED patients per age category. Per age category $0.25 \times 32\,000 = 8000$ patients are hospitalized and $0.02 \times 32\,000 = 640$ patients have died before discharge from the hospital, which corresponds to a sufficient number of patients per age category.

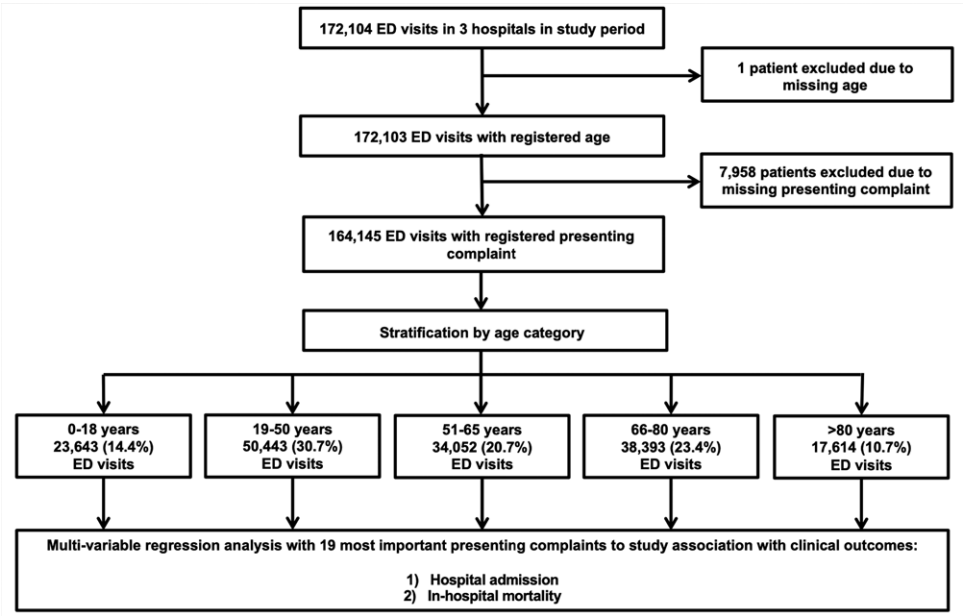
Descriptive statistics

Patients were stratified into five age categories: 0–18, 19–50, 51–65, 66–80 and >80 years. Patient characteristics were summarized per age category. Data were presented as mean with SD when normally distributed. Skewed data were presented as median with interquartile range (IQR). Categorical data were presented as the number with percentages.

Main statistical analyses

Hospitalization and in-hospital mortality were assessed for 19 presenting complaints. Subsequently, multivariable

Fig. 1



Patient flow through study.

Table 1 Patient characteristics in different age groups

	Total cohort	0–18 years	19–50 years	51–65 years	66–80 years	>80 years
Demographics						
N (%)	172104 (100)	25101 (14.6)	53289 (31.0)	35556 (20.7)	39900 (23.2)	18257 (10.6)
Age, mean (SD)	49.9 (25.2)	9.1 (6.1)	34.1 (9.6)	58.3 (4.3)	72.8 (4.2)	85.8 (4.0)
Gender (female), *N* (%)	82812 (48.1)	11137 (44.4)	26014 (48.8)	16896 (47.5)	18408 (46.1)	10357 (56.7)
Urgency						
Triage category, *N* (%)						
Blue and green	53815 (31.3)	11278 (44.9)	18991 (35.6)	9566 (26.9)	9566 (24.0)	4414 (24.2)
Yellow	68445 (39.8)	8866 (35.3)	21059 (39.5)	14524 (40.8)	16395 (41.1)	7601 (41.6)
Orange	36128 (21.0)	3283 (13.1)	9191 (17.2)	8452 (23.8)	10476 (26.3)	4726 (25.9)
Red	6216 (3.6)	264 (1.1)	1299 (2.4)	1609 (4.5)	2105 (5.3)	939 (5.1)
Top 19 presenting complaints, *N* (%)						
(missing)[a]	(7959) (4.6)	(1458) (5.8)	(2846) (5.3)	(1504) (4.2)	(1507) (3.8)	(643) (3.5)
Extremity problems	36614 (21.3)	10242 (40.8)	11934 (22.4)	5963 (16.8)	5371 (13.5)	3104 (17.0)
Feeling unwell	26653 (15.5)	2605 (10.4)	5052 (9.5)	6110 (17.2)	8613 (21.6)	4273 (23.4)
Abdominal pain	17425 (10.1)	1583 (6.3)	7413 (13.9)	3939 (11.1)	3397 (8.5)	1093(6.0)
Dyspnea	14369 (8.3)	1362 (5.4)	2389 (4.5)	3098 (8.7)	5088 (12.8)	2432 (13.3)
Chest pain	12196 (7.1)	161 (0.6)	3153 (5.9)	3812 (10.7)	3772 (9.5)	1298 (7.1)
Wounds	8395 (4.9)	1422 (5.7)	3688 (6.9)	1589 (4.5)	1257 (3.2)	439 (2.4)
Trauma	6216 (3.6)	1247 (5.0)	2008 (3.8)	1080 (3.0)	1113 (2.8)	768 (4.2)
Collapse	4484 (2.6)	130 (0.5)	945 (1.8)	1016 (2.9)	1605 (4.0)	788 (4.3)
Palpitations	3794 (2.2)	57 (0.2)	696 (1.3)	1168 (3.3)	1508 (3.8)	365 (2.0)
Urinary problems	3089 (1.8)	186 (0.7)	739 (1.4)	534 (1.5)	1075 (2.7)	555 (3.0)
Headache	2701 (1.6)	221 (0.9)	1118 (2.1)	610 (1.7)	534 (1.3)	218 (1.2)
Falls	2594 (1.5)	563 (2.2)	575 (1.1)	492 (1.4)	563 (1.4)	401 (2.2)
Overdose and poisoning	2478 (1.4)	434 (1.7)	1583 (3.0)	319 (0.9)	122 (0.3)	20 (0.1)
Eye problems	2344 (1.4)	271 (1.1)	990 (1.9)	625 (1.8)	359 (0.9)	99 (0.5)
Diarrhea and vomiting	2332 (1.4)	322 (1.3)	611 (1.1)	463 (1.3)	673 (1.7)	263 (1.4)
Facial problems	2269 (1.3)	397 (1.6)	756 (1.4)	347 (1.0)	511 (1.3)	258 (1.4)
Behaving strangely or suicidal	1637 (1.0)	63 (0.3)	518 (1.0)	292 (0.8)	423 (1.1)	341 (1.9)
Seizures	1311 (0.8)	337 (1.3)	504 (0.9)	278 (0.8)	169 (0.4)	23 (0.1)
Other	13244 (7.7)	2040 (8.1)	5771 (10.8)	2317 (6.5)	2240 (5.6)	876 (4.8)
Disease severity						
Glasgow Coma Scale, *N* (%)						
Not assessed	160974 (93.5)	24570 (97.9)	50941 (95.6)	33050 (93.0)	36243 (90.8)	16169 (88.6)
GCS=15	9745 (5.7)	443 (1.8)	2005 (3.8)	2265 (6.4)	3268 (8.2)	1764 (9.7)
GCS <15	1385 (0.8)	88 (0.4)	343 (0.6)	241 (0.7)	389 (1.0)	324 (1.8)
Vital score, *N* (%)						
No vital signs measured[b]	62430 (36.3)	16063 (64.0)	23180 (43.5)	10703 (30.1)	9081 (22.8)	3402 (18.6)
One or more vital signs measured	58193 (33.8)	7799 (31.1)	17920 (33.6)	12196 (34.3)	13807 (34.6)	6471 (35.4)
All vital signs measured	51481 (29.9)	1239 (4.9)	12189 (22.9)	12657 (35.6)	17012 (42.6)	8384 (45.9)
Fluid administration, *N* (%)						
No fluid administration	147695 (85.8)	23537(93.8)	46966 (88.1)	29800 (83.8)	32488 (81.4)	14903 (81.6)
≤500 mL	11539 (6.7)	998 (4.0)	2921 (5.5)	2585 (7.3)	3331 (8.3)	1704 (9.3)
>500 mL	12870 (7.5)	566 (2.3)	3402 (6.4)	3171 (8.9)	4081 (10.2)	1650 (9.0)
ICU/CCU/MCU admission, *N* (%)	5541 (3.2)	137 (0.5)	882 (1.7)	1562 (4.4)	2167 (5.4)	793 (4.3)
Proxies of comorbidity and complexity						
Number of consultations, *N* (%)						
No consultations	71079 (41.3)	13307 (53.0)	23342 (43.8)	14043 (39.5)	14324 (35.9)	6063 (33.2)
1 consultation with specialist	82307 (47.8)	8945 (35.6)	22873 (42.9)	18058 (50.8)	21998 (55.1)	10433 (57.1)
2 consultations with specialist	8356 (4.9)	696 (2.8)	2196 (4.1)	1793 (5.0)	2331 (5.8)	1340 (7.3)
>2 consultation with specialist	1112 (0.6)	86 (0.3)	257 (0.5)	247 (0.7)	326 (0.8)	196 (1.1)
Treating specialty, *N* (%)						
Emergency medicine	33908 (19.7)	6828 (27.2)	12173 (22.8)	6236 (17.5)	5735 (14.4)	2936 (16.1)
Surgery	35561 (20.7)	5787 (23.1)	12408 (23.3)	6901 (19.4)	7109 (17.8)	3356 (18.4)
Medicine	90456 (52.6)	9918 (39.5)	22713 (42.6)	20506 (57.7)	25705 (64.4)	11614 (63.6)
Blood tests, *N* (%)	97584 (56.7)	3863 (15.4)	25745 (48.3)	23751 (66.8)	30106 (75.5)	14119 (77.3)
Blood cultures, *N* (%)	13680 (7.9)	364 (1.5)	2467 (4.6)	3335 (9.4)	5092 (12.8)	2422 (13.3)
Blood gas analysis, *N* (%)	22833 (13.3)	477 (1.9)	4754 (8.9)	5367 (15.1)	8200 (20.6)	4035 (22.1)
Radiology imaging, *N* (%)[c]	94258 (54.8)	11316 (45.1)	25184 (47.3)	20079 (56.5)	24635 (61.7)	13044 (71.4)
Outcome measures						
In-hospital mortality, *N* (%)	2863 (1.7)	16 (0.1)	171 (0.3)	492 (1.4)	1208 (3.0)	976 (5.3)
Hospital admission, *N* (%)	66813 (38.8)	4651 (18.5)	13168 (24.7)	15183 (42.7)	22232 (55.7)	11579 (63.4)

Patient characteristics are presented for the total cohort and for five different age groups: 0–18, 19–50, 51–65, 66–80 and >80 years. Normally distributed data is presented as mean (SD), skewed data as median (IQR) and categorical data as number (%).

ED, emergency department;GCS, Glasgow Coma Scale; ICU/CCU/MCU, intensive/coronary/medium care units, IQR, interquartile range; ED, emergency department; GCS, Glasgow Coma Scale; *N*, number; n/min, breaths/beats per minute; ICU/CCU/MCU, intensive/coronary/medium care units, IQR, interquartile range.

[a]The numbers in square brackets refer to missing presenting complaints.

[b]Vital signs measured entitles: Respiratory Rate, O_2 Saturation, Heart Rate, Systolic Blood Pressure, Diastolic Blood Pressure, Temperature.

[c]Radiology imaging is positive if either an X-ray, echo or a CT- scan was performed.

binary logistic regression analysis was used to investigate the association between presenting complaints and case-mix adjusted clinical outcomes in five age categories. Potential confounders were entered through backward stepwise elimination into the model: age, gender, ED location (LUMC, MCL, CHE), triage category, GCS, vital score, amount of fluid administration during ED stay, number of consultations, treating specialty, blood testing and radiology imaging, time of the ED visit and other presenting complaints. In the regression analyses, as a reference, the presenting complaint 'trauma' was chosen because of its relatively constant hospitalization and in-hospital mortality across the age categories. Sensitivity analyses were performed. Multicollinearity was considered not to be a problem if the variance inflation factor was below three. Adjusted odds ratios (AORs) were reported with 95% confidence intervals as OR (95% CI). A P value <0.05 was considered to be statistically significant. Data were analyzed using SPSS (version 25.0, IBM, New York, USA).

Results

Patient inclusion and characteristics

Patient flow through the study is shown in Fig. 1. In total 164 145 ED visits had a registered presenting complaint. In Table 1, patient characteristics are shown. The mean age of all patients was 49.9 (25.2) years. Overall, the most frequent presenting complaints were 'extremity problems' [range across age categories (13.5–40.8%)], 'feeling unwell' (9.5–23.4%), abdominal pain (6.0–13.9%), dyspnea (4.5–13.3%) and chest pain (0.6–10.7%). In total, 38.8% of the ED patients were hospitalized, with in-hospital mortality of 1.7%.

Frequency and outcomes of presenting complaints

The top 10 presenting complaints differed across age categories, but the following presenting complaints occurred frequently in all age categories; 'extremity problems', 'feeling unwell', 'abdominal pain' and 'dyspnea'. Figure 2 shows that the number of patients who were hospitalized increased with age, but the rate of the increase differed per presenting complaint. 'Diarrhea and vomiting' (range across increasing age categories; 37.3–85.2%), 'feeling unwell' (32.0–81.4%), dyspnea (44.9–81.4%) and 'behaving strangely or suicidal' (31.7–86.9%) accounted for the highest hospitalization rates.

Below the age of 50 years, in-hospital mortality per presenting complaint was low (Fig. 3). In patients aged over 50 years, in-hospital mortality increased with age categories. The highest mortality was found in patients with 'dyspnea' (2.9–8.4%) and 'feeling unwell' (2.9–8.2%).

Independent determinants of hospitalization and mortality

Table 2 shows that for most presenting complaints, compared to 'trauma', the AORs for hospitalization rises with increasing age categories. The most common presenting complaints with the most increased risk for hospitalization relative to 'trauma' were 'diarrhea and vomiting' [AOR (95% CI) 2.30 (2.02–2.62) and 'feeling unwell' 1.60 (1.48–1.73). Compared to 'trauma', the risk for hospitalization was reduced in patients with 'chest pain' 0.58 (0.53–0.63) and 'palpitations' 0.64 (0.58–0.71).

In patients older than 18 years, most presenting complaints were independent determinants of in-hospital mortality (Table 3). As the absolute risk of mortality in the reference category increases with age, the AOR on mortality is generally lowest in patients over 80 years of age. Compared to 'trauma', the presenting complaints with the most increased risk for in-hospital mortality were 'diarrhea and vomiting' 3.08 (2.11–4.49), 'feeling unwell' 2.56 (1.96–3.34) and 'behaving strangely or suicidal' 2.53 (1.71–3.77). Presenting complaints 'palpitations' 0.26 (0.14–0.50) and 'chest pain' 0.60 (0.43–0.83) were associated with higher survival than 'trauma'.

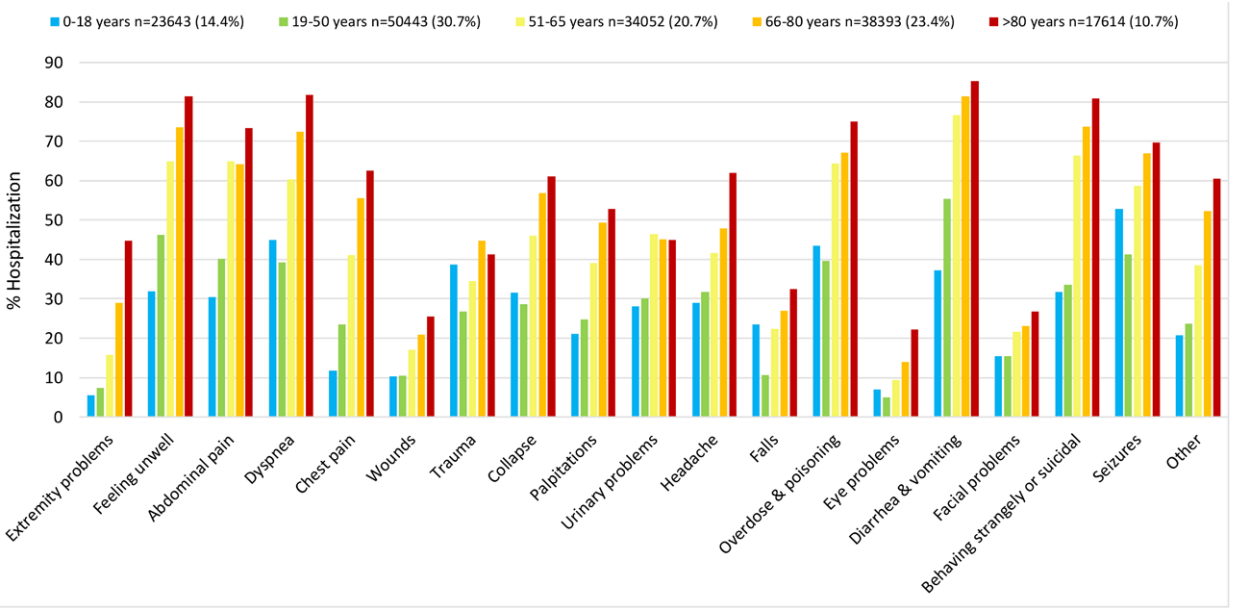
Discussion

This study has three conclusions. First, the frequency of presenting complaints in ED patients varies with age, but the same presenting complaints occur frequently in the top 10 of all age categories. Second, the presenting complaints 'chest pain' and 'palpitations,' usually considered as 'very urgent' in triage systems, carry a low risk for hospitalization and mortality. Finally, for most presenting complaints, (case-mix adjusted) hospitalization and mortality vary across age categories.

Several presenting complaints occur frequently, although the distribution of these complaints differs across age categories, in accordance with studies examining solely ages above 45 years [9,11–13]. The distribution of presenting complaints found in age categories is comparable to another smaller study in an all-comer ED population [7], except for 'headache' which had a 10-times higher incidence compared to our study. This may be explained by the fact that in this study ED patients could report multiple symptoms during interviews after triage.

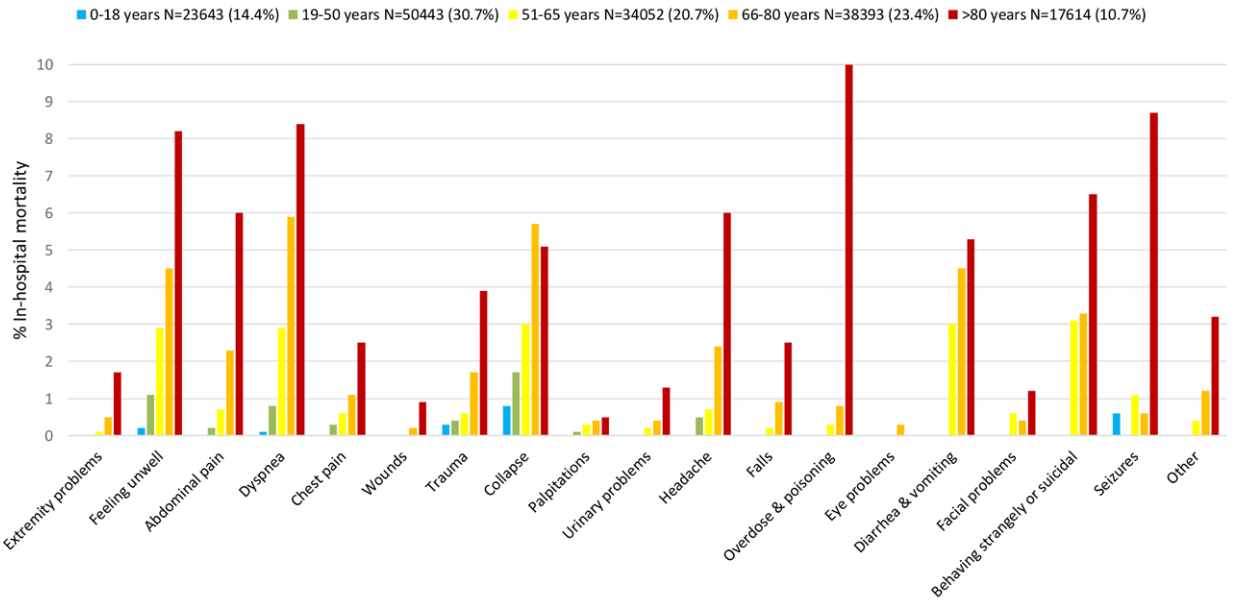
Several studies have shown that presenting complaints have prognostic value regarding hospitalization and mortality, such as 'feeling unwell', 'dyspnea', 'abdominal pain' and 'collapse' [3,5,7]. These results are consistent with our findings, where the same presenting complaints had the highest risk of hospitalization and mortality. In contrast to Bingisser *et al.*, [7], who excluded patients with altered mental status, we found that 'seizures' and 'behaving strangely or suicidal' were independent determinants of hospitalization. Two studies assessing nonspecific complaints found high mortality rates, corresponding to our mortality rates, in patients with 'feeling unwell' [6,23]. Weigel *et al.*, [8] show that the number of presenting complaints in a patient is not predictive of ICU admission or mortality but has a

Fig. 2



Hospitalization for presenting complaints of patients in different age categories

Fig. 3



In-hospital mortality for presenting complaints of patients in different age groups.

positive correlation with the use of hospital resources. Remarkably, although in most triage systems, complaints such as 'chest pain' and 'palpitations' are considered very urgent, in the previous studies [3,5,7] these complaints had a relatively low risk of hospitalization and mortality. Our findings confirm these observations. The low risks for 'chest pain' and 'palpitations' can be explained in several ways:

First, in the Netherlands, patients with a ST-elevation myocardial infarction (STEMI), bypass the ED and go directly for primary coronary intervention. Therefore, the ED misses some of the high-risk patients with 'chest

Table 2 The association between presenting complaints and case-mix adjusted hospitalization

	Total cohort		0–18 years		19–50 years		51–65 years		66–80 years		>80 years	
Presenting complaint	AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI
Trauma	Ref		Ref		Ref		Ref		Ref		Ref	
Extremity problems	0.86[a]	0.79–0.93	0.23[a]	0.19–0.27	0.88	0.75–1.02	1.04	0.87–1.25	1.34[a]	1.13–1.59	1.92[a]	1.57–2.36
Feeling unwell	1.60[a]	1.48–1.73	0.39[a]	0.41–0.46	1.68[a]	1.44–1.95	2.08[a]	1.74–2.50	2.01[a]	1.69–2.38	2.67[a]	2.17–3.30
Abdominal pain	1.33[a]	1.23–1.44	0.46[a]	0.37–0.58	1.63[a]	1.41–1.89	2.02[a]	1.68–2.43	1.72[a]	1.44–2.05	2.38[a]	1.86–3.04
Dyspnea	1.36[a]	1.26–1.48	0.87	0.71–1.07	1.15	0.98–1.36	1.42[a]	1.18–1.72	1.45[a]	1.22–1.73	2.14[a]	1.70–2.68
Chest pain	0.58[a]	0.53–0.63	0.15[a]	0.08–0.28	0.54[a]	0.45–0.63	0.74[a]	0.62–0.90	0.92	0.77–1.10	1.07	0.85–1.36
Wounds	0.99	0.89–1.09	0.55[a]	0.43–0.71	1.53[a]	1.28–1.84	1.30	1.04–1.64	1.11	0.88–1.39	1.20	0.86–1.66
Collapse	0.83[a]	0.75–0.91	0.49[a]	0.30–0.79	0.88	0.71–1.08	1.06	0.85–1.32	1.12	0.92–1.36	1.16	0.90–1.49
Palpitations	0.64[a]	0.58–0.71	0.36[a]	0.17–0.74	0.75[a]	0.59–0.96	0.87	0.70–1.08	0.92	0.76–1.13	0.77	0.57–1.05
Urinary problems	1.42[a]	1.27–1.60	0.76	0.51–1.13	1.69[a]	1.34–2.15	2.25[a]	1.71–2.95	2.00[a]	1.59–2.51	2.01[a]	1.49–2.72
Headache	0.78[a]	0.70–0.88	0.61[a]	0.41–0.90	1.09	0.90–1.33	1.05	0.82–1.35	0.83	0.65–1.06	1.18	0.82–1.69
Falls	1.27[a]	1.11–1.46	0.99	0.75–1.31	0.92	0.65–1.32	1.62[a]	1.19–2.22	1.26	0.94–1.68	1.45[a]	1.04–2.02
Overdose and poisoning	1.03	0.91–1.16	0.57[a]	0.42–0.78	1.53[a]	1.27–1.84	2.50[a]	1.81–3.47	1.82[a]	1.13–2.94	3.40	0.84–13.79
Eye problems	0.83[a]	0.69–0.99	0.23[a]	0.12–0.45	1.09	0.78–1.54	1.27	0.89–1.81	1.21	0.81–1.80	2.40[a]	1.31–4.42
Diarrhea and vomiting	2.30[a]	2.02–2.62	0.59[a]	0.43–0.81	2.48[a]	1.97–3.14	3.42[a]	2.54–4.60	3.25[a]	2.48–4.26	3.36[a]	2.19–5.16
Facial problems	0.80[a]	0.70–0.93	0.55[a]	0.38–0.79	1.30	0.99–1.70	0.98	0.69–1.40	0.96	0.71–1.29	0.89	0.60–1.30
Behaving strangely or suicidal	1.61[a]	1.40–1.85	0.57	0.29–1.15	1.51[a]	1.16–1.96	3.13[a]	2.23–4.38	2.28[a]	1.70–3.06	2.71[a]	1.92–3.84
Seizures	1.62[a]	1.39–1.87	0.83	0.60–1.14	1.45[a]	1.14–1.85	1.83[a]	1.32–2.54	2.03[a]	1.35–3.04	1.61	0.59–4.43
Other	1.34[a]	1.24–1.46	0.51[a]	0.42–0.63	1.89[a]	1.62–2.20	1.67[a]	1.37–2.03	1.87[a]	1.55–2.27	2.24[a]	1.73–2.89

Multivariable logistic regression analysis adjusted for demographic characteristics (age and gender), hospital, urgency (triage category), disease severity (GCS, vital score and amount of fluid administration during ED stay), proxies of comorbidity and complexity (number of consultations, treating specialty, blood tests, blood gas analysis, blood cultures, radiology imaging and time of the ED visit) and other presenting complaints.
AOR, adjusted odds ratio; CI, confidence interval; Ref, reference; GCS, Glasgow Coma Score.
[a]$P<0.05$

Table 3 The association between presenting complaints and case-mix adjusted in-hospital mortality

	Total cohort		19–50 years		51–65 years		66–80 years		>80 years	
Presenting complaint	AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI
Trauma	Ref		Ref		Ref		Ref		Ref	
Extremity problems	0.66 [a]	0.47–0.92	–	–	0.46	0.16–1.41	0.84	0.45–1.55	0.77	0.47–1.24
Feeling unwell	2.56 [a]	1.96–3.34	4.39[a]	1.94–9.95	4.77[a]	2.16–10.54	3.15[a]	1.93–5.16	1.90[a]	1.25–2.88
Abdominal pain	1.69 [a]	1.25–2.27	1.78	0.69–4.63	2.06	0.87–4.85	2.30[a]	1.35–3.92	1.86 [a]	1.16–2.99
Dyspnea	2.11 [a]	1.60–2.79	2.67[a]	1.07–6.70	3.70[a]	1.64–3.35	3.17[a]	1.92–5.24	1.41	0.91–2.19
Chest pain	0.60 [a]	0.43–0.83	0.82	0.28–2.40	0.77	0.31–1.88	0.74	0.41–1.32	0.62	0.36–1.07
Wounds	0.29 [a]	0.13–0.64	–	–	–	–	0.50	0.14–1.71	0.49	0.17–1.44
Collapse	2.26 [a]	1.67–3.06	4.77[a]	1.87–12.13	3.11[a]	1.31–7.38	3.50[a]	2.06–5.94	1.18	0.70–1.99
Palpitations	0.26 [a]	0.14–0.50	0.76	0.09–6.57	0.43	0.11–1.72	0.39	0.15–1.01	0.13[a]	0.03–0.57
Urinary problems	0.57	0.30–1.08	–	–	0.76	0.09–6.33	0.58	0.19–1.74	0.62	0.26–1.48
Headache	1.88 [a]	1.23–2.89	3.30[a]	1.07–10.18	1.46	0.41–5.17	2.33[a]	1.09–4.97	2.06[a]	1.02–4.15
Falls	0.70	0.40–1.23	–	–	0.44	0.05–3.59	0.84	0.31–2.30	0.92	0.43–1.95
Overdose and poisoning	0.34 [a]	0.15–0.81	0.36	0.07–1.80	0.25	0.03–2.08	0.33	0.04–2.60	2.32	0.47–11.47
Eye problems	0.14	0.02–1.06	–	–	–	–	0.67	0.09–5.01	–	–
Diarrhea and vomiting	3.08 [a]	2.11–4.49	3.78	0.90–15.85	6.28[a]	2.37–16.65	4.57[a]	2.46–8.50	1.62	0.81–3.22
Facial problems	0.46	0.21–1.03	–	–	1.28	0.25–6.53	0.49	0.11–2.16	0.39	0.11–1.32
Behaving strangely or suicidal	2.53 [a]	1.71–3.77	3.29	0.81–13.28	4.96[a]	1.72–14.25	2.69[a]	1.30–5.59	2.01[a]	1.11–3.67
Fits	0.81	0.39–1.67	0.41	0.05–3.47	1.34	0.33–5.39	0.32	0.04–2.45	1.35	0.26–7.09
Other	0.95	0.67–1.35	1.26	0.46–3.41	0.92	0.34–2.49	1.17	0.63–2.18	1.04	0.59–1.82

Multivariable logistic regression analysis adjusted for demographic characteristics (age and gender), hospital, urgency (triage category), disease severity (GCS, vital score and amount of fluids administered), proxies of comorbidity and complexity (number of consultations, treating specialty, blood gas analysis and radiology imaging) and other presenting complaints. As baseline in-hospital mortality increases with age (see Table 1), AORs become smaller with increasing age categories. For the ages up to and including 18 years, there were too few events to run the model. This remains the case with some presenting complaints, even at higher ages. In these cases, there is a dash (–).
AOR, adjusted odds ratio; CI, confidence interval; Ref, reference, GCS, Glasgow Coma Score.
[a]$P<0.05$.

pain'. Second, in current triage systems 'chest pain' and 'palpitations' are considered as 'very urgent' and subjected to a standardized approach [24] in which the use of high-sensitive troponins and readable cardiac devices often prevents the need for hospitalization.

Third, the urgency of 'chest pain' and 'palpitations' may be overestimated, because of the public awareness of the association between 'chest pain' and myocardial infarction, combined with the low threshold used by general practitioners and emergency medical services to transport to the ED once 'chest pain' is mentioned [25]. ED patients with 'chest pain' and 'palpitations' may therefore often represent less dangerous underlying etiologies. Our findings support this hypothesis as patients with 'chest pain' are often self-referrers, despite the fact that they are transported by ambulance almost twice as much as the average emergency patient (Supplementary File 4, Supplemental digital content 1, *http://links.lww.com/EJEM/A316*).

In contrast, 'feeling unwell' is often rated as nonurgent [23,26] despite a high risk of hospitalization and mortality possibly because underlying time-sensitive etiologies such as sepsis or myocardial infarction are recognized relatively late. Perhaps, immediate attention to 'feeling unwell' will lead to earlier treatment of time-sensitive medical conditions, which is currently not facilitated by triage systems [27]. The same accounts for the common complaints 'abdominal pain' and 'dyspnea' and for less frequently occurring complaints such as 'diarrhea and vomiting' and 'behaving strangely or suicidal.' These complaints may therefore also need higher urgency in triage systems. Interestingly, in patients aged >18 years, 'headache' and 'collapse' had a two-fold higher risk for in-hospital mortality but not a high probability of hospitalization. Whether or not hospitalization would have reduced the odds for mortality remains to be elucidated.

To the best of our knowledge, this is the first study showing that the risk for hospitalization and mortality of presenting complaints differs across age categories. For most presenting complaints, the risk for hospitalization showed an increasing trend with increasing age categories. Below the age of 19 years, the absolute mortality was too low to assess AORs of presenting complaints. In contrast, in patients older than 18 years, several presenting complaints carried an increased risk of mortality which was attenuated in patients older than 80 years. This knowledge is essential in an ED, where its major tasks (triage, work-up and disposition) generally occur without a final diagnosis, but where presenting complaints are available as the most patient-oriented characteristic. Now, as is self-evident with 'chest pain', a standardized, tailored approach can also be applied to other presenting complaints. Moreover, with knowledge about the modified prognostic value of presenting complaints across the different age categories, hospital resources can be better allocated in an aging society, where patients will present themselves with the same presenting complaints regardless of age.

Limitations

Although our study has its strengths such as the large unselected sample size, incorporation of both tertiary and urban care centers and the ability to adjust for multiple confounders, there are several limitations. First, because of the observational nature of the study, the NEED is subject to human errors of documentation. However, data transfers are automated, data are validated prior to registration in the NEED and only variables which are reliably registered in the hospital information system are retrieved. Second, within the age category 0–18, it is possible that different PCs exist in the years 0–5 compared to, for example, the years 13–18. However, even in the age category 0–18 the frequencies and associated hospitalization and mortality of presenting complaints differ from other age categories. Third, patients with an STEMI bypass the ED. Therefore, the found 'chest pain' ORs would be higher when STEMIs also were included. However, the proportion of STEMIs in 'chest pain' is limited. Furthermore, with a STEMI, it is immediately apparent which treatment is indicated, and thus risk stratification is needed less, whether they bypass the ED or not. Especially in the rest of the patients, it is relevant to investigate the prognostic value of 'chest pain', as this complaint can have many different diagnoses depending on the age category.

Fourth, comorbidities cannot be reliably recorded in the NEED. However, we believe that the use of proxies was justified as previous studies have shown that they are associated with comorbidities and complexity [3,18]. Fifth, transfers of ED patients to another hospital resulted in lost to follow-up. However, our sensitivity analysis (Supplementary File 5, Supplemental digital content 1, *http://links.lww.com/EJEM/A316*) showed that exclusion of these patients did not alter the association between presenting complaints and in-hospital mortality. Sixth, the synchronization of the presenting complaints in the NTS and MTS may have caused some erroneous classification. Nevertheless, similar results among the different triage systems (Supplementary File 6, Supplemental digital content 1, *http://links.lww.com/EJEM/A316*) suggests that this has not been a large problem. Furthermore, the extremely low in-hospital mortality limited the power of the regression analyses in younger patients. Finally, the increasing absolute in-hospital mortality in the successive age categories, falsely decreasing the AORs in the older age categories.

Conclusion

The frequency of presenting complaints in ED patients varies with age, but the same presenting complaints occur frequently in the top 10 of all age categories. The presenting complaints 'chest pain' and 'palpitations' carry a low risk for hospitalization and mortality. For most presenting complaints, the risk of (case-mix adjusted) hospitalization and mortality, vary across age categories. Future studies should investigate whether (pre)hospital triage and risk stratification tools can be improved by making use of age-adjusted prognostic values of presenting complaints.

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The study was approved by the medical ethics committee of the LUMC, who waived the need for individual informed consent as this was a pure observational study.

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

B.D.G., W.R. and C.H.N. devised and designed the study. B.D.G., W.R., M.I.G., E.T.A., O.S., H.L.,

R.A.P.A.H. and R.R. collected the data. W.R. and E.M.P.v.d.H. analyzed the data and wrote the manuscript. B.D.G. and W.R. contributed to the analyses. E.v.Z advised on statistical analyses. B.D.G., W.R. and E.d.J. edited the manuscript. B.D.G. takes full responsibility for the study as a whole. All authors have read and approved the manuscript.

Conflicts of interests

There are no conflictsof interest.

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