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Original Contribution

Emergency department mortality: Fair and square☆,☆☆,★

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ABSTRACT

Objective: This study explored the therapeutic approaches used for end-of-life (EOL) patients admitted to the emergency department (ED) and examined whether the decision to perform life-extending treatment (LET) or to allow natural death (AND) depends on patient characteristics, medical staff variables, and ED setting.
Methods: A retrospective archive study was conducted from January 2015 to December 2017 in the ED of a tertiary hospital. The study sample were 674 EOL patients who had died in the ED. For each patient, data were collected and measured for dying process (LET vs. AND), patient characteristics, ED-setting variables, and medical-staff characteristics.
Results: The proportion of EOL patients undergoing LET increased from 18.1% in 2015 to 25.9% in 2016 and to 30.3% in 2017 ($p = .010$), and a quarter of them were treated by emergency medical services. Males tended to receive LET more than females ($p < .001$). An association was found between Jewish physicians and nurses and AND ($p = .001$). Heavier workload in the ED and greater severity of the triage classification predicted more LET (OR-1.67, CI = 1.05–1.76, $p = .003$ and OR = 1.42, CI-0.60-0.81, $p < .001$, respectively). Receiver operating characteristic analysis showed that patient characteristics contributed most crucially to the therapeutic approaches (C statistic 0.624–0.675, CI-0.62-0.71).
Conclusions: The therapeutic approach used for EOL patients in the ED depends on variables in all three treatment layers: patient, medical staff, and ED setting. Applicable national programs should be developed to ensure that no external factors influence the dying-process decision.

1. Introduction

1.1. Background

Emergency teams are trained to provide critical treatments for emergency medical conditions that are aimed at protecting life [1]. Alongside emergency teams, emergency departments (EDs) are increasingly used for end-of-life (EOL) patients [2,3]. A growing number of patients at the EOL are admitted to EDs and receive increasingly invasive care [4-6]. The characteristics of patients at EOL cover a wide range of demographic, clinical, and psychosocial factors in relation to time and place of death [2,7,8]. They also encompass a wide range of ages [9,10] and conditions [6,8,9]. These patients pose a challenge in the ED because most appear not to have access to palliative-care options or lack of awareness as to the status of EOL patients [2,5].

In an acute setting, such as ED, three main variables affect treatment: the patient, the medical staff, and the ED setting.

Previous studies investigated patients and team factors associated with the decision of whether to allow natural death (AND) or to provide life-extending-treatment (LET) [4]. Patients and clinicians may approach EOL discussions with different expectations and preferences, influenced by religion, race, culture, and ED characteristics. Hamel et al. [11] found that older patients preferred less aggressive care than younger patients, but that many older patients wanted cardiopulmonary resuscitation (CPR) and care focused on life extension. Barnato et al. [12] found that more blacks and Hispanics than whites wanted LET. Ehlenbach et al. [4] found the incidence of CPR to be higher among black and other nonwhite patients. Mebane et al. [13] investigated whether physicians' preferences for EOL decision making differs between races and gender. In the scope of quality of life vs. length of life, the authors found a significant preference for length of life among black physicians ($p < .001$). Additionally, significant differences between attitudes of male and female physicians ($F(3,427) = 6.71$ ($p < .05$)) and between attitudes of white and black physicians ($F(3,425) = 49.71$ ($p < .001$)) were found with regard to the issue of tube-feeding. Fifty-eight percent of white physicians, compared with 28% of black physicians, agreed that tube-feeding in terminally ill patients is “heroic.” In addition, 42.4% of

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male physicians agreed that tube-feeding is "heroic" compared with only 28.9% of female physicians. Age was not significant, and there were no significant interactions.

Few studies, if any, have investigated the influence of ED setting, such as workload, on the decision to perform LET or to AND among EOL patients. Moreover, the relative contribution of each of the three factors has not been fully elucidated. Thus, the aim of this study was to explore the therapeutic approaches used for EOL patients admitted to the ED, and to examine whether and to what extent the decision to perform LET or to AND depends on each of these factors.

1.2. Importance

The volume of EOL patients admitted to the ED increase annually while the percentage of EOL patients who receive LET is at an all-time high, resulting in an unsustainable number of patients who are being kept alive by artificial means.

1.3. Goals of this investigation

The goal of this study is to map the contributing factors to the decision to perform LET or AND, enabling the development of a better and more appropriate decision-making process.

2. Methods

2.1. Study design and setting

A retrospective archive study in 2018 reviewed admissions from January 2015 to December 2017 in the ED of a tertiary hospital, after institutional review board approval. The ED contains 100 beds and serves about 130,000 patients, on average, over the age of 18 years per year. In cases of trauma all age groups are accepted in the ED.

2.2. Selection of participants

The study sample consisted of 226, 220, and 228 files of patients who had died in the ED during 2015, 2016, and 2017, respectively. Patient files were chosen from electronic medical records (EMR) using the ICD-9 code for mortality in ED as a filter (R79891, R7983, R79811, and R7982).

2.3. Procedure and measurements

For each patient, file data were collected and measured, by the second and the fourth authors, on the dying process (LET vs. AND), individual characteristics (age, gender, ethnicity), morbidity and mortality variables, ED-setting variables (triage urgency classification according to the Canadian Triage and Acuity Scale [CTAS], shift, day and workload), and variables associated with the medical staff (position and ethnicity). We defined ethnicity as per our nation's central bureau of statistics (Jewish, Arabs and others).

Interrater agreement assessed by having a sample of charts reviewed independently by the first and second author ($\kappa = 0.94$).

The first and the third authors were blinded to the group assignment, and the third and fifth authors were blinded to the study hypothesis.

We defined *EOL patients* primarily based on existing medical records indicating that this was a EOL patient for whom no invasive intervention should be performed, called "hospice status." The first and second authors performed database search in the EMR by several queries: "Do not resuscitate"; "DNR", "AND", "palliative care", "hospice".

We defined *LET* patients according to the American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care (2015). These patients may receive the following interventions: cardiopulmonary resuscitation include defibrillations and chest compressions, vasopressor agents, mechanical ventilation, blood products and antibiotics.

We defined *AND* patients according to the American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care (2015). These patients may receive the following alleviating care: parenteral fluids, nutrition, oxygen, analgesia, sedation, antiarrhythmics, or vasopressors, unless these are included in the order.

Where there were no records, the medical team asked the patient's relatives about pre-instructions. In other cases, three senior ED physicians determined whether the diagnosis of the patient was acute, with poor prognosis (life expectancy <12 h), due to the patient's comorbidity, such as catastrophic hypovolemic shock attributable to multiple trauma in older sick patients.

2.4. Outcomes

The coprimary outcomes measured were the proportion of patients who received LET or AND and the rate of contribution of each characteristic (patient, medical staff, ED setting) to the therapeutic approach.

2.5. Analysis

The statistical analyses were performed by the first author using descriptive data analysis, including ranges, means, medians, standard deviations (SDs), and interquartile ranges for continuous variables, and frequencies and percentages for categorical variables. Comparisons of means were performed, using one-sample *t*-tests, between the gold standard mean and the study results. Comparisons of means between more than two groups were performed using one-way ANOVAs. Post-hoc comparisons were performed using the Bonferroni test.

In addition, three logistic regression models were performed for each year, to predict the effect of each factor category—patient, medical staff, and ED setting—on LET. Odds ratios (ORs) and 95% confidence intervals (CIs) were estimated for each predictor.

To test the additive value of each factor, we entered the variables into receiver operating characteristic (ROC) curves one at a time: patient characteristics (cause of death, age, male, Jewish), followed by team characteristics (physician ethnicity, physician position, nurse ethnicity) and, finally, the ED-setting variables (shift, day, workload). The level of significance for all statistical analyses was 5%. We analyzed the data using the Statistical Package for Health & Welfare Science for Windows (SPSS, version 22.0, Chicago, IL, USA).

3. Results

During the study period, 674 patients died in the ED (226 in 2015, 220 in 2016, and 228 in 2017); they were between the ages of 1 and 104 years (M = 73.58; SD = 16.18). No statistical differences for age were found during the study period. Most patients were males (52.1%) and Jewish (77.9%).

Most patients experienced AND (52.2%), although a decrease was observed in this rate during the study period (60.6% in 2015, 49.5% in 2016, 46.5% in 2017; p = .007). Simultaneously, the proportion of patients undergoing CPR increased, and there was also growth in the number of patients who were dead on arrival (DOA) after receiving treatment by emergency medical services (EMS); from 18.1% in 2015, to 25.9% in 2016, to 30.3% in 2017 (p = .010). The share of Jewish patients decreased over the period, and the share of Arab patients increased (p = .001).

No differences were found in the percentage of mortality during the weekday. However, the highest mortality rate (46.3%) was observed in the morning shift, followed by evening (37.4%) and night (16.3%). Over time, the proportion of patients dying during heavy-workload shifts increased (p = .001).

Most patients were classified as high triage priority level (P1) and therefore immediately entered the shock room (resuscitation bay); a smaller fraction of patients were admitted first to the urgent area during the study period (p = .001) (Table 1).

Table 1
Descriptive statistics for the study sample.[a]

	2015 ($n = 226$)	2016 ($n = 220$)	2017 ($n = 228$)	p-value
Cause of death n (%)				
DOA	41 (18.1)	57 (25.9)	69 (30.3)	0.010
AND	137 (60.6)	109 (49.5)	106 (46.5)	0.007
LET	48 (21.2)	54 (24.5)	53 (23.2)	0.705
Patient characteristics				
Age (mean ± SD)	74.92 ± 15.38	72.19 ± 16.89	73.59 ± 16.23	0.207
Gender				
% Male	52.7	49.1	54.4	0.521
Ethnicity (%)				
Jewish	82.7	72.3	78.5	0.001
Arabs	14.2	19.5	20.2	
Others	3.1	8.2	1.3	
Team characteristics n (%)				
Physician ethnicity				
Jewish	86 (38.1)	59 (26.8)	68 (29.8)	0.132
Arabs	86 (38.1)	101 (45.9)	99 (43.4)	
Others	54 (23.9)	60 (27.3)	61 (26.8)	
Physician position				
Intern	58 (25.7)	89 (40.5)	96 (42.1)	0.000
Senior	168 (74.3)	131 (59.5)	132 (57.9)	
Nurse ethnicity				
Jewish	94 (41.6)	80 (36.4)	106 (46.5)	0.000
Arabs	132 (58.4)	126 (57.3)	121 (53.1)	
Others	–	14 (6.4)	1 (0.4)	
ED setting n (%)				
Shift				
Morning	106 (46.9)	92 (41.8)	114 (50.0)	0.344
Evening	81 (35.8)	94 (42.7)	77 (33.8)	
Night	39 (17.3)	34 (15.5)	37 (16.2)	
Day				
Sunday	34 (15.0)	34 (15.5)	33 (14.5)	0.999
Middle of week	120 (53.1)	117 (53.2)	122 (53.5)	
Weekend	72 (31.9)	69 (31.4)	73 (32.0)	
Workload				
If ≥250 patients	127 (56.2)	140 (63.6)	167 (73.2)	0.001
Triage classification				
1	133 (58.8)	131 (59.5)	124 (54.4)	0.471
2	18 (8.0)	18 (8.2)	26 (11.4)	
3	64 (28.3)	55 (25.0)	55 (24.1)	
4	9 (4.0)	12 (5.5)	18 (7.9)	
5	2 (0.9)	4 (1.8)	5 (2.2)	
Area admission				
Shock room	101 (44.7)	109 (49.5)	117 (51.3)	0.001
Emergent area	96 (42.4)	98 (44.5)	105 (46.1)	
Urgent area	29 (12.8)	13 (5.9)	6 (2.6)	

[a] DOA = Dead on arrival; AND = Allow natural death; LET = Life-extending treatment.

Table 2
Causes of death during the study period.[b]

	Frequency	%
DOA	152	22.6
Oncology terminally ill	137	20.3
Sepsis	94	13.9
MOF	87	12.9
Respiratory failure	72	10.7
Cardiac failure	55	8.2
Multiple trauma	25	3.7
Brain bleeding	12	1.8
Aortic dissection	7	1
GI bleeding	7	1
Abdominal peritonitis/perforation	6	0.9
Acute mesenteric ischemia/event	5	0.7
Hypothermia	3	0.4
ARF	3	0.4
Hypoglycemia	2	0.3
DIC	2	0.3
Drug overdose	2	0.3
STEMI	1	0.1
Massive PE	1	0.1
Massive burn	1	0.1
Total	674	100

[b] DOA = Dead on arrival; MOF = Multi-organ failure; GI = Gastrointestinal; ARF = Acute renal failure; DIC = Disseminated intravascular coagulation; STEMI = ST elevation myocardial infarction; PE = Pulmonary embolism.

The leading causes of death were stage 4 metastatic cancer, called "terminal oncology" (20.3%), sepsis (13.9%), and multi-organ failure (12.9%) (Table 2).

A positive association was found between age and the AND approach ($t_{(483)} = 2.864$, $p < .001$), while the average age for natural death was higher than for resuscitation (AND: mean = 76.54 ± 14.20, LET: mean = 70.34 ± 17.57; $p < .001$). A correlation was found between gender and type of therapeutic approach: men tended to receive higher rates of CPR ($p < .001$; 56.1% vs. 38.7%) and women tended to experience more natural death ($p < .001$; 61.3% vs. 43.9%). Jewish patients experienced more natural death than Arab patients did (54.3% vs. 44.3%; $p = .035$).

Physicians and nurses were mostly Arab (42.4% and 56.2%, respectively). The number of interns who participated in mortality events increased over the period ($p < .001$).

No correlations were found between staff shift, day, and dying process. We found a positive association between Jewish nurses and the AND approach ($\chi^2 = 16.71$, $p = .001$).

Three logistic regression models were run to predict significant factors that influence the therapeutic approach in EOL patients (Table 3). Throughout the first two years, age was a protective factor for the LET approach (in 2015: 95% CI 0.954–0.992, OR 0.97; in 2016: 95% CI 0.960–0.995; OR 0.98). In 2017, male patients were more likely to receive LET than females (95% CI 1.704–5.246; OR 2.99), and Jewish physicians predicted more use of the AND approach (95% CI 0.289–0.940; OR 0.52). In 2016 and 2017, Jewish ethnicity for nurses was found to be predictive of AND in comparison to Arab nurses (in 2016: 95% CI 0.324–0.993, OR 0.57; in 2017: 95% CI 0.314–0.921, OR 0.54).

Nevertheless, in 2015, workload was a significant factor predicting LET (95% CI 1.005–6.503, OR 2.56). The higher the patient's level of urgency, the greater his or her chance of receiving LET during 2016 and 2017 (95% CI 1.491–5.016, OR 2.74; 95% CI 0.108–5.830, OR 3.25; respectively).

ROC analysis was used to determine the additive effects of each factor on LET (Fig. 1). The results indicated that during the study period, the contribution of patient characteristics was most crucial to LET (C-statistics: 2015: 0.62; 2016: 0.64; 2017: 0.67). After the ED-setting characteristics were added to the model, the accumulated contribution increased slightly (C-statistics: 2015: 0.59; 2016: 0.63; 2017: 0.68). However, entering the team characteristics decreased the impact (C-statistics: 2015: 0.52; 2016: 0.57; 2017: 0.62).

3.1. Limitation

Our study has several limitations. First, neither personal approach nor religion of ED staff have been elucidated. This may have an impact on the therapeutic approaches chosen.

Second, the study did not include and investigate the EOL patients who received LET or AND and survived the ED visit. Therefore, we present an incomplete portrait of ED therapeutic approaches in EOL patients. Third, DOA patients who received LET by EMS were admitted to the ED in a regular manner and documented as usual in the medical records. Maybe there is a need to regard these patients as a separate sub-population. In addition, we related to all cases together. It is possible that external injuries (e.g., trauma) and internal injuries (e.g., respiratory failure) should be divided into two separate groups, and that age groups should be considered separately.

Table 3
Logistic regression and receiver operating characteristic models for predicting life-extending treatment.

Characteristics	2015					2016					2017				
	OR	95% CI		Sig.	Area	OR	95% CI		Sig.	Area	OR	95% CI		Sig.	Area
		Low	High				Low	High				Low	High		
Patient															
Age	0.97	0.954	0.992	0.005		0.980	0.9600	0.9950	0.011		0.970	0.9680	1.005	0.140	
Male	1.49	0.851	2.567	0.165		1.44	0.8330	2.478	0.193		2.99	1.704	5.246	0.000	
Jewish	0.93	0.443	1.960	0.852		0.740	0.4040	1.452	0.414		1.21	0.5980	2.438	0.600	
C-statistics		0.550	0.699	0.002	0.624		0.542	0.690	0.002	0.636		0.606	0.746	0.000	0.675
Team															
Jewish physician	0.860	0.4970	1.502	0.605		0.880	0.4780	1.600	0.664		0.520	0.2890	0.9400	0.030	
Senior physician	0.99	0.535	1.823	0.969		0.90	0.5220	1.557	0.710		1.65	0.9560	2.850	0.072	
Jewish nurse	1.16	0.6750	1.994	0.591		0.570	0.3240	0.9930	0.047		0.540	0.3140	0.9210	0.024	
C-statistics		0.446	0.601	0.549	0.524		0.491	0.644	0.042	0.568		0.547	0.692	0.002	0.619
ED															
Morning	0.98	0.570	1.697	0.952		1.14	0.643	2.004	0.661		0.44	0.253	0.772	0.004	
Weekday	0.57	0.213	1.528	0.264		1.61	0.422	6.159	0.485		0.96	0.412	2.224	0.918	
Workload	2.56	1.005	6.503	0.049		0.83	0.230	3.019	0.782		0.75	0.305	1.845	0.532	
High-severity P scale	1.05	0.586	1.863	0.882		2.74	1.491	5.016	0.001		3.25	0.108	5.830	0.000	
Admission to shock room	0.90	0.516	1.575	0.716		1.44	0.832	2.489	0.193		0.990	0.570	1.727	0.977	
C-statistics		0.510	0.661	0.030	0.586		0.560	0.707	0.000	0.634		0.620	0.758	0.000	0.689

CI = Confidence interval; OR = Odds ratio; Sig. = Significance.

4. Discussion

We found that 47.8% of patients in this study received LET. Likewise, previous studies found that the proportion of patients undergoing in-hospital CPR before death increased over time and was higher for minority patients [2,4]. This finding correlates with evidence that some patients at EOL experience a dying process that does not always comply with the basic thought of a "good death." [2,6,7] 52% experienced natural death, although this percentage decreased during the study period.

Reduction in the AND approach despite an increase in the number of palliative-care patients may indicate a widening gap between the ED team and patient perceptions, or lack of information upon arrival.

The main accepted purpose of the ED team is to treat undifferentiated patients, to assess the patient quickly, and to resuscitate and stabilize the patient [2,14]. In the case of patients at EOL, these principles cannot be implemented permanently because these patients are treated dissimilarly [15-17]. Interactions between EOL models and ED team have been investigated by Chan [15], even though the ED might not be the most appropriate setting for giving EOL care. Additionally, LET for these patients may not be the best or preferred option [18]. Elderly patients were found to have greater odds for AND, which is reasonable given patient multi-morbidity and poor prognosis [4,5].

We found a substantial number of DOA patients (24.8%). For these patients, an out-of-hospital resuscitation was begun by EMS, in most cases without taking the patient's condition into account. It seems that EMS is not prepared for palliative care. Previous studies point out that EMS teams frequently did not avoid resuscitating EOL patients, particularly if there was no documentation of precise instructions [19,20].

Arab patients received LET at higher rates, despite their prognosis, than Jewish patients ($p = .001$). These results might imply racial bias.

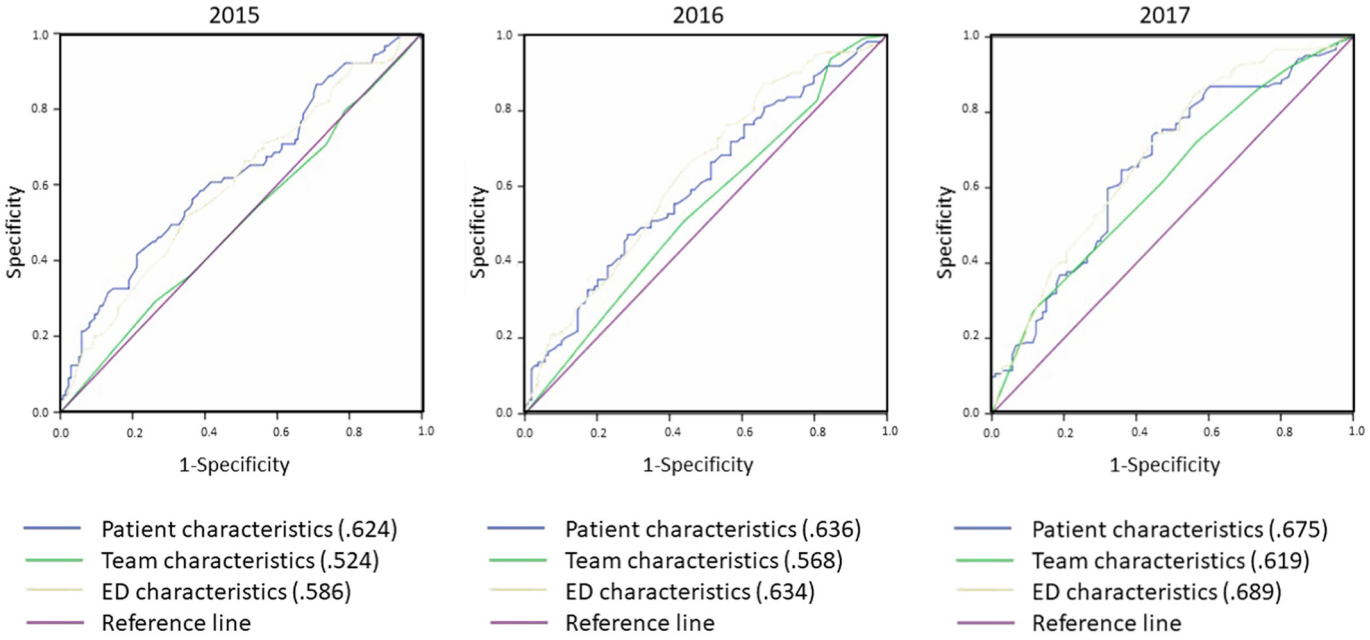

Fig. 1. Receiver operating characteristic analysis.

Previous studies showed that it is possible that the quality of care before, during, and after cardiac arrest is lower for minority patients [4,21,22]. In our study this is a surprising finding, because most of the team members were Arab. Therefore, it is not certain whether there is a concern of malpractice or whether there is discrimination in treatment. Maybe the difference in results is due to cultural variance [23].

The ED is a tumultuous area, especially in cases of overcrowding. Logistic regression analysis, in 2015, indicated that as ED workload increased, more LETs were performed (OR = 1.67, p = .003 and OR = 1.42, p < .001, respectively). This finding may indicate that in workload scenarios at the ED, teams must focus on doing rather than on being. There is significant agreement across research papers and guidelines concerning the core elements of palliative care [1,24]. Beck and her colleagues concluded [25], in a study focused on nurse assistants' experience of palliative care in municipal residential care settings, that more focus is needed on the trajectory of older peoples' dying, and that there is also a need for engaged care leaders (doing vs. being).

Our results indicate that the contribution of patient characteristics was most crucial to the selection of therapeutic approach. These results correlate with previous studies finding an association between patient characteristics and the EOL dying process, such as age and ethnicity [2,4]. Surprisingly, ED-setting characteristics decrease the variance explanation for therapeutic approach. From what we know, there is a lack of evidence in the literature regarding this finding in an ED setting. On the contrary, team characteristics increase the proportion of outcome explained. This finding corresponds with prior studies showing an association between team characteristics and EOL dying process, such as physician and nurse ethnicity [12,13].

5. Conclusion

The type of therapeutic approach used for EOL patients in the ED depends on variables in all three treatment layers, especially patient characteristics. There is a need for a unique national protocol that contains precise instructions for EOL patients in various situations, both outside and inside the hospital.

Author contributions

All authors interpreted the data and edited and approved the final article. SM and PH drafted and conceived the study. SM, SR and DA designed the intervention. SM, PH, ZL and DA analyzed the data, designed the study and performed data collection. SM, PH and SR take responsibility for the paper as a whole.

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