International Emergency Nursing 43 (2019) 34–39

Contents lists available at ScienceDirect

International Emergency Nursing

journal homepage: www.elsevier.com/locate/aaen

Round-off decision-making: Why do triage nurses assign STEMI patients with an average priority?

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ARTICLE INFO

Keywords:
Chest Pain
Door-To-Balloon Time
Emergency department
ST elevation myocardial infarction
Triage

ABSTRACT

Patients with suspected ST elevation myocardial infarction should be classified with a high-priority triage level in the Emergency Department. Accurate triage can reduce mortality and morbidity in ST elevation myocardial infarction patients. Yet, half of these patients were given a low-priority score, especially the average classification (P3 on a P1–P5 scale).

Aim: To identify and clarify significant factors in the triage process that result in P3 assignment for patients with ST Elevation Myocardial Infraction diagnosis.

Methods: A retrospective-archive study was conducted at a tertiary hospital from January 2015 to November 2017. We collected and measured patients' characteristics, Emergency Department setting variables, and hospitalization characteristics. Data files were extracted from the electronic database (n = 140).

Results: The results show several key factors that affect the decision to assign P3 in the triage process. Analysis of patients' sociodemographic characteristics show that being female (OR = 1.96, *P* = .05) or having Arab ethnicity (OR = 2.19, *P* = .01) is significant to P3 assignment. Number of cardiac events (*P* = .02) is the only noteworthy cardiologic comorbidity of all that were reviewed.

A connection was observed between a patient being classified as average urgency and poor treatment outcomes, namely for the variables time to physician, total time in the Emergency Department, door-to-balloon time, and in-hospital mortality.

Conclusion: Average classification demonstrates the extreme risk involved in the triage process. Our research provides considerable data to identify factors that affect the decision to classify patients as P3.

1. Introduction

Triage is typically defined as the initial assessment of the clinical status of a patient admitted to the Emergency Department (ED) [1–4]. The triage aim is to diagnose and prioritize as quickly and accurately as possible the current state of the patient and determine their trajectory for care [1]. Several five-level triage scales for ED triage have been developed in western countries; of these, the Canadian Triage and Acuity Scale (CTAS) is the most commonly used [2]. The CTAS triage levels range from high priority (P1) to low priority (P5), as follows: P1: resuscitation is needed, P2: emergency treatment is needed, P3: urgent treatment, P4: non-urgent treatment, and P5: non-urgency visit. Patients categorized as P1 require immediate treatment, while patients categorized as P2–P5 are expected to receive medical assessment and treatment within 15, 30, 60, and 120 min respectively [1].

The triage nurse uses a valid semi structured scoring system that categorizes the level of the patient's clinical urgency, based on inputs from the patient's subjective complaint, medical documentation, clinical assessment and vital signs [5,6]. In Israel, chest pain is the third most common complaint in ED triage, which accounts for four percent of all ED visits [7] and can indicate ST elevation myocardial infarction (STEMI) [8]. This rate is similar to those reported in Europe and the United States [9].

Accurate classification during triage plays a pivotal role in the triage process for patients with STEMI. ED assessment of patients with suspected STEMI begins at arrival, when they undergo triage by an ED nurse, who assigns a priority score for subsequent physician assessment in the ED [10]. Patients presenting with signs and symptoms of a STEMI should be classified as P1 or P2 according to CTAS [11]. Inappropriate triage classification may result in adverse outcomes, such as longer wait times for reperfusion therapy and subsequent increased rates of morbidity and mortality [2,11,12]. In the case of STEMI, reperfusion must

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https://doi.org/10.1016/j.ienj.2018.07.001
Received 30 November 2017; Received in revised form 18 June 2018; Accepted 6 July 2018

be performed in 90 min and therefore, the difference in waiting time to physician for P2 (15 min) and P3 (30 min) is crucial due to administrative delays such as catheterization team convergence time [10–11]. However, only 50% of patients in the ED are prioritized accurately [11,13].

CTAS as a scale is not without fault, although it is a valid tool [14–19]. A key concern is its intuitive and analytical nature, which is subjective and is based on the nurse's personal characteristics [19]. In addition, leading organizational characteristics influence the triage decision making, such as workload and shift, which are accounted for in current research due to their confounding potential [17,19].

The CTAS, in general, has been criticized for a lack of accuracy: Mirhaghi et al., [18] noted that 42.82% of triage decisions were a mistriage, 25.52% of which were over-triage. Furthermore, a number of studies found evidence of high levels of average assignments (P3) [14–16]. Atzema et al., [17] who focused on patients with acute myocardial infarction (AMI), found similar results, with 43.3% being triaged as P3.

To date, it is not known what the reasons for P3 classification are, or which related factors relate to nurse's ability to make such decisions. Since accurate triage decisions are crucial to trustworthy ED triage, it is necessary to further explore what influences average P3 classification.

2. Aim

This study investigates the relationship between patient and organizational characteristics and the frequency of P3 classification in patients with STEMI and explores the potential causes for this phenomenon.

3. Methods

3.1. Study design and setting

A retrospective quantitative study was conducted from January 2015 to November 2017 in the ED at tertiary hospital in northern Israel. The ED contains 100 beds, and about 130,000 patients > 18 years old are treated per year on average. Of these, about 5500 (5%) arrive with chest-pain complaints; of which about 80 (1.5%) are diagnosed with STEMI.

3.2. Data collection

The study sample consisted of 140 patient files who were triaged and diagnosed as a possible STEMI at the ED during 2015 (n = 60) and 2016 (n = 80), respectively, who received P1–P3 classification, and who were diagnosed with STEMI. Files were extracted from the electronic database by using the ICD-10 code for STEMI in ED transfer as a filter (i21.3, "acute transmural myocardial infarction of unspecified site").

Overall sample was drawn from a total of 335 patient files (170 in 2015 and 165 in 2016) who were hospitalized with STEMI. Patients who were transferred directly to the Intensive Coronary Care Unit (ICCU) were excluded from the study (n = 186).

Patient files who received inappropriate P4–P5 urgency classifications were excluded as their sample was minor (n = 9) and they are not relevant to this study's aims in which the focus group is P3.

The patient files were entered into the study according to the following criteria: Patients over 18 years old and patients that were diagnosed with STEMI and underwent a Primary percutaneous coronary intervention (PCI).

We excluded files of patients that died in the ED due to STEMI and patient files that were diagnosed with STEMI and did not undergo PCI due to clinical considerations (such as high KILLIP classification).

3.3. Methods and measurements

The data were collected retrospectively in November 2017 using a data sheet, from the hospital's electronic medical records, by the first and the second authors. The data divided into three sections:

3.3.1. Section A: Demographic information and clinical risk factors

Demographic information includes age, gender and ethnicity (Jews, Arabs and others - patient files with no stated nationality). These categories are synchronized with the Israeli population census.

Clinical risk factors for STEMI include smoking, dyslipidemia, hypertension, diabetes mellitus, number of previous cardiac events and family history (FH) of coronary heart disease (CHD). After extracting this initial data, we proceeded with obtaining the ED time lags, described in section B.

3.3.2. Section B: Dependent variables

Depended variables include P-scale classification, time to nursing triage < 15 min, time to ECG < 10 min, time to physician < 30 min, and total waiting time at ED < 60 min.

Lastly, we followed up on patient files from PCI initiation up until 18 months, including ED revisit and readmission rates and In-hospital mortality, specified in section C.

3.3.3. Section C: Outcomes variables

Outcomes variables include Door-to-balloon time (DTBT) < 90 min, length of stay (LOS) hospital, total and cardiac ED revisit and readmission to hospital and in-hospital mortality during the current event, within 30 days and within one to 18 months.

To assess the contribution of the *organizational characteristics*, we collected data on ED workload, day of the week, type of shift, and whether the patient was admitted during shift handover.

The data were collected as dichotomous (e.g. time to triage ≤15 min = 1, otherwise = 0) and continuous variables (e.g., DTBT in minutes) for certain analysis. To minimize bias, data were documented on two separate data sheets and two different abstractors were trained, one for the outcome variables and one for the dependent variables.

3.4. Data management and statistical analysis

After clearing and handling the data, we categorized all dependent variables according to the time lags defined above (e.g. time to triage ≤15 min = 1, otherwise = 0). These variables were also analyzed continuously. Associations between P3 classification and each of the study variables, namely *Demographic information and clinical risk factors*, *Dependent variables and Outcome variables,* were examined using χ^2 tests for categorical variables and t-tests or one-way ANOVAs, when appropriate, for continuous variables.

To capture the contribution to DTBT of each factor category – *Demographic information and clinical risk factors, and Dependent variables* – we constructed multivariate logistic regression models separately and as blocks. Associations having an alpha threshold level of 0.25 in the univariate analysis were entered into the multivariate model [20]. To test the additive effects of the dependent variables over the effects of *Demographic information and clinical risk factors* and *organizational characteristics*, we added the dichotomous variable categories to the model one after another, first the *clinical risk factors,* then the *organizational characteristics,* and finally the *Dependent variables*. Adjusted odds ratios (ORs) and 95% confidence intervals (CIs) were estimated for each predictor. We used a receiver operating characteristics (ROC) model to examine the contribution of each category of predictors. Results were designated by C-statistics.

The level of significance for all statistical analysis was 5%. The data analysis was performed using the Statistical Package for Health & Welfare Science for Windows (SPSS, version 22.0, Chicago, IL, USA).

Table 1
Correlation between P-Classification and Clinical-Organizational Variables.

	P3	P1/2	*P*-value
	(*n* = 70)	(*n* = 70)	
Clinical risk factors			
Age (mean ± SD)	63.53 ± 12.58	63.70 ± 14.03	.39
Male (*n*, %)	25 (35.7%)	36 (51.4%)	.05
Ethnicity (n, %)			
Jews	14 (20.0%)	29 (41.4%)	
Arabs	50 (71.4%)	37 (52.9%)	.02
Others	6 (8.6%)	4 (5.7%)	
Smoking (*n*, %)	33 (47.1%)	31 (44.3%)	.95
Dyslipidemia (*n*, %)	36 (51.4%)	37 (52.9%)	.72
Hypertension (*n*, %)	38 (54.3%)	38 (54.3%)	.84
Diabetes mellitus (*n*, %)	25 (35.7%)	21 (30%)	.54
FH of CHD (*n*, %)	24 (34.3%)	25 (35.7%)	.85
No. of cardiac events (mean ± SD)	1.32 ± 0.63	1.47 ± 0.88	.05
ED setting characteristics			
Workload (*n*, %) > 300 patients at ED	58 (82.9%)	64 (91.4%)	.13
Day in the week (n, %)			
Sunday	14 (20.0%)	12 (17.1%)	.48
Monday to Thursday	34 (48.6%)	41 (58.6%)	
Friday and Saturday	22 (31.4%)	17 (24.3%)	
Type of Shift (n, %)			
Morning (7am-3 pm)	29 (41.4%)	28 (40.0%)	
Evening (3pm-11 pm)	19 (27.1%)	28 (40.0%)	.17
Night (11 pm-7am)	22 (31.4%)	20 (20.0%)	
Arrived in shift handover (*n*, %)	3 (4.3%)	2 (2.9%)	.64
ED assessment			
Time to triage (n, %)			
≤15′	51 (72.9%)	56 (80.0%)	.32
> 15′	19 (27.1%)	14 (20.0%)	
Mean ± SD	11.49 ± 10.09	12.37 ± 10.89	.62
Time to ECG (n, %)			
≤10′	32 (45.7%)	38 (54.3%)	.31
> 10′	38 (54.3%)	32 (45.7%)	
Mean ± SD	15.47 ± 12.64	13.94 ± 11.15	.45
Time to physician (n, %)			
≤30′	52 (74.3%)	63 (90.0%)	.01
> 30′	18 (25.7%)	7 (10.0%)	
Mean ± SD	34.40 ± 25.95	22.86 ± 17.71	.00
Total time in ED (n, %)			
≤60′	52 (74.3%)	63 (90.%)	.01
> 60′	18 (25.7%)	7 (10.0%)	
Mean ± SD	63.84 ± 52.91	40.57 ± 25.90	.00
ED outcomes			
DTBT (n, %)			
≤90′	37 (52.9%)	56 (80.0%)	.00
> 90′	33 (47.1%)	14 (20.0%)	
Mean ± SD	107.19 ± 59.99	74.35 ± 30.21	.00
Length of stay in hospital (Mean ± SD)	5.46 ± 2.88	5.93 ± 3.455	.38
Readmission to ED by cardiac event (n, %)			
Within 30 days	22 (31.4%)	18 (25.7%)	.58
Within 1 to 18 months	35 (50.0%)	30 (42.8%)	.29
Readmission by all other causes			
Within 30 days	9 (12.8%)	8 (11.4%)	.58
Within 1 to 18 months	26 (37.1%)	24 (40.0%)	.04
Total hospital readmission by *cardiac event*	11 (15.7%)	16 (22.8%)	.45
Total hospital readmission by *all other cause*	16 (22.8%)	17 (24.2%)	.17
In-hospital mortality (n, %)			
In the current event	3 (4.3%)	11 (15.7%)	.02
Within 30 days	4 (4.9%)	12 (17.1%)	.01
Within 1–18 months	4 (4.9%)	14 (25.0%)	.00

FH = family history; CHD = coronary heart disease; ED = emergency departent; ECG = electrocardiography; DTBT = door-to-balloon time.

4. Results

One hundred and forty patients' medical documents were identified who arrived at the ED with a STEMI from January 2015 to November 2017. Though, a valid tool [5,6], fifty percent of the patients were incorrectly classified as P3 by the triage nurses. According to *Demographic information and clinical risk factors,* males tended to be classified as P3 less often than females (p = .05). Arabs were more likely to receive a P3 classification (p = .02) than patients of other ethnicities. Furthermore, the number of previous cardiac events was a contributing factor in the variability of P-scale classification. Patients with a higher mean number of previous cardiac events were more likely to be classified correctly (P1 or P2) (p = .05). No other clinical risk factors were found to contribute to classification variability, and no *organizational characteristics* were found to be significant to P3 designation (Table 1).

Analysis of the *Dependent variables*, namely ED assessment process exhibited the following results: time to triage and time to ECG did not significantly contribute to P3 classification, whereas time to physician (p < .001), total time in ED (p < .001), and DTBT were correlated (p < .001) with P3 classification both categorically and continuously. Patients who received accurate P-scale classifications had a longer LOS in the hospital, but this result was not statistically significant. In-hospital mortality for the P1/2 patients diagnosed with STEMI were significantly higher in the current event (15.7%, p = .02), within 30 days (17.1%, p = .01), and within 1 to 18 months (25.9%, p = .00).

To predict the variables that affect P3 classification, we performed a logistic regression analysis based on the significant triage-related variables (Table 2). In the *Demographic information and clinical risk factors*, we found that men were less likely to receive a P3 classification (95% CI 0.028–0.691, OR 0.140). We also found FH of CHD and Arab ethnicity to be predictive of P3 classification (95% CI 0.978–26.830, OR 5.122; 95% CI 0.152–0.754, OR 0.339, respectively). *Dependent variables and organizational characteristics* were not significant predictors of P3 classification (Table 2).

To examine which of the three factors most contributes to P3 classification, we performed ROC analysis. We found that the patient's demographic information and clinical risk factors (age, male, DM, FH of CHD, Jewish patients) are the main contributors to P3 classification (C-statistics: 0.667). *Organizational characteristics* (Workload > 300 patients at ED and night shifts) contributed slightly (Model 1 subtracted from Model 2 = 0.032), but the dependent variables did not contribute at all (Fig. 1).

Table 2
Logistic Regression of Predictive Factors for P3 Classification.

	Characteristics	OR	95% CI		Significance
			Low	High	
Demographic information and clinical risk factors					
	Age	0.993	0.962	1.025	0.66
	Male	0.140	0.028	0.691	0.01
Model 1	DM	1.202	0.547	2.637	0.64
	FH of CHD	5.122	0.978	26.830	0.05
	Jewish patients	0.339	0.152	0.754	0.00
Organizational characteristics					
Model 2	Workload > 300 patients at ED	0.401	0.132	1.218	0.10
	Night shifts	1.609	0.716	3.618	0.25
Dependent variables					
Model 3	Time to triage	0.763	0.316	1.843	0.54
	Time to ECG	0.787	0.373	1.657	0.52

FH = family history; CI = confidence interval; OR = odds ratio; SE = standard error.

5. Discussion

The purpose of this study was to initially highlight the P3 assignments phenomenon among STEMI patients. Our main goal was to explore the reasons for this phenomenon. Three possible answers are offered. First, the cognitive aspect, which includes decision making under uncertainty and the effect of the middle option as a choice set. Secondly, racial disparities in a multicultural society which might lead to a gap in nurse-patient communication in triage. Thirdly, heterogenic clinical features in distinct ED applicants such as females or those diagnosed with FH of CHD present occasionally with atypical symptoms.

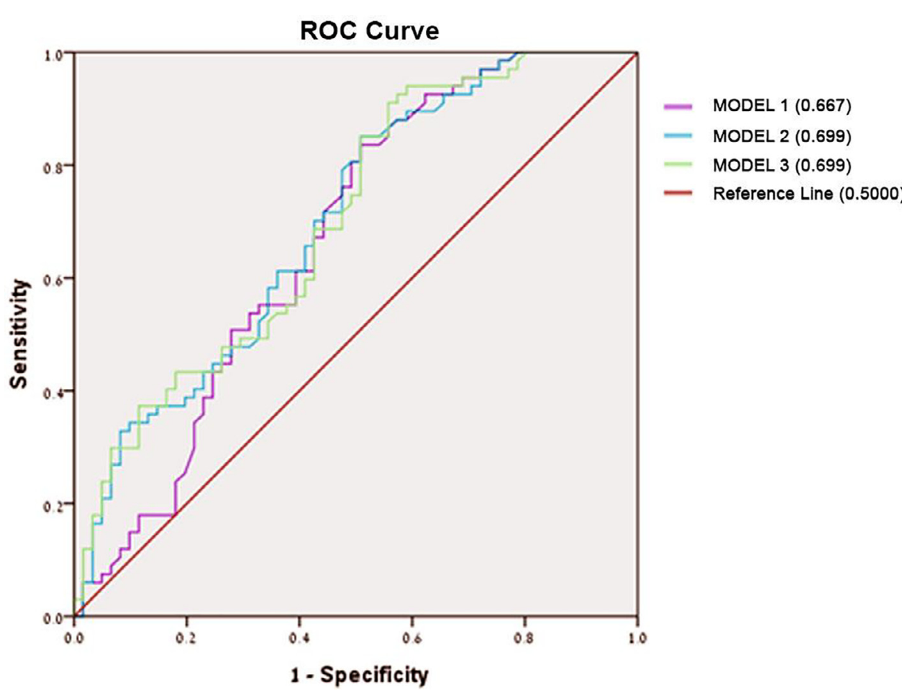

Fig. 1. Receiver operating characteristic curves for P3 classification.

A triage nurse might assign a wrong priority contrary to clinical guidelines.

Results show a notable 50 percent P3 assignments. In an ED setting this triage-level designation is crucial to determining how quickly a patient (maximum of 30 min) is examined by a physician [13,21]. Thus, an accuracy rate of 50% is noteworthy. Previous studies of triage accuracy have identified accuracy rates of 50–76% [17,21–26]. The CTAS triage levels range from P1 to P5. Hence, P3 is a middle option in a way which is similar to a Likert scale. Kalton, Roberts, and Holt [26] examined the importance of a middle/neutral option and compared questionnaires with a middle option and without. The results showed an increase in participants who chose the middle option (15% to 49% in six tests). Another study [27] showed that the meaning of the middle option in a choice set can vary between respondents and might include "no opinion," "don't care," "unsure," "neutral," "equal/both" and "neither"; the study's authors found that "neither" was chosen most often. Assigning a priority in triage on a five-level scale is a complex task with multiple thinking strategies [1,2,19]. Furthermore, the ED is a chaotic environment which is characterized by the need to make fast decisions under uncertainty [28,29]. For a triage nurse, to encounter a patient with multiple complaints and/or vague clinical presentation, the middle option becomes an alluring choice [30].

Of the variables investigated, only patient race/ethnicity and gender were identified as significant in predicting a P3 triage classification. Arabs (n = 50, 71.4%) were classified as P3 patients more than other racial groups (Jews-n = 14, 20.0%; Others-n = 6, 8.6%). These findings align with prior research on racial disparity and evidence of increasing recognition of racial bias in other aspects of medical management, including the ED setting, which adds external validity to these findings [31–34]. Gender differences found in this research are similar to findings of previous studies by Arslanian-Engoren [35,36], who identified gender as a predictor of accuracy, with men more likely to be assigned an accurate designation than women despite their presenting identical symptoms in a vignette. This finding is contrary to a recent study by Sorensen et al [37] which found that sex differences in clinical presentation did not impair diagnostic accuracy. The results imply that discrimination exist within the triage process, despite national multicultural program implementation.

P3 classification was not correlated with decreased delay to ECG and triage assessment. Such a delay may be due to overcrowding in the ED or to processes in the ED itself, such as the physical location of the triage booth or availability of personnel to perform an ECG. Choosing an inaccurate triage designation of level 3 for the possible STEMI may result in prolonged delay before treatment, especially when the volume of patients in the ED is high. In contrast, the three following time-lags, namely time to physician, total time in ED, and DTBT, were significant. Delay at any point decreases the chances of meeting the ACC/AHA goal of < 90 min DTBT for establishment of cardiac muscle reperfusion. This is accentuated in the mortality rates among patients with P3 designations in our study and in the literature [38–40]. The aforementioned results show an important conception that has been overlooked both in triage and STEMI research. While difference in mean time to physician between the groups is 12 min, the difference in door-to-balloon time is 36 min. We surmise that the accounts of 24 min after the physician has evaluated the patient are due to catheterization laboratory convergence time which the healthcare providers in the ED cannot control.

Contrary to the established literature for the contribution of clinical risk factors to AMI as well as overcrowding and shift type, our ROC curve shows that the *Demographic information and clinical risk factors* (model 1) were the main contributor to P3 classification, whereas the *Dependent variables* and *organizational characteristics* contributed in a slight manner (model 2 and 3, respectively). An important and paradoxical issue to note is the in-hospital mortality which is lower with P3 patients, although they have delay in DTBT. These findings are contrary to previous studies that show a strong association between DTBT < 90 and mortality [10,13,17]. On the other hand, this may suggest that triage nurses are correctly recognizing the sicker patients who are at higher risk for mortality and categorizing them as P1/P2. The clinical risk factors were similar between the two groups (Table 1), further suggesting that unmeasured factors (such as presenting characteristics) might be influencing triage decisions.

5.1. Limitation

This study has several limitations. First, it includes a small number of participants and a two-year follow-up; future research should validate the findings with larger samples over a longer period. Secondly, we did not account for nurse characteristics and personality traits such as the five basic dimensions of personality ("Big 5"). Thirdly, we acquired the sample retrospectively and focused only on STEMI patients. Different populations might exhibit different results.

Further limitations include the triage system – in our study the triage performed exclusively by a nurse. It is possible that triage performed by a physician would have yielded a different designation. In addition, no data were collected on patients' presenting characteristics – vital signs, chief complaint, and history of present illness. These factors could be very important in the assignment of a triage category. Furthermore, we did not consider the findings of the ECG; it is likely that an initial negative or no diagnostic ECG would receive a lower triage category than an ECG diagnostic for STEMI.

6. Conclusion

A large number of level 3 patients is not uncommon in any ED on any given day. To inaccurately include the possible AMI in this group is hazardous and potentially deadly. Our research coupled with previous studies shows an association between assigning an incorrect triage-level designation and delay in care of patients with AMI.

The phenomenon of P3 classification, backed by our findings, illustrates a tangible effect on patients with STEMI with ramifications on DTBT and in-hospital mortality. As such, it adds further knowledge in emergency medicine as a whole and triage in particular.

Our recommendations to address this issue include mandatory triage course, staff training and new nurse training, quarterly statistical findings with select cases debriefing and disallowance of P3 marking when "chest pain" or its variations are written. Changing the triage tool is also a conceivable option.

7. Author contributions

All authors interpreted the data and edited and approved the final article. MS and LZ drafted and conceived the study. MS, RS and LZ designed the intervention. MS, LZ, HP, RS and AD analyzed the data, designed the study and performed data collection. MS and LZ take responsibility for the paper as a whole.

8. Conflict of interest

All the authors declare no conflict of interest.

9. Author notes

The study was approved by the Ethic committee of study hospital.

No financial support was received for this research.

The research has not been presented.

All authors attest to meeting the ICMJE.org authorship criteria.

10. Article summary

- *Why is this topic important?*

Inaccurate triage classification of patients with ST elevation myocardial infarction (STEMI) in the ED is significantly correlated with increased morbidity, mortality, and related complications which are correlated with prolonged waiting times. An alarming fact is that the main population which is affected by it is the racially different groups (minorities).

- *What does this study attempt to show?*

The study investigates the relationship between patient and organizational characteristics and frequency of average triage classification (P3) in patients with STEMI.

- *What are the key findings?*

Females and those of Arab ethnicity are prone to receive an average classification during triage. There is an association between average urgency classification and poor treatment outcome.

- *How is patient care impacted?*

This research provides considerable data in identifying factors that affect the decision to classify patients with STEMI.

References

[1] Beardsell I, Robinson S. Can emergency department nurses performing triage predict the need for admission? Emerg Med J 2010;ooo.
[2] Goransson KE, Ehrenberg A, Marklund B, Ehnfors M. Emergency department triage: is there a link between nurses' personal characteristics and accuracy in triage decisions? Accid Emerg Nurs 2006;14:83–8.
[3] Hunold KM, Pereira GF, Jones CW, et al. Priorities of care among older adults in the emergency department: a cross-sectional study. Acad Emerg Med 2016;23:362–5.
[4] LeVasseur S. Consistency of Triage in Victoria's Emergency Departments: Literature Review. Melbourne: Department of Human Services and Monash Institute of Health Services Research; 2001.
[5] Roscoe LA, Eisenberg EM, Forde C. The role of patients' stories in emergency medicine triage. Health Commun 2016;31:1155–64.
[6] Cameron A, Ireland AJ, McKay GA, Stark A, Lowe DJ. Predicting admission at triage: are nurses better than a simple objective score? Emerg Med J 2016;34:2–7.
[7] Haklai Z, Meron J, Appelbaum Y, Aburbeh M, Shlichkov G. Emergency Room Visits Summary 2014. Jerusalem: State of Israel Ministry of Health Accessed: March 11, 2017 Health Information Division; 2015 Accessed: March 11, 2017.
[8] Nawar EW, Niska RW, Xu J. National hospital ambulatory medical care survey: 2005 emergency department summary. Adv Data 2005;2007:1–32.
[9] Groarke J, O'Brien J, Go G, Susanto M, Owens P, Maree AO. Cost burden of non-specific chest pain admissions. Ir J Med Sci 2013;182:57–61.
[10] Atzema CL, Schull MJ, Austin PC, Tu JV. Temporal changes in emergency department triage of patients with acute myocardial infarction and the effect on outcomes. Am Heart J 2011;162:451–9.
[11] Sanders SF, DeVon HA. Accuracy in ED triage for symptoms of acute myocardial infarction. J Emerg Nurs 2016;42:331–7.
[12] Morgans A, Burgess SJ. What is a health emergency? The difference in definition and understanding between patients and health professionals. Aust Health Rev 2011;35:284–9.
[13] Atzema CL, Austin PC, Tu JV, Schull MJ. ED triage of patients with acute myocardial infarction: predictors of low acuity triage. Am J Emerg Med 2010;28:694–702.
[14] Dong SL, Bullard MJ, Meurer DP, et al. Predictive validity of a computerized emergency triage tool. Acad Emerg Med 2007;14:16–21.
[15] Dong SL, Bullard MJ, Meurer DP, et al. Reliability of computerized emergency triage. Acad Emerg Med 2006;13:269–75.
[16] Dallaire C, Poitras J, Aubin K, Lavoie A, Moore L. Emergency department triage: do experienced nurses agree on triage scores? J Emerg Med 2012;42:736–40.
[17] Atzema CL, Austin PC, Tu JV, Schull MJ. Emergency department triage of acute myocardial infarction patients and the effect on outcomes. Ann Emerg Med 2009;53:736–45.
[18] Mirhaghi A, Heydari A, Mazlom R, Ebrahimi M. The reliability of the Canadian triage and acuity scale: meta-analysis. N Am J Med Sci 2015;7:299–305.
[19] Goransson K, Ehnfors M, Fonteyn ME, Ehrenberg A. Thinking strategies used by registered nurses during emergency department triage. J Adv Nurs 2008;61(2):163–72.
[20] Hosmer DW, Lemeshow S. Interpretation of the fitted logistic regression. Logistic Regression 2000.
[21] Arslanian-Engoren C. Do emergency nurses' triage decisions predict differences in admission or discharge diagnoses for acute coronary syndromes? J Cardiovasc Nurs 2004;19:280–6.
[22] Considine J, LeVasseur SA, Villanueva E. The Australasian Triage Scale: examining emergency department nurses' performance using computer and paper scenarios. Ann Emerg Med 2004;44:516–23.
[23] Goransson K, Ehrenberg A, Marklund B, Ehnfors M. Accuracy and concordance of nurses in emergency department triage. Scand J Caring Sci 2005;19:432–8.
[24] Holdgate A, Morris J, Fry M, Zecevic M. Accuracy of triage nurses in predicting patient disposition. Emerg Med Australas 2007;19:341–5.
[25] Kosowsky JM, Shindel S, Liu T, Hamilton C, Pancioli AM. Can emergency department triage nurses predict patients' dispositions? Am J Emerg Med 2001;19:10–4.
[26] Wilper AP, Woolhandler S, Lasser KE, et al. Waits to see an emergency department physician: U.S. trends and predictors, 1997-2004. Health Aff 2008;27:w84–95.
[27] Nadler JT, Weston R, Voyles EC. Stuck in the middle: the use and interpretation of mid-points in items on questionnaires. J Gen Psychol 2015;142:71–89.
[28] Tversky A, Kahneman D. "Judgment Under Uncertainty: Heuristics and Biases." Utility, Probability, and Human Decision Making. Netherlands: Springer; 1975.
[29] Cioffi J. Decision making by emergency nurses in triage assessments. Accident Emerg Nurs 1998;6(4):184–91.
[30] Kalton G, Roberts J, Holt D. The effects of offering a middle response option with opinion questions. Statistician 1980;29:65–78.
[31] Hirsh AT, George SZ, Robinson ME. Pain assessment and treatment disparities: a virtual human technology investigation. Pain 2009;143:106–13.
[32] Schrader CD, Lewis LM. Racial disparity in emergency department triage. J Emerg Med 2013;44:511–8.
[33] Vigil JM, Coulombe P, Alcock J, et al. Patient ethnicity affects triage assessments and patient prioritization in U.S. Department of Veterans Affairs emergency departments. Medicine 2016;95:e3191.
[34] Zook HG, Kharbanda AB, Flood A, Harmon B, Puumala SE, Payne NR. Racial differences in pediatric emergency department triage scores. J Emerg Med 2016;50:720–7.
[35] Arslanian-Engoren C. Gender and age bias in triage decisions. J Emerg Nurs 2000;26:117–24.
[36] Arslanian-Engoren C. Gender and age differences in nurses' triage decisions using vignette patients. Nurs Res 2001;50:61–6.
[37] Sorensen NA, Neumann JT, Ojeda F, Schäfer S, Magnussen C, Keller T, Blankenberg S. Relations of sex to diagnosis and outcomes in acute coronary syndrome. J Am Heart Assoc 2018;7(6):e007297.
[38] Jernberg T, Johanson P, Held C, et al. Association between adoption of evidence-based treatment and survival for patients with ST-elevation myocardial infarction. JAMA 2011;305:1677–84.
[39] Chui PW, Parzynski CS, Nallamothu BK, Masoudi FA, Krumholz HM, Curtis JP. Hospital performance on percutaneous coronary intervention process and outcomes measures. J Am Heart Assoc 2017;6.
[40] Yiadom MYAB, Baugh CW, McWade CM, et al. Performance of emergency department screening criteria for an early ECG to identify ST-Segment Elevation Myocardial Infarction. J Am Heart Assoc 2017;6.